

## DEPARTMENT OF EDUCATION

**National Institute on Disability and Rehabilitation Research; Notice of Final Funding Priorities for Fiscal Years 1998–1999 for Rehabilitation Engineering Research Centers**

**SUMMARY:** The Secretary announces final funding priorities for four Rehabilitation Engineering Research Centers (RERCs) under the National Institute on Disability and Rehabilitation Research (NIDRR) for fiscal years 1998–1999. The Secretary takes this action to focus research attention on areas of national need. These priorities are intended to improve rehabilitation services and outcomes for individuals with disabilities.

**EFFECTIVE DATE:** This priority takes effect on April 8, 1998.

**FOR FURTHER INFORMATION CONTACT:** Donna Nangle. Telephone: (202) 205–5880. Individuals who use a telecommunications device for the deaf (TDD) may call the TDD number at (202) 205–2742. Internet: Donna\_Nangle@ed.gov

Individuals with disabilities may obtain this document in an alternate format (e.g., Braille, large print, audiotope, or computer diskette) on request to the contact person listed in the preceding paragraph.

**SUPPLEMENTARY INFORMATION:** This notice contains final priorities under the Disability and Rehabilitation Research Projects and Centers program for RERCs related to information technology access, communication enhancement, ergonomic solutions for employment, and hearing enhancement.

The authority for RERCs is contained in section 204(b)(3) of the Rehabilitation Act of 1973, as amended (29 U.S.C. 762(b)(3)). Under this program the Secretary makes awards to public and private agencies and organizations, including institutions of higher education, Indian tribes, and tribal organizations, to conduct research, demonstration, and training activities regarding rehabilitation technology in order to enhance opportunities for meeting the needs of, and addressing the barriers confronted by, individuals with disabilities in all aspects of their lives. An RERC must be operated by or in collaboration with an institution of higher education or a nonprofit organization.

These final priorities support the National Education Goal that calls for every adult American to possess the skills necessary to compete in a global economy.

The authority for the Secretary to establish research priorities by reserving

funds to support particular research activities is contained in sections 202(g) and 204 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 761a(g) and 762).

**Note:** This notice of final priorities does not solicit applications. A notice inviting applications under this competition is published in this issue of the **Federal Register**.

**Analysis of Comments and Changes**

On October 30, 1997, the Secretary published a notice of proposed priorities in the **Federal Register** (62 FR 58862–58867). The Department of Education received 12 letters commenting on the notice of proposed priorities by the deadline date. Technical and other minor changes—and suggested changes the Secretary is not legally authorized to make under statutory authority—are not addressed.

**General**

**Comment:** Each RERC should be required to collaborate on a utilization plan with the RERC on Technology Transfer. This will not only improve their utilization activities, but also parallel the dissemination requirement that each RERC must consult with the National Center for the Dissemination of Disability Research (NCDDR) in the development and implementation of a dissemination plan.

**Discussion:** This comment and the comment that follows (on providing applicants with more discretion) have prompted reconsideration of all the general requirements. In order to provide applicants with more discretion in their dissemination and utilization activities and achieve a proper balance between the dissemination and utilization requirements, both requirements have been revised. The revisions provide applicants with the discretion to propose to consult with the RERC on Technology Transfer or the NCDDR, but do not require it. NIDRR strongly encourages these consultations. The peer review process will determine the merits of the dissemination and utilization activities that an applicant proposes.

In regard to the other general requirements, the proposed requirements related to graduate training and sharing information have been eliminated as technical changes. The graduate training requirement repeats the statutory training requirements for RERCs, and the sharing information provision is not a requirement per se.

**Changes:** The requirements applicable to each RERC regarding dissemination and utilization have been revised to be

internally consistent and less prescriptive. The graduate training and sharing information requirements have been eliminated.

**Comment:** The priorities are too prescriptive and do not provide applicants with sufficient discretion to propose research and engineering activities within each field of study. The priorities should not set forth the specific research problems to be addressed by each RERC, but instead provide a general framework of issues within the authority of the RERCs.

**Discussion:** NIDRR attempts to provide applicants with as much discretion as possible. Finding the proper balance between providing applicants with this discretion, while at the same time ensuring that an approved application will accomplish the purposes of the RERC, is an admittedly subjective task. This delicate balance is evidenced in the fact that most of the comments that NIDRR receives on this issue request that NIDRR be more prescriptive and include one or more specific requirements. Unless there is compelling evidence of the merits of additional specific requirements, NIDRR routinely declines those requests in order to provide applicants with as much discretion as possible.

There are two sets of requirements applicable to each priority: the general requirements prefacing the priorities and the priorities themselves. In response to this comment, NIDRR has reviewed all of the requirements in the proposed general requirements and the proposed priorities to determine if any could be revised to be less prescriptive without compromising their purposes. As a result, the proposed general requirements have been revised to provide applicants with increased discretion. As indicated in the following sections, NIDRR has made a number of changes to the priorities in response to specific comments suggesting greater flexibility.

**Changes:** The general requirements regarding dissemination and utilization have been revised to be less prescriptive.

**Comment:** Paragraphs b and c of the description of the RERC Program are very similar and place too much emphasis on service delivery.

**Discussion:** Paragraphs b and c of the description of the RERC Program are consistent with the statute.

**Changes:** None.

**Priority 1: Information Technology Access**

*Comment:* The RERC might benefit from collaborating with the European Commission's Telematics Programme.

*Discussion:* NIDRR encourages all of its RERCs to collaborate with entities undertaking related research and development. The commenter's recommendation is one of many appropriate collaborations that could be undertaken by the RERC. Applicants have the discretion to propose to collaborate with other organizations and agencies, and an applicant could propose to collaborate with the European Commission's Telematics Programme. The peer review process will evaluate the merits of any proposed collaborations.

*Changes:* None.

*Comment:* The RERC should be required to coordinate with the RERC on Adaptive Computers and Information Systems and the National Science Foundation's (NSF's) Universal Access Initiative that will, in part, examine access to the World Wide Web.

*Discussion:* The project period for the RERC on Adaptive Computers and Information Systems ends before the project period for the Information Technology Access RERC begins. The NSF's Universal Access Initiative is expected to address many topics of interest to this RERC, and that coordination will be necessary in order to avoid duplication of effort.

*Changes:* The priority has been revised to require the RERC to coordinate on research projects of mutual interest with the NSF's Universal Access Initiative.

**Priority 3: Ergonomic Solutions for Employment**

*Comment:* Three commenters expressed concern that the priority overemphasized prevention of cumulative trauma disorders (CTDs) and did not place sufficient emphasis on developing ergonomic solutions to the problems persons with disabilities face in obtaining and maintaining employment. The commenters were also concerned that this over-emphasis would neglect the needs of persons with developmental and other significant disabilities.

*Discussion:* The fact that only one of the five activities required by the priority relates to obtaining and maintaining employment, supports the commenters' contention that the priority overemphasizes prevention. NIDRR agrees that the proposed priority does not place sufficient emphasis on the promotion of employment.

In regard to the issue of addressing the needs of individuals with developmental and other significant disabilities, NIDRR's authorizing statute requires NIDRR to place a special emphasis on "individuals with the most severe disabilities. Unless noted otherwise in the priority, all of NIDRR's Centers and Projects are required to address the needs of all persons with disabilities, including those with developmental and other significant disabilities. In addition, it should be noted that the "Description of the RERC Program" includes two references to addressing the "needs of individuals with severe disabilities." This RERC is required to address the needs of persons with developmental and other significant disabilities.

*Changes:* The number of activities to be carried out by the RERC that relate to assisting persons with disabilities to obtain and maintain employment has been increased. The second activity has been expanded beyond prevention-related activities to include evaluation of the worksite accommodation needs of workers with disabilities. The third and fourth activities have been revised and combined to eliminate a prevention focus and, instead, to design, develop, and evaluate ergonomically-based technologies, modifications, techniques, and tools to provide worksite accommodations to workers with disabilities, including elderly workers with disabilities.

*Comment:* The RERC should include at least two certified professional ergonomists in leadership positions.

*Discussion:* Persons who fill the leadership positions of this RERC could come from a wide range of professional fields. Applicants have the discretion to propose key personnel, and an applicant could propose to have two certified professional ergonomists in leadership positions on the grant. The peer review process will evaluate the merits of the proposed personnel.

*Changes:* None.

*Comment:* The location of the RERC should be limited to an academic institution that includes accredited engineering and medical schools.

*Discussion:* Eligibility to be an applicant for an RERC is established by statute. RERCs are required to be operated by or in collaboration with an institution of higher education or a nonprofit organization. No further restrictions are permissible by law.

*Changes:* None.

*Comment:* The extent of the problem, as stated in the background section of the proposed priority, is incorrectly stated and could be misinterpreted. According to the Bureau of Labor

Statistics report on Workplace Injuries and Illnesses in 1995, repeated trauma accounted for 62% of occupational illnesses (emphasis added), not injuries as stated in the proposed priority.

*Discussion:* The commenter is correct. The reference cited refers to illnesses rather than injuries.

*Changes:* The Bureau of Labor Statistics report citation has been revised to refer to illnesses and not injuries.

*Comment:* The priority should be expanded beyond biomedical factors to include the psychosocial, cognitive and sensory aspects of ergonomics.

*Discussion:* Having met the requirements of the priority, applicants have the discretion to propose to expand a field of investigation. An applicant could propose to investigate the psychosocial, cognitive and sensory aspects of ergonomics in addition to proposing to investigate the biomechanical factors that lead to CTDs. The peer review process will evaluate the merits of such a proposal. There is no compelling evidence to justify requiring all applicants to investigate the psychosocial, cognitive and sensory aspects of ergonomics.

*Changes:* None.

*Comment:* The fourth and fifth activities should be revised to include evaluation activities.

*Discussion:* The commenter is correct that adding evaluation components to the fourth and fifth activities of the proposed priority will substantially improve them. In response to other comments the fourth and fifth activities have been revised.

*Changes:* The revised activities have been expanded to include evaluation components.

*Comment:* As a matter of clarification, does NIDRR want the RERC to focus its efforts on paid employment or "include solutions which might include non-paid and home maintenance types of work?"

*Discussion:* When the purpose of a center or project is to promote obtaining and maintaining employment for persons with disabilities, NIDRR expects the center or project to focus, but necessarily limit, its efforts on paid employment.

*Changes:* None.

*Comment:* As a matter of clarification, does NIDRR expect the RERC to link outcome measures related to quality of life to their research and development activities?

*Discussion:* The outcome measures for each of the priorities should at a minimum include the purposes of the RERCs as stated in the priority. Applicants have the discretion to

propose other outcome measures, including quality of life measures.

*Changes:* None.

*Comment:* The priority should be broadened to include addressing injury and pain experienced as a result of secondary conditions by persons with disabilities.

*Discussion:* The priority requires the RERC to address the needs persons with disabilities. Therefore, the priority requires the RERC to address secondary disabilities that in the case of CTDs necessarily involve pain and injury.

*Changes:* None.

*Comment:* The priority should be modified to include the commonly accepted scope of ergonomic research thereby allowing the RERC to exploit the full range of possibilities for research.

*Discussion:* The priority does not limit applicants to a limited scope of research related to ergonomics. Applicants have the discretion to explore any and all aspects of ergonomic research that will contribute to accomplishing the RERC's purposes. It is unnecessary to revise the priority in order for an applicant to address a wide range of ergonomic research.

*Changes:* None.

*Comment:* Two commenters recommended requiring the RERC to develop and make available a design database of ergonomically-based performance data, including anthropomorphic data, to better understand the work-related capabilities of individuals with a wide range of disabilities.

*Discussion:* The commenters are correct. There is a significant need for development of a database in this area.

*Changes:* The priority has been revised to require the RERC to develop and disseminate a database of ergonomically-based performance data on the work-related capabilities of persons with disabilities.

*Comment:* The RERC should design technologies, modifications, techniques and tools that will aid others in providing ergonomically-based worksite accommodations.

*Discussion:* The commenter has suggested language that more effectively captures the NIDRR's intent for the fifth activity of the proposed priority. As a result of revisions in response to other comments, the fifth activity in the proposed priority has been incorporated into the third activity of the final priority.

*Changes:* The third activity of the RERC has been revised to design, develop, and evaluate ergonomically-based technologies, modifications, techniques, and tools to provide

worksite accommodations to workers with disabilities, including elderly workers with disabilities.

#### *Priority 4: Hearing Enhancement*

*Comment:* Two commenters suggested studying telecoil functioning in hearing aids, including better shielding to prevent electronic interference and weak telecoil sensitivity levels.

*Discussion:* NIDRR agrees with the commenters that current telecoil functioning in hearing aids can present significant problems to users.

*Changes:* The priority has been revised to require the RERC to develop and evaluate new, emerging technology for integration into more advanced versions of next generation hearing aids, assistive listening devices (ALDs), and telecoils; *Comment:* The RERC should study whether an individual can hear as well or better on the telephone using a completely-in-the-canal-aid rather than with another type of aid which has the telecoil option.

*Discussion:* An applicant could propose to study whether an individual can hear as well or better on the telephone using a completely-in-the-canal-aid rather than with another type of aid which has the telecoil option. The peer review process will evaluate the merits of the proposal. However, there is insufficient evidence to warrant requiring all applicants to conduct this study.

*Changes:* None.

*Comment:* The RERC should coordinate with the U.S. Architectural and Transportation Barriers Compliance Board's (Access Board's) efforts at developing standards for ALDs including research.

*Discussion:* NIDRR agrees with the commenter that the Access Board's research activities in the area of ALDs complement the research of the RERC. While applicants have the discretion to propose specific coordination activities, e.g., research related to developing standards for ALDs, NIDRR believes that a general requirement for the RERC to coordinate with the Access Board will assist the RERC to fulfill its purposes.

*Changes:* The priority has been revised to require the RERC to coordinate with the Access Board on research projects of mutual interest.

*Comment:* The RERC should investigate the overall functioning of microphones used with ALDs.

*Discussion:* An applicant could propose to study the overall functioning of microphones used with ALDs. The peer review process will evaluate the merits of the proposal. However, there is insufficient evidence to warrant

requiring all applicants to conduct this study.

*Changes:* None.

*Comment:* The RERC should compare the benefits and costs of high tech hearing aids with other available aids in order to provide consumers with impartial information.

*Discussion:* An applicant could propose to compare the benefits and costs of high tech hearing aids with other available aids. The peer review process will evaluate the merits of the proposal. However, there is insufficient evidence to warrant requiring all applicants to conduct this cost benefit analysis.

*Changes:* None.

*Comment:* While maskers have proved to be effective for some persons with significant tinnitus, they are by no means the only, or even the most used, treatment for the relief from the symptoms of tinnitus. The priority places too much emphasis on improving tinnitus maskers.

*Discussion:* NIDRR agrees with the commenter that maskers are one of a number of strategies to address the symptoms of tinnitus, and that the priority should provide the RERC with greater discretion to explore not only maskers, but other approaches to alleviate these symptoms.

*Changes:* The fifth activity expands the discretion of the RERC to develop and evaluate technology, including, but not limited to maskers, to alleviate the problems of tinnitus.

*Comment:* Technology is already available to detect hearing loss in infants. What is needed is better utilization of this technology.

*Discussion:* NIDRR agrees that there has significant progress in the technology to detect hearing loss in infants. The priority does not require the RERC to develop new technology. The priority directs the RERC to address increased utilization through automation and simplification of hearing loss evaluations.

*Changes:* None.

#### **Description of the Rehabilitation Engineering Research Center Program**

RERCs carry out research or demonstration activities by:

- (a) Developing and disseminating innovative methods of applying advanced technology, scientific achievement, and psychological and social knowledge to (1) solve rehabilitation problems and remove environmental barriers, and (2) study new or emerging technologies, products, or environments;
- (b) Demonstrating and disseminating (1) innovative models for the delivery of

cost-effective rehabilitation technology services to rural and urban areas, and (2) other scientific research to assist in meeting the employment and independent living needs of individuals with severe disabilities; or

(c) Facilitating service delivery systems change through (1) the development, evaluation, and dissemination of consumer-responsive and individual and family centered innovative models for the delivery to both rural and urban areas of innovative cost-effective rehabilitation technology services, and (2) other scientific research to assist in meeting the employment and independent needs of individuals with severe disabilities.

Each RERC must provide training opportunities to individuals, including individuals with disabilities, to become researchers of rehabilitation technology and practitioners of rehabilitation technology in conjunction with institutions of higher education and nonprofit organizations.

#### General

The following requirements apply to these RERCs pursuant to these absolute priorities unless noted otherwise. An applicant's proposal to fulfill these requirements will be assessed using applicable selection criteria in the peer review process:

The RERC must have the capability to design, build, and test prototype devices and assist in the transfer of successful solutions to relevant production and service delivery settings. The RERC must evaluate the efficacy and safety of its new products, instrumentation, or assistive devices.

The RERC must disseminate research results and other knowledge gained from the Center's research and development activities to persons with disabilities, their representatives, disability organizations, businesses, manufacturers, professional journals, service providers, and other interested parties.

The RERC must develop and carry out utilization activities to successfully transfer all new and improved technologies developed by the RERC to the marketplace.

The RERC must involve individuals with disabilities and, if appropriate, their representatives, in planning and implementing its research, development, training, and dissemination activities, and in evaluating the Center.

The RERC must conduct a state-of-the-science conference in the third year of the grant and publish a comprehensive report on the final

outcomes of the conference in the fourth year of the grant.

#### Priorities

Under 34 CFR 75.105(c)(3), the Secretary gives an absolute preference to applications that meet the following priorities. The Secretary will fund under this competition only applications that meet one of these absolute priorities.

##### Priority 1: Information Technology Access

##### Background

High speed computers, high speed modems, sophisticated telecommunication networks, cable networks, intranets, the Internet, the World Wide Web, and satellites constitute an unparalleled global information network. However, the proliferation of information technology has also created problems of accessibility for persons with disabilities (Paciello, M., *People with Disabilities Can't Access the Web*, Yuri Rubinsky Insight Foundation, 1997). Persons with disabilities will be significantly disadvantaged if this new generation of information technology is inaccessible. Promoting accessibility to this dynamic field is a highly technical and complicated task that will place unique demands on an RERC to serve as a resource to a wide range of industry and government officials, as well as persons with disabilities.

The Internet is expanding at a phenomenal rate. There were 1,000 Internet host computers worldwide in 1980. That number increased to 200,000 in 1996 and is expected to reach 12 million by the year 2000. The number of Internet users has virtually doubled every year over the past three years from an estimated 16 million in 1995 to 68 million in 1997 (*Computer Industry Forecasts*, Third Quarter, 1997). Emerging nomadic technologies will enable individuals to access information systems from virtually anywhere, at anytime, and in entirely visual, audio, or mixed modes.

The Internet and World Wide Web are also undergoing dramatic structural changes. Internet 2 is a consortium of academic institutions planning to interconnect its members with a new high-bandwidth Internet that will support advanced applications that are not possible or practical on the current Internet (Kennedy, K., Testimony Before the Senate Commerce, Science, and Transportation Committee; Subcommittee on Communications, June 3, 1997). Once developed, the Next Generation Internet will interconnect 100 Federal research institutions and

their research partners with a network capable of operating at speeds 100 to 1000 times faster than today's Internet (Lane, N., Testimony Before the Senate Commerce, Science, and Transportation Committee; Subcommittee on Communications, June 3, 1997). In the spring of 1997, the International World Wide Web Consortium held special workshops at their Sixth International World Wide Web Conference that focused on developing strategies for designing accessibility into the Web core environment.

New generations of computer and information technologies become available long before anyone has fully grasped the implications of the previous generation (Kelly, H., Testimony Before the Senate Commerce, Science, and Transportation Committee; Subcommittee on Communications, June 3, 1997). Product cycles and lifetimes are measured in months, not years. There are many small high technology firms that remain virtually unknown until they announce their product. These firms may have little, or no experience with design accessibility. In addition, the industry is highly competitive, and companies may not be willing to incorporate accessible design features into their products if they believe it involves additional development time and expense.

Designing accessible features into new information technologies early in the design process provides persons with disabilities with immediate access and is more cost effective than retrofitting. Increasingly, functions are integrated onto single chips and motherboards, obviating the need for third party accessories such as sound cards or voice input devices, and making changes or modifications to these built-in features difficult or impossible. The earlier accessibility occurs in the design process for new products, the easier it is to incorporate accessibility features.

Universal design is a process whereby environments and products are designed with built-in flexibility so they are usable by all people, regardless of age and ability, at no additional cost to the user. While advances in computers and information technologies create new opportunities for some individuals, they create barriers for others. Information presented in graphical modes (i.e., images, photographs, icons) poses problems for people who are blind unless there are built-in "hooks" that can be identified by the user's screen reader. Conversely, audio cues (beeps) do not convey information to individuals who are deaf or hard of hearing.

The proliferation of public access terminals creates unique accessibility challenges. Access to these terminals requires the use of keyboards, touch screens, telephone handsets, and smart cards and will require the development of flexible, multi-modal interface techniques that can work across all disabilities.

The ability to access computer-based information technologies is quickly becoming a prerequisite for successful employment. Companies are increasingly using internal networks, commonly referred to as intranets, to share information within the company. This presents unique problems for individuals with disabilities if the company uses proprietary software and databases that are specifically designed for their company and do not follow standard protocols. In those cases, the information may be inaccessible to individuals who use assistive devices (e.g., screen readers) to access their computers.

There are emerging information and communication policy issues that will have an enormous impact on technology development. Section 508 of the Rehabilitation Act of 1973, as amended, and the Telecommunications Act of 1996 require the development of accessibility standards and guidelines that direct government agencies, Federal customers and contractors, manufacturers, and developers to address accessibility for new and existing products.

Although computer and information technologies are expanding at phenomenal rates, it is also important to recognize that there are many individuals with disabilities who have problems accessing the current generation of technologies (e.g., integrating assistive devices with existing computer workstations). Continued support and guidance for these individuals are necessary to promote access to the computers and information systems they currently use.

#### Priority 1

The Secretary will establish an RERC on information technology access for the purposes of developing technological solutions and promoting access for individuals with disabilities to current and emerging information technologies and technology interfaces, including hardware, software, networks, nomadic technologies, the Internet and the World Wide Web. The RERC must:

(1) Develop and evaluate technological solutions in collaboration with industry to promote accessibility and universal design at the outset of the development of information

technologies including software, hardware, intranets, and nomadic technologies;

(2) Develop through research and in collaboration with industry flexible, multi-modal interface techniques for computer and information technologies that provide universal access for all individuals with disabilities;

(3) Develop and disseminate strategies for integrating current accessibility features into newer generations of computer and information systems;

(4) Develop through research and in collaboration with Federal agencies, universities and industry the technologies necessary to promote access to current and emerging generations of the Internet and the World Wide Web for persons with disabilities;

(5) Develop and evaluate technologies and strategies to promote universal access to intranet systems;

(6) Provide technical assistance to public and private organizations responsible for developing policies, guidelines and standards that affect the accessibility of information technology products and systems that are developed, manufactured, and implemented; and

(7) Provide technical assistance and guidance to individuals with disabilities and employers on accessibility problems affecting current computer and information systems.

In carrying out the purposes of the priority, the RERC shall coordinate on research projects of mutual interest with the RERC on Telecommunications and the National Science Foundation's Universal Access Initiative.

#### Priority 2: Communication Enhancement

##### Background

Speech and language disorders affect the way people talk and understand language, range from mild to significant, and may be developmental or acquired. According to the American Speech-Language and Hearing Association (ASHA), approximately 14 million individuals may be described as having a speech or language disorder (Bello, J., *Communication Facts*, ASHA Research Division, 1994). Two million of those individuals experience significant communication disorders and need access to augmentative and alternative communication (AAC) (Beukelman, D., *Augmentative and Alternative Communication*, Volume 11, June, 1995). For the purpose of this priority, augmentative and alternative communication refers to all forms of communication that enhance or

supplement comprehension, speech, and writing, including electronic devices and communication boards.

Historically, AAC has been associated with specific technologies that provide individuals who have significant communication disorders with some type of alternative output. Research documenting successful AAC use has been confined primarily to adolescents and adults with reasonably intact cognitive capabilities and moderate to significant motor impairment (Shane, H., Presentation at ASHA Annual Convention, Seattle, 1995). This limited approach does not address the needs of all persons with significant communication disorders such as persons with mental retardation, aphasia, traumatic brain injury, and autism. A more holistic approach to communication enhancement strategies for persons with significant communication disorders must take into account the complexities of human language and incorporate those factors as unique physical, cognitive, and sensory manifestations and individualized learning styles.

There is a need for new and improved AAC technologies that take the more holistic approach to AAC intervention by addressing input technologies, language processing, and output strategies for a wide range of disabilities. These new or improved technologies could address an array of issues, including, but not limited to: speed enhancement and rate of communication that enable the user to operate in or close to real-time; cosmesis and aesthetics of devices; ergonomic and human factors relationships to interventions and technologies for significant communication disorders; quality, diversity, and naturalness of speech output as it relates to a user's actual voice; human and machine interface and multiple control options; using technology to reduce the burden on users with physical disabilities; reliability, portability, and cost; and developing and disseminating measurable outcomes of research.

Studies of the brain and language acquisition emphasize the importance of addressing the language needs of toddlers and school aged children who use or could use AAC (Blackstone, S., *Augmentative Communication News*, Volume 10, No. 1, 1997). Often children and others with significant communication disorders encounter difficulty in processing and comprehending spoken language. In order to address the needs of these children and adults with significant communication disorders, systems to

enhance communication must support comprehension as well as expression.

Reading and writing are interrelated skills that emerge as part of an interactive language and communication process that begins early in life and continues for approximately 6 years. This process is referred to as emergent literacy. Users of AAC in contrast to those who do not use AAC are often found to be in a phase of emergent literacy for many more years (Koppenhaver, D., et al., *Technology and Disability*, Vol 2., No. 3, 1993). Emergent literacy and AAC use are interrelated processes. This relationship has an impact on the way that the next generation of technology for communication enhancement should be studied and developed. Research issues related to emergent literacy of AAC users include, but are not limited to: the effects of AAC use on reading and writing development; differences in written language development between AAC users and non-users; the effects of early AAC use on emergent literacy; and the impact of different types of technologies on better understanding and use of written language in AAC users.

Aging presents a unique challenge to AAC researchers because technologies must address linguistic, speech, and sensory deterioration as well as tolerance for technology. As persons age, the need for communication enhancement technology increases, yet, according to data reported by the National Health Interview Survey in 1990 only six-tenths of one percent of individuals aged 65 or older were using AAC technology. Elderly persons with acquired communication disorders encounter a lack of awareness on the part of service providers and an absence of communication services in general.

To date there has been only minimal attention to the job options available for persons with disabilities who use AAC. Anecdotal reports suggest that individuals with severe communication disorders are frequently considered unemployable. The high rate of unemployment results from a number of factors including, but not limited to: lack of skills, inadequate job preparation; attitudinal barriers; transportation barriers; architectural and accommodation barriers; and limitations in the AAC technology (Light, J., et al., AAC, Volume 12, 1996). Issues related to unemployment for users of AAC devices include, but are not limited to, compatibility with other technology on the worksite and the ability of the AAC user to transition easily from one task to another.

There are over 40 companies in the United States developing, manufacturing and distributing AAC devices. The next generation of development must challenge conventional AAC approaches and improve the way in that new technologies incorporate and blend principles of communication theories and engineering. Communicative competence ensures that individuals are able to attain communication goals that include expressing needs and wants, developing social skills and routines, and exchanging information (Light, J., AAC, Volume 13, 1997). Communication competence is built over time through improved science, engineering, and the modification of environments, parameters, opportunities and instruction as well as improving communication tools.

#### Priority 2

The Secretary will establish an RERC on communication enhancement to improve AAC technologies that can further the development of communication, language, natural speech, discourse skills, and literacy of persons with significant communication disorders. The RERC must:

- (1) Develop and evaluate in collaboration with industry improved AAC technologies for individuals with significant communication disorders;
- (2) Develop and evaluate strategies that promote literacy proficiency for AAC users;
- (3) Develop and evaluate communication enhancement strategies and AAC technologies that factor in the speech, linguistic and multiple sensory needs of the elderly;
- (4) Investigate and disseminate strategies to build the capacity of service providers and increase their involvement with elderly persons with significant communication disorders who use or could use AAC; and
- (5) Identify barriers that negatively affect the employment status of individuals with significant communication disorders who use, or could use, AAC and develop and evaluate approaches to overcome those barriers in order to improve their employment status.

In carrying out the purposes of the priority, the RERC shall:

- Coordinate on research projects of mutual interest with the RERC on Hearing Enhancement;
- Address the needs of individuals of all ages with significant communication disorders including, but not limited to, toddlers and the elderly; and
- Address the needs of persons with developmental disabilities and acquired

disabilities including but not limited to mental retardation, aphasia, traumatic brain injury, and autism.

#### Priority 3: Ergonomic Solutions for Employment

##### Background

The familiar components of the work environment (i.e., tools, machines, and equipment) often are designed without adequate consideration for the people who must use them. Similarly, work tasks may require capabilities that individuals do not have or cannot sustain over long periods of time without injury. Improperly designed workplaces can lead to fatigue, discomfort, and injury that result in reduced productivity and increased costs for employers. These same work environment components may present additional physical barriers to persons with disabilities and negatively impact their employment status.

The Bureau of Labor Statistics estimates that repeated trauma, commonly referred to as cumulative trauma disorders (CTDs), accounted for 62 percent of all occupational illnesses in 1995—up from 15 percent in the early 1980s. The National Institute for Occupational Safety and Health (NIOSH) estimates that annual U.S. medical costs from repetitive stress injuries total \$13 billion (NIOSH, "Musculoskeletal Disorders and Workplace Factors," July, 1997), and the Labor Department's Occupational Safety and Health Administration (OSHA) has estimated overall costs at nearly \$100 billion a year when one considers lost work time, lost productivity, and retraining costs.

Ergonomics is an interdisciplinary field concerned with the performance and safety of individuals at work and how they cope with the work environment, interact with machines, and, in general, negotiate their work surroundings (Scheer, S. and Mital, A., "Ergonomics," *Archives of Physical Medicine & Rehabilitation*, Volume 78, pg. 36, March, 1997). Ergonomic principles are based on a combination of science, engineering, and biomechanics (the study of the body as a system operating under two sets of laws: Newtonian mechanics and the biological laws of life) and are used to promote the proper design of products, workplaces, and equipment (Kroemer, K.H.E., et al., *Ergonomics: How to Design for Ease & Efficiency*, Prentice Hall, N.J., pgs. 6–7, 1994). When these principles are applied correctly, the incidence and severity of musculoskeletal disorders decrease (Stobbe, T. J., "Occupational

Ergonomics and Injury Prevention," *Occupational Medicine*, pgs. 531-543, July, 1996) thereby reducing the likelihood of work related injuries and employer costs.

Cumulative trauma disorders (CTDs) are a class of musculoskeletal disorders involving nerves, tendons, muscles and supporting bony structures (i.e., back, neck, shoulders, and hands). They represent a wide range of disorders that can differ in severity from mild periodic conditions to those that are severe, chronic and debilitating. Since the early 1980s, there has been a dramatic increase in CTDs. OSHA attributes much of this increase to changes in production processes and technologies, resulting in more specialized tasks with increased repetitions and higher assembly line speeds. Two of the most frequently occurring, occupationally induced CTDs are carpal tunnel syndrome and low back pain.

Carpal tunnel syndrome is a condition caused by pressure on the median nerve as it passes through the carpal tunnel of the wrist; it results in the gradual onset of numbness and tingling in one's thumb and the first two and a half fingers of the hand. If allowed to continue, carpal tunnel syndrome may cause pain, muscle atrophy at the base of the thumb, and clumsiness (Phalen, G.S., "The Carpal-Tunnel Syndrome: Seventeen Year's Experience in Diagnosis and Treatment of Six-Hundred Fifty-Four Hands," *The Journal of Bone and Joint Surgery*, pgs. 211-228, 1996). Carpal tunnel syndrome is recognized as a disabling condition of the hand caused by excessive or repetitive movements, undesirable hand positions, or exertions that impose prolonged loads on the affected tissues (Huenting, H., et al., "Constrained Postures in Accounting Machine Operations," *Applied Ergonomic*, Volume 11, pgs. 145-149, 1980).

Improper working posture is a major factor in the development of lower back pain. The strain on one's body may be caused by external loads (e.g., when one lifts, lowers, pulls, pushes, carries, holds onto heavy objects or any combination of these factors) or by simply moving one's own body or by maintaining postural support using muscle tension alone. In addition to the loss in function and pain, the direct and indirect costs associated with lower back injuries are significant. There is a need for reliable and validated measurement tools to measure mechanical strains within the body and to incorporate the various findings into models of strains and capabilities (Kroemer, K.H.E., op. cit., pgs. 473-475).

The ability to perform physical work depends greatly upon a number of variables including an individual's age, size, strength, overall health and fitness, training, motivation, and physical dexterity. A common approach to matching an individual's work capacity with specific job tasks is to assess the individual's overall energy capacity by measuring heart rate and oxygen consumption while on a treadmill or bicycle ergometer and then comparing that information with the amount of energy it takes for a "normal" person to do the specific job tasks (Kroemer, K.H.E., op. cit., pgs. 118-131). Improper matches can lead to early fatigue, and impact a person's ability to do the job tasks safely and efficiently.

Individuals with disabilities present unique ergonomic challenges particularly if they use assistive devices to overcome deficits and function independently. The use of ergonomic knowledge in rehabilitation engineering is widespread, ranging from wrist splints to environmental control systems. Technology for people with significant disabilities depends increasingly on the development and implementation of sophisticated devices including voice input systems, screen readers, and eye tracking systems. However, development alone of those types of devices does not ensure success. It is sometimes necessary to quantitatively measure one's residual capabilities and energy capacity and compare these results with specific job tasks. After selecting the appropriate ergonomic solutions, it is necessary to have the individual demonstrate the usability of those solutions within the worksite environment and make the necessary changes or adaptations to ensure proper use and fit. There are testing devices and procedures that have been developed to quantitatively measure the residual capabilities of impaired persons, such as the Basic Elements of Performance Test and the Available Motions Inventory Test (Smith, R. V. and Leslie, J. H., *Rehabilitation Engineering*, CRC Press, pgs. 127-143, 1990). These tests measure an individual's ability for specific tasks (i.e., reach, grasp, manipulation), but do not measure one's ability to incorporate complex assistive devices into the workplace of people with significant disabilities.

Elderly individuals are working longer than ever before and the proportion of people with work disability (defined as a limitation in work due to chronic illness or impairment) increases with age (Disability Statistics Program, "People with Work Disability in the U.S.,"

*Disability Statistics Abstract*, U.S. Department of Education, Volume 4, May, 1992). Older workers face unique ergonomic challenges due to other changes that occur naturally as part of the aging process (i.e., changes in biomechanical features, respiratory capabilities, visual functions, hearing, reaction times, etc). Without proper ergonomic design and strategies, older workers could well find themselves at an unnecessary disadvantage due to compromised productivity and health.

#### Priority 3

The Secretary will establish an RERC on ergonomic solutions for employment to develop ergonomic strategies and devices to reduce and prevent the onset of cumulative trauma disorders and to assist persons with disabilities in obtaining and maintaining appropriate employment. The RERC must:

(1) Investigate the biomechanical factors that lead to cumulative trauma disorders including, but not necessarily limited to, carpal tunnel syndrome and low back injuries;

(2) Develop and evaluate worksite ergonomic analysis tools to: (a) determine the causes of ergonomic stress associated with repetitive motions, awkward postures, and excessive energy expenditure, and (b) evaluate the worksite accommodation needs of workers with disabilities;

(3) Design, develop, and evaluate ergonomically-based technologies, modifications, techniques, and tools to provide worksite accommodations to workers with disabilities, including elderly workers with disabilities; and

(4) Develop and disseminate a database of ergonomically-based performance data on the work related capabilities of persons with disabilities.

In carrying out the purposes of the priority, the RERC shall coordinate on research projects of mutual interest with the RRTC on Workplace Supports to Improve Employment Outcomes.

#### Priority 4: Hearing Enhancement

##### Background

Individuals whose hearing is impaired, but who can understand conversational speech with, or without, amplification are hard-of-hearing (HoH). Individuals classified as HoH range in age from infants to the elderly. The National Center for Health Statistics (NCHS), using the "Gallaudet Hearing Scale" that is self-reporting and quantifies the amount of interference with hearing in ordinary day-to-day situations, estimates that the number of persons who are HoH and who might benefit from using a hearing aid ranges



from 20 million to 22 million ("National Health Survey," Series 10, No. 188, 1994).

Developments over the past five years have resulted in significant growth in digital hearing aid technology, improved evaluation of hearing loss, especially in very young children, improved computer assisted fitting of hearing aids, and more cosmetically acceptable hearing aids that do not sacrifice important functions for the sake of appearance. Modern science and technology continue to offer even greater opportunity for improvements in the simplification and automation of hearing loss evaluation and in the proper fitting of appropriate hearing aids to individual users. Concurrently there have been important developments in related areas, such as assistive listening devices (ALDs) and in automatic speech recognition (ASR), a technology that enables a person to dictate words into a microphone and have those words converted into computer-language text. The 1996 National Strategic Plan of the National Institute on Deafness and Other Communication Disorders (NIDCD) reflects a growing realization that new technology offers potential relief from the symptoms of tinnitus. New developments in ultra-thin circuit boards and chips, flash ROM, better power management, and other forms of emerging technology offer increasing opportunities to expand features available in the next generation of hearing enhancing devices.

While improving, consistent and early identification of hearing loss in small children remains problematic. The diagnostic technology needs to be simplified and made available to pediatric and child care personnel with minimal training in audiology.

The proper fitting of hearing aids ensures that tonal quality, amplification levels, and environmental noise are controlled to the maximum extent possible. New developments in sophisticated digital hearing technology must be accompanied by new training and fitting procedures to ensure that new multi-channel aids deliver maximum performance.

Tinnitus affects about 17 percent of the general population and about 33 percent of the elderly (Jastreboff, P. and Hazell, J., "Neurophysiological Approaches to Tinnitus" *British Journal of Audiology*, 1993). Tinnitus is described as an incessant ringing in the ears or other head noise that is heard when there is no external cause for that noise. Currently, there is no cure for tinnitus (Goldstein, B. & Shulman, A., "Tinnitus Masking—A Longitudinal

Study of Efficacy/Diagnosis 1977–1994." Proceedings of the Fifth International Tinnitus Seminar, 1995). Often, tinnitus accompanies hearing loss. However, there are cases of severe hearing loss without tinnitus. Tinnitus also occurs without evidence of other auditory system diseases or disorders. This variation drives the need for better dual channel hearing aid/tinnitus maskers and single channel tinnitus maskers. Although there are currently some devices on the market that combine amplification and masking, those efforts have not been widely accepted, possibly because recent technical developments in miniaturizing have not been fully exploited (Gold, S., et al., "Selection and Fitting of Noise Generators and Hearing Aids for Tinnitus Patients." Proceedings of the Fifth International Tinnitus Seminar, 1995).

In recent years there have been significant advances in assistive devices that enhance the ability of individuals to integrate more successfully in personal and business arenas. In a survey by one of the largest organizations for the HoH, Self-Help for the Hard of Hearing (SHHH), it was found that nearly half of its membership used ALDs, both personal devices and large room systems (Sorkin, D., "Understanding Our Needs: The SHHH Member Survey Looks at Hearing Aids." *SHHH Journal*, Volume 16, No. 4, 1995). Perhaps the most promising new technology for broadening the application of assistive devices is ASR. The potential for using speech-to-print mechanisms based on ASR offers promising benefits including real-time transcription in meetings and automated telephone relay services to HoH persons. However, the mechanisms to realize the full potential of those benefits for this population remain to be developed.

There is a need for improvements in the shielding of hearing aid components from the emission of extraneous electronic signals. The Federal government is working to establish standards to reduce those signals from a multitude of devices regulated by the Federal Communications Commission (FCC). However, the probability of blanket suppression of all sources is low.

#### Priority 4

The Secretary will establish an RERC on hearing enhancement to develop new and improve existing technologies for persons who are HoH. The RERC must:

(1) Evaluate current technology available for hearing aids, ALDs, tinnitus maskers, and ASR systems and

develop improvements for these technologies including, but not limited to, improved shielding for extraneous electronic signals and new training and fitting procedures for new multi-channel aids;

(2) Develop and evaluate new, emerging technology for integration into more advanced versions of next generation hearing aids, ALDs, and telecoils;

(3) Automate and simplify methods for conducting hearing loss evaluation in infants, children, and adults;

(4) Develop training and technical assistance materials and provide training and technical assistance to hearing aid developers, technicians, and appropriate organizations representing persons who are HoH to enable them to effectively address the hearing enhancement needs of individuals who are HoH;

(5) Develop and evaluate technology, including, but not limited to maskers, to alleviate the problems of tinnitus.

(6) Develop and evaluate protocols for efficient integration of ASR with interfacing needs of persons with hearing loss including, but not limited to, "real-time captioning," automated relay telephone systems, and personal hand-held communicators; and

(7) Develop training and technical assistance materials and provide training and technical assistance to hearing aid fitters, pediatric and audiology personnel, appropriate counseling organizations, and organizations representing people who are HoH to enable them to address effectively the hearing aid needs and adjustment to hearing loss problems experienced by persons who are HoH and also to provide appropriate counseling and guidance to individuals who experience tinnitus;

In carrying out the purposes of the priority, the RERC shall coordinate on research projects of mutual interest with the RERCs on Universal Telecommunications Access and Communication Enhancement, the RRTC on HoH/Late Deafened, and the Access Board.

#### Electronic Access to This Document

Anyone may view this document, as well as all other Department of Education documents published in the **Federal Register**, in text or portable document format (pdf) on the World Wide Web at either of the following sites:

<http://ocfo.ed.gov/fedreg.htm>  
<http://www.ed.gov/news.html>

To use the pdf you must have the Adobe Acrobat Reader Program with Search,



which is available free at either of the preceding sites. If you have questions about using the pdf, call the U.S. Government Printing Office toll free at 1-888-293-6498.

Anyone may also view these documents in text copy only on an electronic bulletin board of the Department. Telephone: (202) 219-1511 or, toll free, 1-800-222-4922. The documents are located under Option G—Files/Announcements, Bulletins and Press Releases.

**Note:** The official version of this document is the document published in the **Federal Register**.

Applicable Program Regulations: 34 CFR Parts 350 and 353.

Program Authority: 29 U.S.C. 760-762.

(Catalog of Federal Domestic Assistance Number 84.133E, Rehabilitation Engineering Research Centers)

Dated: March 3, 1998.

**Judith E. Heumann,**  
*Assistant Secretary for Special Education and Rehabilitative Services.*

[FR Doc. 98-5894 Filed 3-6-98; 8:45 am]

BILLING CODE 4000-01-P

## DEPARTMENT OF EDUCATION

[CFDA No.: 84.133E]

### Office of Special Education and Rehabilitative Services; National Institute on Disability and Rehabilitation Research; Notice Inviting Applications for New Rehabilitation Engineering Research Centers for Fiscal Year 1998

**Note To Applicants:** This notice is a complete application package. Together with the statute authorizing the programs and applicable regulations governing the programs, including the Education Department General Administrative Regulations (EDGAR),

this notice contains information, application forms, and instructions needed to apply for a grant under these competitions.

This program supports the National Education Goal that calls for all Americans to possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.

The estimated funding levels in this notice do not bind the Department of Education to make awards in any of these categories, or to any specific number of awards or funding levels, unless otherwise specified in statute.

**Applicable Regulations:** The Education Department General Administrative Regulations (EDGAR), 34 CFR Parts 74, 75, 77, 80, 81, 82, 85, and 86; and Disability and Rehabilitation Research Projects and Centers—34 CFR Part 350, particularly *Rehabilitation Engineering Research Centers* in Subpart D.

## APPLICATION NOTICE FOR FISCAL YEAR 1998, REHABILITATION ENGINEERING RESEARCH CENTERS, CFDA NO. 84.133E

Funding priority	Deadline for transmittal of applications	Estimated number of awards	Maximum award amount (per year)*	Project period (months)
Information Technology Access .....	May 11, 1998 .....	1	\$1,350,000	60
Communication Enhancement .....	May 11, 1998 .....	1	900,000	60
Ergonomic Solutions for Employment .....	May 11, 1998 .....	1	800,000	60
Hearing Enhancement .....	May 11, 1998 .....	1	900,000	60

**Note:** The Secretary will reject without consideration or evaluation any application that proposes a project funding level that exceeds the stated maximum award amount per year (See 34 CFR 75.104(b)).

**Program Title:** Rehabilitation Engineering Research Centers.  
**CFDA Number:** 84.133E.

**Purpose of Program:** Rehabilitation Engineering Research Centers (RERCs) conduct research, demonstration, and training activities regarding rehabilitation technology—including rehabilitation engineering, assistive technology devices, and assistive technology services, in order to enhance the opportunities to better meet the needs of, and address the barriers confronted by, individuals with disabilities in all aspects of their lives.

**Eligible Applicants:** Parties eligible to apply for grants under this program are States, public or private agencies, including for-profit agencies, public or private organizations, including for-profit organizations, institutions of higher education, and Indian tribes and tribal organizations.

### Selection Criteria

The Secretary uses the following selection criteria to evaluate applications under the RERC program. (See § 350.54)

(a) *Importance of the problem* (8 points total).

(1) The Secretary considers the importance of the problem.

(2) In determining the importance of the problem, the Secretary considers the following factors:

(i) The extent to which the applicant clearly describes the need and target population (3 points).

(ii) The extent to which the proposed activities address a significant need of rehabilitation service providers (2 points).

(iii) The extent to which the proposed project will have beneficial impact on the target population (3 points).

(b) *Responsiveness to an absolute or competitive priority* (4 points total).

(1) The Secretary considers the responsiveness of an application to the absolute or competitive priority published in the **Federal Register**.

(2) In determining the application's responsiveness to the absolute or competitive priority, the Secretary considers the following factors:

(i) The extent to which the applicant addresses all requirements of the

absolute or competitive priority (2 points).

(ii) The extent to which the applicant's proposed activities are likely to achieve the purposes of the absolute or competitive priority (2 points).

(c) *Design of research activities* (20 points total).

(1) The Secretary considers the extent to which the design of research activities is likely to be effective in accomplishing the objectives of the project.

(2) In determining the extent to which the design is likely to be effective in accomplishing the objectives of the project, the Secretary considers the following factors:

(i) The extent to which the research activities constitute a coherent, sustained approach to research in the field, including a substantial addition to the state-of-the-art (3 points).

(ii) The extent to which the methodology of each proposed research activity is meritorious, including consideration of the extent to which—

(A) The proposed design includes a comprehensive and informed review of