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## ABSTRACT

This handbook presents guidance for federal managers and other personnel who are unfamiliar with the policy and practice of information accessibility to accommodate users with disabilities and to provide for their effective access to information resources. It addresses federal requirements for accessibility, adopting accessibility as a sound information resource management practice, establishing accessibility support services, and acquisition planning for accessibility. The following section describes strategies for accommodating users with: (1) visual impairments by using a glare protection screen, a large monitor with high resolution, magnified display of computer screen, large print production, keyboard orientation aids, speech synthesizer, screen reader software, braille printer, and speech recognition system; (2) hearing impairments by using amplification devices, captioning, signaling system, TDD, and electronic mail; and (3) mobility impairments by using sequential keystroke input programs, key repeat rate control, keyboard macros, word prediction packages, speech recognition, robotic devices, mouse alternatives, optical character recognition, phone headset, and speed dialing. Also addressed are areas of unmet accommodation needs and end-user training considerations and options. Appendices include information on sample contract provisions, federal government accessibility programs, U.S. Government TDD/TTY, public and private sector resources, applicable public laws, and federal regulations on reasonable accommodation. (CR)

# MANAGING INFORMATION RESOURCES FOR ACCESSIBILITY

Office of Information Technology  
US General Services Administration  
Washington, DC 20407

December, 1995

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# Managing Information Resources for Accessibility

December, 1995

Please note, in 1996 Congress enacted legislation that eliminated the Federal Information Resources Management Regulations (FIRMR). Many provisions have been moved into the Federal Acquisition Regulations. At present it is uncertain where the language will be placed to carry out the mandate of Section 508. Please keep this in mind when reading references to the FIRMR in the following pages.

Managing Information Resources for Accessibility has been prepared by the IT Accommodation Division (CITA), General Services Administration (GSA). This handbook presents guidance to Federal managers and other personnel who are unfamiliar with the policy and practice of information accessibility to accommodate users with disabilities and provide for their effective access to information resources. Issues reviewed represent "lessons learned" by agencies and GSA's IT Accommodation Division.

CITA staff invite comments and contributions to the guide. In addition, CITA can be contacted to arrange demonstrations of accommodation solutions at their technical resource center. CITA is also available to assist managers with technical advice and assistance during acquisition planning.

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- People with disabilities Federal employees with disabilities need to be aware of the requirements for accessible information resources in the Federal government. Individuals with newly acquired disabilities may find the accommodation resources and information section (Appendices C, D, and E) helpful in identifying resources for assistance.
- Procurement officials The text of the statutes and applicable Federal Information Resources Management Regulation (FIRMR) excerpts are provided in appendices F, G, H, and I. Procurement officials involved in drafting requests for proposals for information processing equipment and services may be particularly interested in Appendix B which contains possible proposal elements that may be adapted to meet the agency's need.
- Personnel and Equal Employment Opportunity professionals It is critical for personnel and EEO specialists to be acquainted with the range of information technology accommodations possible so they can help managers understand how qualified people with disabilities can do the job when provided with the appropriate tools. After reading the body of the document, the appendices focusing on accommodation resources and information (Appendices C, D, and E) may also be helpful.
- Information processing industry professionals Industry professionals who are informed on the needs and considerations for accessible information environments within the Federal government are in a position to become catalysts for better accessibility in the future. As the Americans with Disabilities Act (ADA) places similar accommodation requirements upon the private sector, those industry professionals capable of meeting accessibility requirements in the Federal government will be able to respond to the needs from within their own companies and the expanding market created by ADA.

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## I. Accessibility in the Evolving Information Environment

### A. Federal Requirements for Accessibility

When information environments accommodate people with limitations of vision, hearing, or mobility they are afforded equal opportunities to become proficient users of information resources. Federal agencies are responding to their mission level responsibility to ensure that evolving information environments are accessible to current and prospective employees with disabilities and citizens with disabilities who need to access Federal offices and public information services. By establishing accessible information environments, agencies also promote productivity, job retention of employees who develop disabilities, and the introduction of innovative interfaces to enhance access to information by all users.

This accessibility policy is based on two laws, the 1986 Reauthorization of the Rehabilitation Act of 1973 (Pub.L. 99-506, Section 508) and the Telecommunications Accessibility Enhancement Act of 1988 (Pub.L. 100-542). These statutes have been implemented in the Federal Information Resources Management Regulation (FIRMR) promulgated by GSA. The FIRMR requires that agencies identify computer and telecommunications accessibility requirements for current and prospective employees and public information services and address the functional aspects of these requirements in solicitation documents and when subscribing to telecommunications services. (See Appendices F, G, H, and I for text of the laws, regulations, and bulletins).

These laws do not represent a radical new direction for agencies, but serve to reinforce through a strong IRM focus, the existing mission requirements under the Rehabilitation Act of 1973. This Act requires federally conducted or federally sponsored programs to be accessible to persons with disabilities and mandates that management policies must not discriminate in the hiring, placement, and advancement of persons with disabilities. In 1986, Congress amended this legislation and added Section 508 on electronic equipment to make more explicit the importance of information technology to meet mission responsibilities for accessibility to Federal programs and facilities. The second statute, the Telecommunications Accessibility Enhancement Act, mandates a proactive approach within the government to advancing accessibility to the Federal telecommunications system by hearing impaired and speech impaired individuals.

The Americans with Disabilities Act of 1990 (ADA) has adapted and extended many of the existing responsibilities of the Rehabilitation Act for implementation outside the Federal government. The law requires barrier-free access to places that serve the public, such as theaters, restaurants, and museums. State and local government services, transportation, and telecommunications services must also be accessible. Discrimination on the basis of disability in private sector employment is also prohibited. As implementation of ADA begins, accessibility to information resources represents just one important area where Federal departments can demonstrate to the private sector successful implementation strategies and the benefits of accessibility policies.

### B. How People with Disabilities Access Information Resources

People with limitations of vision, hearing, or mobility are ensured full access and integration to information resources at a level equivalent to people without disabilities when automated information environments offer the flexibility they need. This flexibility can be achieved in most information environments through off the shelf "drop in" or "add on" hardware and software enhancements that modify the common keyboard input and monitor output interactions familiar to most computer users. When a common keyboard requires too much dexterity, coordination or effort from an individual it can be replaced or enhanced so that less effort is required. In addition to being more user responsive, this input capability may also offer portability,

speech input, or a wireless connection to the computer. If a person can not use a monitor without undue effort and visual strain, the display contents are magnified or replaced with synthesized speech.

Organizations already expect this kind of flexibility as they routinely add firmware boards with specialized modems, terminal emulation, memory, or fax capabilities to personal computers. Having become aware of the need to accommodate people with disabilities and the availability of flexible "drop in" or "add on" products to do so, agency acquisitions are now being planned to ensure continued integration of the access capabilities needed in the information systems purchased. Many of these access products represent maturing technologies that are beneficial to all users such as speech input/output and enhanced monitor and keyboard capabilities. Braille displays and printers are an exception, being used almost exclusively by blind individuals. The following examples highlight how people with specific requirements for accessing and using information technology are readily accommodated in evolving information environments.

The primary limitation experienced by a blind individual using a computer is the inability to benefit from the visual feedback presented on the screen. This access limitation is overcome by adding software and a peripheral device to provide usable feedback in the form of synthesized speech or refreshable braille. Many blind individuals have a strong preference to receive memos, correspondence, and reports electronically by disk, electronic mail (E-mail), or LAN service. Optical character readers configured to support speech would typically be used when documents are received in printed form only. An inexpensive pocket computer consisting of a 7-key braille input keypad and synthesized speech output is frequently used by braille users at meetings to take notes, prepare summary documents, and complement the office-based computer. Because there is no monitor requirement, true portability has been readily achieved.

Many blind individuals are also early and avid users of CD-ROM technology. As more and more volumes of documentation and reference material become available on CD-ROM disks, this technology represents a cost and availability breakthrough to the print barrier experienced by blind people. Using CD-ROM technology, documents can be searched efficiently. When a desired section is located, it can be skimmed at a fast rate of speech output or reviewed at a slower rate for thorough analysis.

Blind individuals may also be eager to adopt voice mail into their office routines. Messages can then be retrieved independently instead of relying upon others. Bulletin boards, on-line services, and telephone-based information services are also highly valued and utilized. These information services provide ease of access to desired information that is complete, concise, and available independently.

Individuals with limitations of hand strength or the ability to execute the fine movements necessary for writing or manipulating printed documents also experience unnecessary constraints when material is not available in electronic form. Accessing documentation for computer application programs on screen via diskette can be much easier and efficient than manipulating manuals and turning pages.

Many keyboard enhancement packages such as keyboard macros and word prediction are used extensively by persons with mobility limitations. Although these techniques offer benefit to almost all users, people with mobility impairments have become early adopters and avid users of these technologies. The appropriate alternative keyboard can compensate for the limited usefulness of more common keyboards. Miniature and expanded keyboards represent two examples of alternative keyboards. In many instances combining several input strategies yields the greatest returns. An alternative keyboard coupled with the use of keyboard macros or word prediction software can result in a significant productivity increase for many people with mobility impairments affecting their arms or hands.



Because individuals with severe mobility impairments are also early users of speech recognition, one solution approach might combine speech recognition with keyboard macros and related keyboard enhancements. The success of this approach depends on the ability to emulate through speech and macros any keystroke, keystroke combination, or mouse control available to other individuals in the same environment. When keyboard commands are executed using speech input, users can access bulletin board systems and other information networks, in addition to controlling their local computer.

Deaf individuals experience few difficulties with printed documents, but are at a disadvantage if information is only presented auditorily, either through live presentation or voice-only telecommunications. Deaf individuals are adversely impacted when organizations fail to provide available alternatives to standard telephones, such as Telecommunications Devices for the Deaf (TDDs). A TDD is a telecommunications device that has a typewriter style keyboard, a readout display, and a phone line connector or an acoustic coupler for a standard telephone handset. TDD users type and read messages over the telephone lines rather than talk and listen like hearing telephone users. TDD compatible modems can also be added to personal computers to enable them to send and receive TDD calls.

Many hard of hearing individuals are able to use a standard telephone set if it has been equipped with a device to provide amplification. Handsets with amplification devices built in can be used to replace the standard handset. Individuals with a speech impairment that permits clear speech, but at a greatly reduced volume, may also benefit from an adapted telephone set. A telephone handset that amplifies the speaker's voice can be added to many phones to replace the standard handset.

Some deaf individuals may also be non-vocal or not have clearly understandable speech. Communication needs within an office can be addressed through a variety of means including handwritten communications, typing to each other using a computer, E-mail, sign language interpreters, and co-workers use of American Sign Language. Communication with other offices may require use of TDDs, E-mail, and fax. Offices equipped with TDDs could be called directly and the exchange would resemble the interactive chat mode of E-mail as the two parties take turns typing their messages. Offices without TDDs could be reached through TDD relay services. Relay operators equipped with TDDs or TDD-compatible computers, relay the typed and spoken messages in the appropriate mode to the sending and receiving parties (see Appendix D for information on the Federal Information Relay Service). A deaf individual could also call a TDD-compatible bulletin board or an automated information service that supports both voice and text output.

This is just a small sampling of information system capabilities employed by people with disabilities today.

As the examples have demonstrated, essential job functions can be readily performed when access to needed information resources and telecommunication services is provided. Many of the previous difficulties associated with the physical aspects of handwriting or turning pages are also eliminated with electronic-based information. In addition, electronic information exchange provides a "disability transparent" means of communication. E-mail messages do not reveal, nor does it matter, whether the sender happens to have a disability in one or more areas such as hearing, speech, vision, or mobility. Identifying and providing the appropriate tools to accommodate people's needs is fundamental to achieving accessibility. More information on the full range of accommodation solutions possible may be found in Section III: Overview of Accommodation Solutions.

### C. How Organizations Benefit from Accessible Information Environments

As implementation of the accessibility statutes proceeds, agencies are discovering that effective utilization of accommodation tools promotes

productivity and ensures access to work-related and public information. Organizations benefit significantly from the ability to recruit and retain quality employees and the ability to effectively interact with all clients, including those with disabilities.

Agency experiences with accommodation solutions that incorporate maturing technologies such as speech synthesis, speech recognition, or document scanning, also provide an effective means for evaluating near-term applications with potential benefit to all users. Many employees in hands busy, eyes busy, or noisy environments can benefit today from flexible interface alternatives that have already been adopted by people with disabilities. Accommodation tools and practices are also being employed to minimize or prevent the visual fatigue and repetitive motion injuries associated with keyboard-intensive environments. As the workforce ages, accessible information environments will support the requirements of people who develop age-related limitations of vision, hearing, or mobility. As planning by Federal agencies increasingly reflects the total information environment, including electronic interfaces with the public and other agencies, accessibility represents a solid foundation to maximizing the value of the evolving information systems.

As a major buyer of information technology, the Federal government is stimulating industry to respond to its accessibility requirement. It is anticipated that the marketplace pull to readily accessible information systems will become even stronger as businesses and state governments implement plans for accessible environments in response to the Americans with Disabilities Act.

## Section II

# II. Accessibility as a Sound IRM Practice

## A. Adopting Accessibility as a Sound IRM Practice

Identifying how the functions of an organization and the activities of its people can be augmented by electronic information tools has become an important responsibility for managers and information resource planners. Responding to these needs ensures that the information tools acquired will advance agency missions and the information proficiency levels of its workforce. For people whose disabling condition(s) make them more reliant upon information resources, responsiveness to their needs ensures that their skills are effectively utilized by the organization. Pub.L. 102-569, Section 508 (see Appendix F) addresses this mission level requirement. The intent of the law is to:

- Ensure that people with disabilities can access and use the same data bases and application programs as other people;
- Ensure that people with disabilities shall be supported in manipulating data and related information resources to attain equivalent end results as other people;
- Ensure that when electronic office equipment is part of a telecommunications system, that people with disabilities can transmit and receive messages in a manner that supports their disability-related needs and provides the capability to communicate with other users of the system.

Pub.L. 100-542 (see Appendix F) serves to reinforce and make more explicit agency responsibilities to ensure telecommunications access to current and future services by people with hearing or speech impairments. In response to the requirements of this law, GSA also established the Federal Information Relay Service (FIRS) to accommodate the communication needs between users of Telecommunications Device for the Deaf (TDD) and users with access to standard telephones only (see Appendix D). Federal offices equipped with both telephones and TDDs are able to initiate and receive TDD calls independent of FIRS. The U.S. Government TDD directory and new building signage identifying public use TDDs (Appendix D) represent two additional statutory-based activities designed to ensure that deaf and hearing people have access to the tools they need to communicate with one another.

The Federal Information Resource Management Regulation (FIRMR) (Appendix G), and related FIRMR Bulletins C8 and C10 (Appendix H) implement Pub.L. 102-569 and Pub.L. 100542. The electronic equipment and telecommunications systems referred to in these statutes are equivalent to the Federal Information Processing (FIP) resources defined in the FIRMR. The FIRMR requires that agencies provide FIP resource accessibility to individuals with disabilities. Accessibility to FIP resources is achieved by the acquisition and application of information technology that readily accommodates the functional limitations of people with disabilities. The agency designated senior official (DSO) is primarily responsible for ensuring FIP resource accessibility. GSA has instituted a procedure to advise agencies to follow its accessibility regulations when granting delegations of procurement authority for information technology resources. GSA's procurement management review program also targets agency compliance with accessibility regulations as a review subject.

Accessibility is becoming integral to IRM, in a manner similar to security planning. Examples of activities include: incorporating access requirements into internal IRM policies and the 5 Year IRM Plan, developing agency procurement vehicles that include accessibility, integrating accessibility practices into enduser support services, and hosting accessible technology fairs.

As the establishment of accessible information environments becomes an important agency goal, IRM provides agencies with a tool to: 1) recruit the most qualified applicants, 2) better utilize the skills of current employees, and 3) improve the delivery of information services to all citizens. This approach ensures that people with disabilities receive equivalent and integrated information services, equipment, training, and technical support as people without disabilities. It also ensures that citizens with disabilities will be able to access automated public information services that are being developed by agencies. Today, people become "handicapped" primarily by environments that are unresponsive and inflexible to

their needs and not by their differing levels of vision, hearing, or mobility functioning.

## **B. Establishing Accessibility Support Services**

User support centers and other technical support services are broadening their functions to include accessibility. The goal is to ensure full access, integration, and continuity of support to people with disabilities using information resources. This includes both employees and citizens. Individual(s) responsible for these support services may want to consider the following activities when integrating access into their support programs:

### **Listen to User Needs**

**Assess Needs** Conduct a survey to determine unmet needs of agency personnel who could benefit from accommodation tools. Consider several means of contacting users including IRM newsletters and questionnaires on electronic bulletin boards. Avoid undue emphasis on disability identification which may inadvertently exclude users such as those with age-related vision problems who could benefit from screen magnification. **Inventory Accommodation Tools** Develop and maintain an inventory of accommodation products and techniques being used by employees with disabilities. Accommodation tools used to provide public access to information resources should also be identified. An inventory is a useful starting point for determining needs when upgrading existing hardware or software or preparing to procure a new system.

### **Know the Technology**

**Develop Access Skills** Spend time with current users of accommodation tools and learn their techniques. Visit and network with technical counterparts in other agencies who are providing accommodation services. Participate in access training and conferences. Become familiar with popular access hardware and software configurations, skills and documentation needed for troubleshooting with users.

**Develop Industry Resources** Become familiar with resources for product information or demonstration of computer and telecommunications access products (Appendices C, D, and E). When visiting information technology shows, inquire how accessibility has been provided within the products, systems, and services.

### **Show the Way**

**Advertise Access** Highlight new accessibility services available through IRM and agency publications and electronic communication resources.

**Conduct Consultations** Assist managers and employees to identify needed tools and sources of supply. Use integrated requirements contracts that include accessibility when available.

**Demonstrate Technology** Include accommodation technology in agency sponsored technology shows to increase agency awareness of the tools readily available for providing accessibility. Purchase representative examples of common accommodation solutions for demonstration in the agency's user support center.

### **Cultivate Integration and Innovation**

**Participate in Procurement** Assist procurement teams by providing the accommodation skills needed to address accessibility requirements in agency Requests for Proposals (RFPs). Invite participation by a knowledgeable person with a disability to the procurement review team that reads RFPs prior to their release. Accessibility related items that others may overlook may be more easily identified by a review team member who has a disability (Appendices A and B).

**Beta Testing** When beta testing a technical solution, either hardware or software, include people with disabilities on the test team. People using accommodation equipment to access the system may find

small problems and areas of concern prior to other users since they are interfacing with the system differently.

Automate Information Services Provide assistance during planning and installation of agency systems that help direct or handle incoming phone calls. This will ensure that the systems can be effectively used by employees and citizens with disabilities. Deaf individuals can be readily accommodated by ensuring that recorded spoken information is also provided in text form in a manner accessible by a TDD.

GSA's Clearinghouse on Computer Accommodation (COCA) provides assistance to agencies in all aspects of accessibility management, from demonstration of enhancement capabilities in their demonstration center to briefings that assist agencies establish their own support capabilities. COCA also hosts meetings with agency counterparts and conducts workshops. Appendix C provides a listing of other Federal government resources.

### C. Acquisition Planning for Accessibility

In the past, few resources were available to managers who felt unprepared to respond to information access needs reported by employees with disabilities. Although costeffective enhancements to meet most access requirements were available, their existence was not well known and utilization was poor. Today, IRM is responding to the need to ensure that people with disabilities have equal opportunities to access and become proficient users of information resources. The responsibility is outlined in the FIRMR (Appendix G). The IRM commitment to action is being expressed primarily through the establishment of internal policy, access support services, and procurement vehicles to ensure integrated access.

Integrated procurement that include accessibility products and services represent the most desired approach for ensuring the full access, integration, and continuity of support required by agencies and the employees they are accommodating. As strategies for acquiring information technology increasingly emphasize the need for software and hardware portability, interoperability, and off the shelf availability, access products provide real examples of these qualities and the benefits obtained.

Throughout an acquisition, beginning with the needs assessment and requirements analysis, the accommodation needs of people with disabilities should be addressed. Functional specifications for alternative input and output capabilities need to be developed. If available, an inventory of current accommodation equipment being used in the agency would facilitate this process. The functional specifications developed should enable the vendors to decide how to best provide the capabilities needed. There are many combinations of commercially available hardware, firmware, and software that can be proposed by the prospective vendors. Using this process of functional specification, the needs of most current and future employees can be effectively met through the specific indefinite quantity and indefinite delivery line item offerings of the contract. Any "technology refreshment" clauses in integrated procurement should be inclusive of accommodation products and services. In this manner, integrated contracts can be readily responsive to the majority of current and anticipated accommodation needs. When an individual's needs cannot be effectively met by the products offered on the contract, the individual should have the opportunity to waive the line item product(s) offered and purchase the product(s) needed through the multiple schedule award or open market. In preparation for supporting an individual in this situation, a contract provision should be included to obtain consultation services to identify and implement an appropriate accommodation. IRM commitment to the integrated approach outlined above will ensure that the accessibility, tools, technical support, and training needs of current and prospective employees with disabilities will be accommodated in the new information environment being planned.

Acquiring access tools for an individual must be done in a timely manner. If the agency has implemented an integrated contract that includes accommodation products and services, the individual should participate in the decision concerning which specific items offered through the contract should be ordered to meet their needs. If there is a functional reason why only one specific product can be used and it is not available through an agency contract, a specific make or model justification is needed for the procurement. Even though there may be several accommodation solutions that are generically the same, such as large print display software or hardware, the small differences in the various products can be

extremely important to the individual. Many of the accommodation specific products available are being offered through multiple distributors. Calling the product manufacturer directly may be the easiest way to determine the vendors servicing each specific geographical area. Determining several distributors of a product will be helpful in obtaining several price quotations on the item. Different distributors may also offer different levels of service for the same product. In a few cases, a specific item may be available only from the manufacturer. It is then necessary to write a justification for the sole source procurement just as it would be for a nonaccommodation item. There are several accommodation products listed on the GSA Multiple Awards Schedules. In many agencies, it is a simpler process to purchase items from the Multiple Awards Schedule. Many of the accommodation vendors are also 8(a) vendors or qualify as a Small or Disadvantaged Business.

This process of identification and provision of tools should be repeated whenever specific needs change. These needs may arise due to new job responsibilities, a change in the condition necessitating an accommodation, or a change in the technology available. If accommodation products are being acquired to augment an existing workstation, or the workstation is being purchased through a different vendor than the accommodation vendor, there are technical considerations that should be reviewed prior to making the purchase. This is true also if several different accommodation products are being purchased to function together on the same workstation. Appendix A contains specific technical considerations that need to be taken into account prior to acquiring accommodation products.

### Additional Considerations

Training, documentation, and maintenance needs must also be taken into consideration. Appropriate training and documentation contributes significantly to the user's productivity with the new products.

#### Training

Training may be as simple as having the vendor install the equipment and showing the enduser and their onsite support personnel how to use the equipment, or how to get started in the tutorial if one is provided. More indepth training may also be required depending on the nature of both the application systems and the accommodation solution being used. During the acquisition planning stage, it should be determined if any training is included in the purchase price, and if that alone will be sufficient or if additional training will be needed. The training considerations included in Section III may be helpful. In integrated contracts including accessibility, the training needs of users with disabilities should be fully incorporated into the overall training plan. Additional training line items may be required to provide for training specific to the accommodation products being used. In addition, the integrated contract should be clear that physical access to the training facility is also a requirement.

#### Documentation

Providing accessible documentation may include providing documentation in braille, large print, cassette tape, or on diskette. During the acquisition planning process it may be possible to determine the preference of the individual if the acquisition is for an individual or a specific group of individuals. In integrated contracts including accessibility, the documentation needs of people with disabilities should be fully incorporated with the overall documentation requirements. A clause may be included to require the vendor to furnish documentation in the appropriate accessible format upon request. The agency may want to require all vendors replying to the specific request for proposal to submit samples of their accessible documentation. Rather than requiring potential vendors to provide all forms of documentation, some agencies have been asking only for documentation on an ASCII disk. The benefit of requiring documentation in ASCII format is that it can then be readily converted into braille or large print as needed in a minimum amount of time for a reasonable cost. There are several service providers and organizations that specialize in producing braille and/or large print documents. By starting with an ASCII disk rather than printed material that needs to be transcribed, agencies realize a significant savings on alternative format production costs. A combination of document formats may also be preferred in some cases. For example, some braille users may want only the introductory sections of documentation and any tables of frequently used commands produced in braille and the remainder of the documentation available on diskette.

## Maintenance

Maintenance of the accommodation products is often forgotten until a product fails. As with the other considerations, maintenance needs to be thought of during the acquisition process, rather than as an afterthought. For many individuals using accommodation products, the entire system becomes unusable to them if their accommodation product fails. Additionally, the individual may be the only person in their area using a specific product so that sharing of resources may not be a viable alternative as it often is for nonaccommodation equipment. What type of maintenance agreement is needed may depend on the nature of the job responsibilities the individual has, the location of the equipment, the number of other individuals in the area using similar equipment, and the vendor responsiveness when repairs are needed. In some cases, onsite maintenance may be preferred while in other situations it may be preferable to send the equipment to the vendor for repair. If accommodation equipment is being used for a critical function within the group, purchasing backup equipment may be an option to consider. Integrated contracts including several levels of maintenance services such as: 1) 4 hour response, onsite, 2) 24 hour repair or replace, onsite, and 3) 48 hour return, depot maintenance, should offer the same options for accommodation products.



## **III. Overview of Accommodation Solutions**

### **A. Introduction**

In preparation for a visit to an agency's accessibility support office or CITA, discussion between the manager and employee should focus on the employee's description of information access problems encountered on the job. Areas of accommodation consideration should include:

- 1) difficulties associated with collection, review, preparation, storage and retrieval of information,
- 2) difficulties with phone usage, and
- 3) accessibility to all information tools and systems currently available in the office or anticipated.

Individual consultation is necessary to identify appropriate accommodation solutions. There is no single "best" solution for all people who are blind, or have low vision, or a mobility impairment. The functional requirements of an accommodation are determined by the nature of the job and how the individual will be using information resources.

A wide array of accommodation addons are available to meet the diversity of needs of end users with disabilities. Choosing the optimal combination of addons requires exposure to the range of possibilities and review of how each could augment the work process. After defining the tasks to be accomplished by an individual user and the anticipated functional problems associated with completing those tasks using standard equipment, vendors should be contacted to review specific descriptions, features, and capabilities of the tools that might best resolve the problem(s). Most of the accommodations currently in use have been developed for the PC environment. A number of solutions are being successfully used within Local Area Network (LAN) configurations and in terminal emulation modes to both mainframe and mini systems using a variety of operating system platforms.

Successful solutions are most readily achieved with a team approach that includes the supervisor, the end user, and a technical support person. Additional accessibility topics less directly related to information processing technologies that managers and employees should discuss include:

- 1) difficulties with participation in discussions and meetings,
- 2) additional assistance needed or currently provided through readers, personal assistants, or interpreters, and
- 3) architectural or physical barriers at the worksite.

A brief description of some tools frequently used by end users with disabilities follows. The review is organized by the functional limitations of vision, hearing, and mobility impairment. A more indepth discussion of many of the topics introduced here is in Appendix A: Technical Considerations in Product Selection.

### **B. Accommodating Users with Visual Impairments**

#### **Low Vision**

The term "low vision" covers a broad range of possible conditions and types of visual impairment. The solutions offered below may be of benefit to some individuals with low



vision, but not to everyone. The individual to be accommodated must be included in any product decision since no one else can see the world in exactly the same way they see it through their eyes.

- Glare Protection Screen -Minimizes visual fatigue associated with glare on the monitor.
- Large Monitor with High Resolution (19" 25") -Increases character size in proportion to monitor dimensions and provides a crisp, sharp image.
- Magnified display of computer screen -Either software or hardware solutions exist to present the images on the computer in a larger format. Character size can be increased approximately 216 times.
- Magnified display of hardcopy material -Hardware exists that will magnify any item placed under a special camera. Documents, drawings, phone messages, etc. can be seen enlarged on a special monitor.
- Large print production -Several software packages are available that will print large, bold text on either a dot matrix or a laser printer.
- Copy machine with enlarging and reducing capability -Provides enlarged print copies for persons with impaired vision that find magnification helpful and small print copies for persons with visual impairments such as tunnel vision which narrowly restricts the field of view.
- Color and contrast selection -Systems or applications which allow the individual user to choose the color combination and level of screen brightness to be displayed.
- Keyboard orientation aids -A raised dot or bleb can be added to certain keys such as the home row keys or the number five on the numeric keypad to give a tactile orientation to the keyboard to augment visual orientation.
- Other keyboard aids -Adhesive backed keycap labels can be purchased and applied to the standard keyboard that have very large, bold letters. These labels can be purchased in either white on black background or black on white background.

## **Blind**

For those users with very limited or no usable vision, accommodation options include refreshable braille display devices, synthesized speech output, optical character recognition, and braille print embossers. A common misconception among sighted users is that braille is always the best solution for blind users. Only about 10 percent of the adult blind population in the U.S. can read braille. Typically, users who have lost their vision later in life tend to rely on speech output as their access strategy rather than braille. Potential equipment add-ons for blind users are briefly reviewed below.

- Speech synthesizer -A hardware device used in conjunction with a screen reader to convert screen contents into spoken words by using synthetic speech.
- Screen reader software -Software package that allows the individual to read the screen by directing the screen contents to a speech synthesizer. The individual can choose to listen to the information appearing on the screen by the letter, word, line, entire screen, etc.
- Braille printer/embosser -Several braille printers are available to provide hardcopy braille documents.

- Braille translation software and firmware -Before a standard word processing document can be printed on a braille printer, it must be converted into the proper format. Both software and firmware exists that will perform this translation function.
- Refreshable braille -A device with a row of braille cells that change to reflect what is being presented on the computer screen. The individual reads the screen contents using the dynamically changing braille display.
- Braille notetaker -Small, portable device that allows braille code entry for notetaking, editing and storage of information.
- Braille input devices -This refers not only to portable notetaking systems that can generate a file to be transferred to the PC, but also to other devices designed to be connected to the PC in place of the standard keyboard to provide for a braille input mechanism. In addition, there are software packages available that will configure a standard keyboard so it can be used for braille input.
- optical character recognition (OCR) -Printed documents may be converted to speech output or written to a PC by use of an OCR configured to support use by a visually impaired person. Use of an OCR allows blind or low vision individuals to independently access many printed materials. Keyboard enhancements A raised dot or bleb, or a braille marker can be added to the standard keycaps on selected keys such as the home row keys, control, or alt keys to provide tactile keyboard orientation. In addition, auditory status indicators for toggle keys, such as "shift lock" or "num lock," can often be provided by software.
- Speech recognition -Some blind computer users have begun to employ speech input systems to give voice commands and/or mouse movements instead of using the keystroke equivalent. This strategy is becoming increasingly useful with new applications employing pulldown menus that may be more difficult to access using speech output and keyboard commands alone.
- Tactile output nonbraille -Tactile output such as raised line drawings may be useful for some blind individuals. Several braille printers and wax jet printers have the capability of producing raised line drawings. There are also handheld devices that use an array of vibrating pins to present a tactile outline of the characters or text under the viewing window of the device.
- CDROM -There are dictionaries, encyclopedias, and magazines currently available on a CDROM format. Even for braille readers, CDROM offers a more easily manipulated, nonbulky format for accessing this type of information.
- Telephone light pen -Blind individuals that use a multibutton phone set may have problems identifying which line is ringing, on hold, or not in use. A light pen is a device that will give an auditory signal when it is held next to the phoneset button that is lit or blinking.

### **C. Accommodating Users with Hearing Impairments**

Although the general term "hearing impaired" is being used to include both deaf and hard of hearing individuals, the needs of these two groups may vary greatly. In general, deaf people depend more upon visual skills for communication and information from their environment while hard of hearing people try to enhance their usable hearing and still rely on auditory input more than visual input. This general difference drives many of the concerns and needs mentioned in this section. It is key that the individual participate in the process of identifying the accommodation solution to ensure it is the proper approach for that

particular individual and their needs.

Many individuals that are hard of hearing can benefit from several of the devices available that provide amplification of standard auditory input. Both individuals with hearing aids and those who do not wear a hearing aid may benefit from use of amplification devices. It should be kept in mind that many deaf individuals also wear hearing aids. For these individuals, the hearing aid allows them to hear loud sounds, but not to discriminate speech regardless of the amount of amplification.

Many of the accommodations discussed for individuals who are deaf focus on the need for visual redundancy to augment what others hear auditorily. The supervisor should discuss with the hearing impaired employee what support structures or procedures may be necessary to perform the job. These discussions should focus on providing visual redundancy to accommodate the individual employee's communication needs relative to one-to-one communications, telephone calls, meetings, and training courses. Accommodation needs vary by the individual, the communication situation, and the job function to be performed.

### Considerations:

Visual redundancy on computers -Ensure that important information conveyed by beeps or speech during computer-related tasks are also displayed visually for the user unable to benefit from the auditory information.

Interpreter -To accommodate hearing impaired people that communicate using American Sign Language or need an oral interpreter, professional interpreters are available on a contractual basis or may be hired by the agency. Hearing impaired individuals and their supervisors should develop a plan to ensure that interpreter services are available when necessary. Interpreters should be available onsite for interpreting at meetings, conferences, and training courses.

Hearing aid compatible phones -When a person wearing a hearing aid attempts to use a telephone that is not hearing aid compatible, they often hear a very loud, high pitched squeal similar to the sound heard when a public address system exhibits a microphone feedback problem. This can be quite uncomfortable, and precludes using this telephone to carry on a conversation. Individuals with hearing aids should be provided with hearing aid compatible phones. The Hearing Aid Compatibility Act (Public Law 100394) required that by August 1989, all essential telephones and all telephones manufactured in the U.S. or imported "provide internal means for effective use with hearing aids that are designed to be compatible with telephones which meet established technical standards for hearing aid compatibility." Some individuals that wear hearing aids may still need an additional phone amplification device.

Speech amplification telephone -For hard of hearing individuals, there are several methods of amplifying the speech being heard over a telephone. There are devices designed both for people who use a hearing aid and for those who do not use a hearing aid. Battery powered, portable handset amplifiers are available for calls made at other phones and on travel.

Speech amplification meeting or conversation -Portable speech amplification devices may be easily set up for use in a group meeting, training course, or lecture for a person who is hard of hearing.

TDD -For an employee who cannot use an amplified telephone, a telecommunications device for the deaf (TDD) or TDD compatible device will be required to support work-related needs. A TDD permits a hearing impaired person to communicate over a standard telephone line with another TDD user or through a relay operator to reach a non-TDD user. The TDD enables the sender to type a message that is displayed as text for the receiving party to read rather than using auditory output like a standard phone. A

personal computer can also be configured to function as a TDD by adding a special modem that supports both the PC code (ASCII) and the code used by most older TDDs (Baudot). A PCbased solution should reflect a user's requirements and allow call announcement and pickup without exiting other PC application programs. TDDs that support Baudot only are rapidly becoming obsolete technology as more TDDs that support both Baudot and ASCII are being produced and used.

**TDD with refreshable braille display** -Deaf/blind individuals may need a specialized TDD that also has a refreshable braille display unit attached. Using this device, a deaf/blind individual and a sighted manager can communicate in a faceto face situation. Both people would type their messages using the TDD keypad. What is typed on the TDD keypad is displayed on the TDD readout and on the refreshable braille display unit. This device also enables a deaf/blind individual to access the telephone system in the same way a standard TDD user would. Instead of reading the text displayed visually, the deaf/blind individual would read the refreshable braille display.

**Signalling system** -For a person that is hard of hearing or deaf, the normal sounds and tones that alert one to take action, such as a phone ringing, may not be heard. A transmitter can be attached to a phone that will cause a light to be flashed or a personal alerting device to vibrate when the phone rings. Transmitters can be used to activate a visual signalling system for fire alarms and door buzzers in addition to telephones. For some individuals, tone ringer devices that convert the ring of telephones into a frequency range more easily heard are beneficial.

**Federal Information Relay Service (FIRS)** -The General Services Administration provides a relay operator service to support government business calls between TDD and nonTDD conversing parties. The operator serves as an intermediary between the hearing impaired or speech impaired (TDDequipped) caller in one direction and the nonTDD equipped caller in the other direction. This service is available to any federal employee as well as members of the public when calling a government office. Within the Washington, D.C. metropolitan area the number is (202) 7089300 v/TDD. Outside the Washington, D.C. area the number is (800) 8778339 v/TDD. More information on this service is available in Appendix D.

**Captioning** -Captioned videos provide the text equivalent of sounds and speech as they occur on the video. Any videobased media produced for instructional, training, or informational purposes either by the agency or for the agency should be captioned so the information presented is accessible to hearingimpaired viewers. When purchasing training tapes, permission should be obtained from the copyright holder to caption them if they are not already captioned.

**Electronic mail** -Electronic mail presents few barriers to communication because it is essentially a visual process. Systems that provide for an interactive "chat" mode in addition to the noninteractive mail mode can greatly expand the communication possibilities for deaf or hard of hearing individuals. The chat mode may be a very viable alternative for many internal communications needs. The electronic mail system should include a feature that provides a visual indicator of message status.

**Bulletin Board Systems (BBS)** -Access to bulletin board systems may be useful in addition to or to supplement access to electronic mail systems. Many BBS exist with information covering a wide variety of topics. A few BBS are accessible by the older Baudot only TDDs. Many more BBS are accessible using the newer TDDs with the ASCII option or the PCbased TDD compatible modems.

**Fax** -Facsimile is the electronic transmission of letters and pictures over regular telephone lines. Sending computer generated information, hard copy documents or handwritten notes through a facsimile machine may provide a valuable alternative to telephone messaging in some situations. The noninteractive nature of fax communications makes it unsuitable as a

substitute for providing TDD communication capabilities. Fax can serve as a technology supplement, to a TDD or TDD compatible device. The fax system used should provide all necessary status information and messages needed for completing the fax transmission in a visual manner. Fax machines that rely on the sender responding to tone or beep indicators are not acceptable for use by deaf or severely hard of hearing individuals. A PC fax card option may be a viable alternative to a standalone fax machine for individuals that typically transmit data that has been generated on a PC. A combination fax machine/telephone may also be an alternative to a standalone fax machine.

**Pay phone TDD** -A pay phone TDD can be purchased or leased. Placed next to other pay phones, it ensures equivalent communications opportunities for visitors to the building who use TDDs. The TDD is in a closed case to protect it from vandalism. The case opens when a TDD is detected at the number that has been dialed. If the number being dialed is a voice and TDD number, a spoken message can be generated that informs the person answering the call that a TDD needs to be connected to respond to the caller.

**Videoconferencing** -As videoconferencing becomes used more widely in the Federal government, the communication needs of deaf individuals should be taken into consideration. At the higher transmission rates used for videoconferencing, a sign language interpreter can still be understood on the receiving end. At lower speeds, movements blur and signs cannot be understood by the receiving individual.

**Automated attendant systems** -If an agency or office is considering installing an automated information service with prerecorded voice messages, plans must be made for providing the same information in a text messaging mode that would support equivalent information access by TDD users. Either a singleline configuration designed to handle both hearing callers and TDD callers or two separate phone lines can be used. In either case, the number should be distinctly identified as being TDD accessible.

#### **D. Accommodating Users with Mobility Impairments**

There are a variety of accommodation solutions available for users with various degrees of mobility limitation. In addition to the actual computer or telecommunications access needs, the entire office environment should be reviewed for barriers to access. Some examples would include narrow aisles that do not allow wheelchair passage, workstation surfaces that are too high or low which may result in fatigue or render the work area inaccessible, or doors that are too heavy for the individual to open. Although many mobility impaired individuals are able to adequately determine which potential accommodation solutions would be most useful for them, others may need additional assistance. For individuals with severe mobility impairments, possibly compounded by muscle control problems or involuntary spastic movements, a professional evaluation of needs may be in order. In this case, a rehabilitation engineer or an occupational therapist may be able to provide assistance during product selection. Specific computer and telecommunications access strategies and products include:

**Sequential keystroke input** -Software programs can be loaded that allow the user to enter keystrokes sequentially that others enter simultaneously and still achieve the same effect. For example CTRLALTDDEL keys are all held down together to perform a soft reboot on a PC. With this program running, CTRL is pressed, then ALT is pressed, then DEL is pressed and a soft reboot still occurs.

**Key repeat rate control** -Programs exist that allow the individual PC user to adjust the sensitivity level of the keyboard or completely turn off the keystroke repeat function.

**Keyboard macros** -Software and hardware solutions exist to allow a few keystrokes to be automatically translated into multiple keystrokes. Macros reduce the number of keystrokes needed to generate a word, phrase, or paragraph. For example, an individual's initials can be

used to generate the entire signature block on the screen.

**Alternative keyboards** -Several alternative keyboards exist that may be more easily used by various mobility impaired individuals. There are small versions of keyboards and large, expanded keyboards. There are also keyboards that are not physically connected to the PC it controls, but rely on infrared transmission to a receiver attached to the PC. The standard keyboard can also be remapped to be used as a righthanded or lefthanded Dvorak keyboard for a person that types with a single hand.

**Nonkeyboard dependent input devices** -There are a variety of alternative input devices that allow keystrokes to be generated by various mechanisms and then transmitted as if generated by the keyboard. Examples are sip and puff systems, muscle switches, optical pointer devices, Morse code input systems, and eye scanning systems.

**Word prediction packages** -Word prediction packages may be used in conjunction with many PC application packages, keyboard enhancement products, and alternative input mechanisms. Word prediction packages try to anticipate the next word the user will be typing and display a list of choices for the user. If the word desired is not on the list, the user selects the first character of the word and the selection list changes. Word prediction can significantly reduce the number of keystrokes the user must enter from either a keyboard or an alternative input device. Some packages will change the listing of words predicted based on the users past usage. Others have a set listing of selections and a predefined presentation order.

**Speech recognition** -Speech input can be successfully used by many individuals that are unable to access the keyboard at all or have very limited access to the keyboard. Speech recognition may be used to either supplement or replace the use of a keyboard.

**Robotic devices** -Voice activated robotic arm devices are available in conjunction with a work station. These units provide a severely mobility impaired user with voice control of the computer and the robotic arm to perform tasks such as loading diskettes, turning pages in a book, and answering the phone. Other environmental control systems may also be attached to this system to control the room lights, blinds, and other things in the office.

**Mouse alternatives** -For programs dependent on mouse functions, there are often keyboard commands that can provide equivalent functions. The use of a trackball may also be a viable alternative to the large sweeping motions often needed for effective utilization of a mouse.

**Keyguard** -A keyguard is a smooth surfaced template with holes corresponding to key locations. The keyguard is placed over a standard keyboard and promotes keyboard accuracy by stabilizing the user's hand movements and preventing inadvertent multiple keystrokes.

**Optical character recognition** -Using an OCR to convert printed documents to an ASCII file may be quite useful. Many mobility impaired individuals are able to read a document on the PC with greater ease than handling a printed version of the document.

**Speaker phone** -For individuals unable to easily pick up or hold a telephone handset, a speaker phone may be quite useful.

**Gooseneck receiver holder** -For individuals in an office setting where a speaker phone would not be appropriate, a flexible gooseneck arm with a clamp to hold the phone receiver may be useful. Typically, a small device would be used in the handset cradle to perform the "offhook" or "hangup" function that happens when the handset is physically placed in the handset cradle.

**Phone headset** -Some individuals may prefer to use a phone headset that is worn on the head

with a small microphone positioned in front of the mouth. Unlike the gooseneck receiver holder mentioned above, this option usually tethers the user to their phone. For an individual unable to put on and remove the headset by themselves, this would decrease their independent movement around the office.

Speed dialing -Many phone systems offer enhancements that allow a short one or two digit code to be used to dial a number. For an individual who has difficulty dialing, this can be quite helpful. Some phone sets can also be purchased that have a speed dial feature built into the phone set itself. A few are available that have voice activated speed dialing.

#### **E. Areas of Unmet Accommodation Needs**

Although there is a wide range of accommodation products readily available, there are still areas of unmet need where accessibility cannot be readily achieved. Hopefully, technology advances will be able to meet these needs in the near future. A few of these areas of unmet accommodation needs will be discussed briefly in the sections below.

##### **General**

One general trend in computer and technology advancements that continues to be a problem is that accessibility is addressed as an afterthought rather than being considered from the beginning in the design of products. Rapid advances leave accommodation practices in a "catchup" role. In some cases, new products are developed that render current accommodation products useless in providing the accessibility required.

##### **Graphical User Interface**

Few technological areas are changing faster than the field of computers. The PC is less than twenty years old, yet we have already gone through several evolutionary changes. The manufacturers and designers of systems to make computers accessible to persons with disabilities have had to constantly keep up with these changes.

Once IBM introduced their PC and the Disk Operation System (DOS) became a widely expected standard, programmers of speech, braille, large print and manufacturers of special keyboards made great strides in providing techniques to make PCs accessible. In the general software market, programmers during the eighties and early nineties began using more and more sophisticated screen layouts. The human computer interface moved into the realm of pull-down menus, color bars and special cursors. Programmers of adaptive equipment have added a variety of features to their programs to make these features accessible. Although challenging, most of these screen innovations have not posed problems that programmers could not overcome.

In the late eighties, the advent of the graphical user interface posed a very strong challenge to computer accessibility. At first, it was assumed that there was no answer to the problem. People who could not see the screen were not going to be able to access these new interfaces. The graphics screen could not be read by a speech or braille system. Fortunately, these fears have not been realized. Programmers are beginning to make advances in developing speech and braille systems that can translate the graphics screen information into an accessible form. As of this publication, these access programs are having limited success with the graphics environment. The main focus is on accessing the Windows environment. There is limited access for the Apple Mackintosh graphical interface and IBM has developed a screen reader to operate in the OS2 graphical environment.

In the realm of the graphical user interface, the biggest challenge will be to just keep up with change. Most of the access software is produced by small companies with limited resources. Producing programs that will work in the graphics environment takes many hours of manpower. The most serious problem arises when we realize that unlike the DOS

environment, access programs in the graphics environment are version specific. A program written to give access to Windows version 3.1 will not work with version 3.0, and most likely will not work with Windows 4.0. Additionally, a Windows access program only works with Windows and does not give access to other graphical environments. Anyone facing the prospect of acquiring an adaptive system to work with any graphical interface should always insist on proof that the system will work in the specific environment. An on-sight demonstration of the access program to assure the employee can actually perform work with the system is highly recommended.

## POSIX

Accommodation product development has not kept pace with the "addons" needed to be utilized with POSIXcompliant systems. Many people with disabilities are left with only one option. This option is to add the appropriate accommodation tools to a personal computer running a VT100 or VT220 emulation as an interface to the POSIXcompliant operating system. The problem is that not all the commands and keystrokes needed are available through these emulations. Better emulation solutions and accommodation products designed for POSIXcompliant operating systems are needed to fill the existing technology gap for people with disabilities.

## Local Area Networks (LANs)

Even though many people using accommodation products are able to access and work within LAN environments, this is not true of all LANs. Many accommodation products have software that runs in a terminatestayresident (TSR) mode. On some LANs there are memory management problems between the accommodation TSRs and the LAN software. Other LANs will automatically terminate any TSR programs running when the workstation accesses the LAN. In addition to these potential software incompatibilities, there may also be conflicts between the LAN boards and some of the accommodation product boards. Often the board level conflicts can be resolved, but not always.

## Telephone Status Indicators

For many years, blind individuals have had few difficulties in working with telephones. For those with multiline sets, a specialized light probe could be used to determine which of the indicator lights was lit, and whether it was solidly lit or blinking. With the change to newer style phonesets, the smaller, red indicator lights are not detectable by the light probes. Several of the newer phone features, such as using a light emitting diode (LED) display to indicate that messages are waiting and to display the numbers to be called, are inaccessible to individuals who are blind or have low vision. Having auditory redundancy added for these features would be helpful.

## F. End User Training Considerations and Options

Training is another key element of accommodation. Both the initial training with the new accommodation equipment and ongoing career development training should be taken into consideration. When new equipment has been procured, both the end user and the technical support personnel involved in the accommodation effort should receive training. The amount of training required varies with the individual and the technology employed. Training may range from computerassisted tutorials to formal instruction. The support personnel should be almost as familiar with the accommodation hardware and software as the end users in order to provide good ongoing support. Training is also necessary for management personnel. The first line supervisor should be the primary focus of this training. The supervisor should have an appreciation of the accommodation taking place, the technology being utilized, and its relation to the other tasks in the office.

For the user just learning to use a personal computer, training in general PC use is needed in



addition to the training focused on the accommodation equipment the individual will be using with their PC. Agency managers in charge of training should be prepared to include employees with disabilities in the standard training courses offered. The individual should have some training on their accommodation add-ons prior to training on new systems or applications. This preliminary training will allow the employees with disabilities to focus on the application training course itself rather than on the accommodation-related procedures.

If the training center does not offer adequate computer accessibility on their computer workstations, the training center will need to make arrangements for the accommodations used by the employee to be installed on the training center PC for the duration of the course. The training center should be prepared to answer questions about serial or parallel port availability, connector type (e.g. 25 pin male, or 9 pin female), and type of monitor (e.g. EGA, VGA, CGA, or monochrome). They should also be supportive of making the computer system available the day before the class is scheduled to begin so the necessary accommodation add-ons can be installed and tested. The course instructor should take a little time prior to the beginning of the course to become familiar with the rudimentary elements of the accommodation packages being used. As with any training course for any nondisabled employee, the documentation and course notebook are an important part of the total training package. Every effort should be made to provide documentation to the user in the most useful format possible. Frequently requested formats may include braille, audio tape, large print, or ASCII diskette. When an individual registering for a course identifies their disability, they should be asked the format they prefer. The assumption should not be made that "all blind students will want braille" or that "all students with low vision will want large print." If video tapes are used for training, they should be available in a captioned format for use by hearing impaired individuals.

Additional ideas that may be useful for training center managers or managers preparing to send an employee with a disability to a training class are listed below.

For a student who is blind these ideas include:

- Have a reader or personal assistant with a blind person for the first morning of training to help orient the person to the keyboard, drive slot, etc.
- Put tactile dots on the keyboard that will be used in training to provide home row key orientation and any special keys the instructor will be directing the students to use during the course of training.
- If the training center does not offer adequate computer accessibility, have the computer support person for the area set up the employee's screen reader and synthesizer at the training center the day before training is due to begin.
- For braille readers, have any "cheat sheets," such as function key assignments, available in braille.
- For all class workbooks available in braille, the page numbers should reference the print page number.
- Instructors should be reminded to read aloud any instructions or material written on the board or on overheads used throughout the course.
- Many students that are blind may want to make an audio recording of the training for their own use. If contractor trainers are being used, they should be aware of this and not prevent the student from recording the course. Courses that involve materials requiring security safeguards would be an exception.
- The instructor or class coordinator should be prepared to give directions to the break

area, restrooms, phones, etc. in a clear manner that does not depend on visual references such as, "the room with the blue door." Directions given stating the distance, or the number of doorways on the left or right would be more usable by a blind individual.

For individuals with low vision, the following ideas may be helpful:

- Large print display monitors would be a nice addition to any training center and provide a benefit to many students that may utilize the center. Both large print display of computer screen contents and large print display of hard copy materials would be useful.
- Large print keycap labels would be quite easy and inexpensive for a training center to add to one or more of their keyboards. Tactile dots on the keyboard are also useful to many students by giving a tactile orientation to the keyboard to supplement the visual orientation.
- Provide copies of transparencies, slides, or material normally printed on the board. Provide these in large print if possible. For individuals who are deaf, the following suggestions have been given.
- Have an adequate number of sign language interpreters so they can be easily seen and have adequate time off between sessions.
- Prearrange for hearing impaired students to share notes taken in class by nonhearing impaired students. This may be facilitated by not grouping all the individuals with hearing impairments together. Sharing notes may also be facilitated by supplying the student designated as the notetaker with paper that produces a carbonless duplicate.
- Prior to giving verbal instructions, the instructor should be sure the deaf individual is looking at the interpreter. Flashing the room lights is a simple and effective means of getting everyone's attention.
- If verbal instructions given are lengthy or involve processes the student will then be asked to perform, such as a computer exercise, it may be difficult for the student to watch the interpreter and accurately record the instructions. Preparing instructions prior to the class and giving the student a printed copy would be helpful.
- The instructor or class coordinator should be prepared to give instructions to the students for the location of a public use TDD similar to giving hearing students the location of a pay phone.

For individuals who are hard of hearing the suggestions include:

- Have the classrooms equipped with an assistive listening system. These systems can be either permanently installed or portable.
- Be sure all the instructors understand assistive listening systems and know they must use the microphone for the system to work.
- Instructors should be careful not to talk to the class while their back turned is to the class, or obstruct their mouth with their hands, a pencil, etc. while they are talking. Many hard of hearing individuals depend on visual cues to aid in their understanding and need to see the instructors lips clearly.
- Instructors should clearly repeat any questions raised by the class participants prior to giving the answer to ensure everyone has heard the question. This is particularly true

if the instructor is using an assistive listening device and the question was not spoken through the system microphone.

- Care should be taken to minimize unnecessary outside noise that might make hearing more difficult.

For mobility impaired individuals attending training, the suggestions include:

- Prearrange for mobility impaired students that would have trouble taking notes to share notes taken in class by another student. This may be facilitated by supplying the student designated as the notetaker with paper that produces a carbonless duplicate.
- Ensure there is adequate space in the classroom to accommodate a wheelchair or a scooter if the student uses either of these.
- Be sure all instructors know the location of the accessible restrooms nearest the classroom location and alternate locations if that facility is not available.

Other types of training:

In addition to standard classroom training situations, people with disabilities may benefit from other types of training media. Training videotapes, audio cassette tapes, onetoone training, and training centers that specifically focus on the training needs of people with disabilities may all be options to supplement traditional classroom training experiences. Which type of training is most appropriate is a decision that should be made jointly between the manager and the individual.

Considerations include:

- The nature of the material being taught.
- Level of difficulty, length of the course, etc.
- Is it on a topic that is routinely taught, such as PC application courses, or something unique, such as a particular piece of accommodation equipment?
- Is the training media accessible?
- Are videotapes captioned for deaf and severely hard of hearing individuals?
- Are audio cassettes indexed to make finding the proper section of the tape easier?
- Is the training being done for just one individual or for an entire group?

Although there are training centers that specifically focus on training individuals with a disability, managers should not assume this is the training of choice. In many cases, if the entire office is going to be receiving training for a new system, the individual with a disability would prefer to receive the same training as their coworkers. The training center performing the training for the office should make every effort to ensure the individual is properly accommodated and can attend the course with their coworkers. In addition, the standard training centers may be the only source for some of the courses needed by the individual.

In some cases, training that is designed specifically for people with disabilities will be the best alternative for the individual and the manager. If the regularly used training center is unable to accommodate the individual's needs, or does not offer the courses needed, specialized training may be the best alternative. Several specialized training centers exist that charge no more for their training courses than the standard training centers.

Management and supervisory training conducted by the agency should also include a component on accessibility and accommodation. In addition to general "sensitivity

training," managers need to be aware of the range of possible computer and telecommunications accommodation solutions currently available. Federal government managers, employees, or groups of agency personnel that may want to see some of the computer and telecommunications solutions discussed in this handbook, can arrange for an informal demonstration at the CITA technical resource center. Please call CITA for more information or to arrange a consultation or demonstration. Hearing callers may call 202-501-4906. TDD callers may call 202-501-2010. Appendix C provides a listing of other Federal government resources.



## Appendix A

The FIRMR requires that agencies consider accessibility for employees with disabilities when conducting requirements analyses for FIP. Those needs must be addressed in specifications describing the functions and capabilities included in solicitations. Information on accessibility may be found in FIRMR Bulletin C-8. Situations will vary, therefore, no precise specification, clause, or provision can be provided which will cover specific agency accessibility needs. The following sample clauses and prescriptive information are provided to assist agencies in developing such specifications, clauses or provisions. Agencies should review each section of their solicitations for agency specific requirements, to determine how individual solicitations should address these special requirements. As a minimum, some variation of the sample clauses/specifications/provisions used here should be included in Section C, H and L.

GSA's Center on Information Technology Accommodation (CITA) can provide additional assistance on accessibility requirements and solicitation provisions/clauses. A guidance document entitled "Managing End User Computing for Users with Disabilities" is available from CITA or from the internet at [WWW.GSA.GOV/cita/front.htm](http://WWW.GSA.GOV/cita/front.htm), or by calling (202) 501-4906 (v) or (202) 501-2010 (TDD).

## **A. Sample language for "Scope of Contract" - SECTION C**

### **Accommodations for Users with Disabilities**

Requirements for meeting the needs of users with disabilities (and any technology enhancements provided for herein), in accordance with FIRMR, 41 CFR Chapter 201 and FIRMR Bulletins C8 and C10, shall be considered part of the scope of this contract. The Offeror shall provide products and services as specified in Section C to meet the needs of users with visual, hearing, and motor impairments to ensure that all users are provided the required accessibility that enables their use of the FIP resources acquired under this contract in accordance with the FIRMR. In addition, the Offeror shall include provisions for substituting accommodation hardware, firmware, and/or software which represent an advancement in technology with respect to that originally offered in the proposal. All substitutions must meet the salient characteristics of the original specification and be certified by the Government as a suitable replacement for or addition to the appropriate accommodation hardware, firmware, and/or software. The Government shall evaluate the Offeror's ability to meet the minimum mandatory requirements specified in Section C. The overall integration of users with disabilities and how they will be provided equal access to the proposed resources offered will be evaluated as a Subjective Technical Factor (see Section M). This will include an evaluation of the Offeror's training plan and support for persons with disabilities.

## **B. Sample language for "Detailed Specifications" - SECTION C**

Detailed Functional Specifications for Specific Requirements for Accommodation. [Note: If these functions have not been stated as hardware or software requirements, it must be clear

in proposals how the function/capability will be satisfied.]

## **1.0. Minimum Functional Requirements**

The Offeror shall provide the FIP resources (e.g. hardware, software, cables, connectors, firmware, etc.) as described in this section in order for the proposed hardware and software to perform as specified herein and to meet all of the requirements of this contract. The resources offered shall meet the minimum requirements outlined below and be fully compatible with all proposed hardware and software. In addition, any single enhancement or combination of enhancements, when enabled, must be compatible with all system operations and procedures that are available when the enhancements are not enabled.

### **1.1. Input.**

Input accommodations for users with physical impairments differ by the type and severity of the functional limitation of the user. Some users with impairments are capable of using the keyboard if it can be modified slightly. Users with more severe impairments may require an alternate input strategy.

1.1.1. Keyboard Enhancement. The Offeror shall provide keyboard enhancement which provides the functionality outlined below. The keyboard enhancement offered shall be capable of operating on the standard keyboard offered with the proposed desktop, laptop, or portable computer. The keyboard enhancement shall be able to execute independently or in combination at a minimum, the following functions:

- Execution of multiple keystroke commands (e.g., "CTRL-C") serially rather than simultaneously.
- Disabling and adjustment of the keyboard repeat tolerances.
- Emulation of a mouse or similar pointing input device movements from the keyboard.
- Visual and auditory indication of key status for the; Number Lock, Shift/Caps Lock, and Scroll Lock keys.
- Adjustment of volume level of the keyboard audible feedback.

1.1.2. Keyboard Alternative(s). The Offeror shall provide an alternate input device to accommodate users unable to use the standard keyboard. The alternate keyboard shall be integrated with the proposed end-user system(s) and provide the following functions:

- Emulation and transmission of user input of any valid keystroke combination available from the standard keyboard.
- Emulation of a mouse or similar pointing input device movements from the keyboard.

The proposed workstations must be capable of working with the following types of alternate input devices.

- Mini keyboard
- Large keyboard
- Row/column scanner
- Braille Chord input
- Chordic device
- DVORAK keyboard

(NOTE: Further language may be necessary to describe exactly what is required by the alternative device. For example a keyboard with 1 1/2" or 1/2" keys or one that is activated by single switch supported by row/column scanning software will have to be specified to meet the particular requirements.)

1.1.3. Keyboard Accessories. The Offeror shall provide the following product(s) to aid users

in the use of the standard keyboard:

1.1.3.1. **Keyguard.** Keyguards or keyboard guards prevent inadvertent or multiple key depressions. Keyguard template holes shall be no less than 1.5 cm or 1/2" in diameter and correspond to the key arrangement of the standard as described in Section 1.1. The keyguard shall be attachable to the surface of the keyboard to ensure stability. The keyguard and any attaching hardware shall be removable.

1.1.3.2. **Keyboard overlays.** Keyboard tactile overlays to identify locations of home row keys and important non-standard location keys, e.g., ESC, ENTER, CTRL and ALT.

1.1.3.3. **Keyboard covers.** Molded plastic covers, designed to cover the standard keyboard, to prevent damage to the keyboard from spilled liquids.

## **1.2. Speech Recognition System.**

The Offeror shall provide an integrated system to control all applications software and operating system functions offered via voice/speech input recognition. The proposed Speech Input Recognition System shall at a minimum provide the following functions:

- a) Ability to use the spoken word or phrase to effect a command or string of commands at the operating system level and the application level.
- b) User access to pre-defined vocabulary sets which include user-controllable editing and cursor movement functions for common applications.
- e) A primary vocabulary expandable to include a minimum of 30,000 words.
- f) Ability to build user-definable vocabulary sets containing a minimum of 2,000 user-definable words and command phrases in each vocabulary set.
- g) Ability to use a standalone microphone or headset with attached microphone or remote cordless microphone with noise-canceling function which provides the highest possible reduction in ambient noise.

## **1.3 Optical Character Recognition System.**

The Offeror shall provide an Optical Character Recognition System that converts various types of print material into an electronic form that can be accessed via proposed workstation. The OCRs offered shall at a minimum provide the following functions:

- a) Recognition accuracy of not less than 95%.
- b) Automatic recognition of print material placed upside-down or sideways on the scanner (i.e. landscape & portrait modes).
- c) Formatting and encoding support for ASCII text and applications included on this project.
- d) Support interpretability with Braille Output System.
- e) Multiple column recognition.
- f) Recognize multiple fonts including: typewritten, typeset, Laser printed, dot matrix (draft quality), 6-28 point sizes, monospaced and proportional.
- g) Batch scanning (i.e. scan now, recognize later).
- h) Support attachment of an optional document feeder for scanning a stack of unbound documents.
- i) Support interoperability with Speech Output System.

## **1.4. Output.**

1.4.1. **Monitor Enhancement.** The Offeror shall provide a monitor enhancement that magnifies text and graphics displayed on the monitor of desktop, laptop, and portable computers. The monitor enhancement proposed shall work with all proposed applications and at a minimum provide the following functions:



- a) User definable magnification levels from 2 to 8 times normal output in graduations of 2x.
- b) Ability to toggle the magnification on and off returning the display to normal output.
- c) User definable views (e.g. full screen, partial screen, or single line magnification).
- d) User definable attribute settings (e.g. cursor tracking, highlight identification, color definition, and font definition.)

1.4.2. Visual/Auditory Enhancement. The Offeror provided workstation shall provide an integrated function that provides a visual and auditory response to the user that would notify the user of significant system activity (i.e. error notification). The proposed visual/auditory feedback enhancement shall at a minimum provide the following functions:

- a) An auditory cue (i.e. beep) that is compatible with the Speech Output System.
- b) A non-auditory cue or on-screen notification (e.g. screen flash, flashing "ERROR" message, or flashing light).

1.4.3. Print Magnification System. The Offeror shall provide a Print Magnification System that magnifies text and color graphics displayed on flat (i.e. newspapers, memos, phone messages, etc.) or three-dimensional objects (i.e. parts, containers, etc.) and displays the magnified image on a high resolution color monitor. The print magnification system is a Closed Circuit TV (CCTV) system which utilizes camera (normally a Charged Coupled Device (CCD)) camera for input and a high resolution color display screen for output. The print magnification system proposed shall at a minimum provide the following functions:

- a) User selectable magnification of printed color graphics and text up to at least 45 times original size.
- b) User selectable black letters on a white background or white letters on a black background.
- c) User adjustable contrast and brightness controls.
- d) Attachment to personal computer.
- e) Automatic gain control adjusting to changes in light.
- f) User controllable viewing table to allow the reader to view an entire page.

1.4.4. Refreshable Braille Output System. This system shall provide the user with an equivalent tactile read-out of information appearing on the computer display screen. The proposed Refreshable Braille Output System shall at a minimum provide the following functions:

- a) Display a minimum of 40 characters.
- b) Recognition and display of control characters and screen attributes.
- c) Review mode that allows the user to move the display around the screen without moving the operating or program cursor.

1.4.5. Speech Output System. The Offeror shall provide an integrated speech output system that is compatible with all proposed applications programs and the proposed workstation that translates text displayed on the monitor into understandable speech. The proposed speech output system shall at a minimum provide the following functions:

- a) Interactive auditory review by character, word, line, definable window(s) and/or entire screen.
- b) Speak current line, (the line at the cursor), current character or letter and cursor position, (screen column and row), at the request of the users.
- c) Selectively read text meeting user defined specification, i.e. highlighted, underlined, displayed in a specific color, or in a defined window.
- d) User-definable customization of window and/or screen layouts of specific

applications programs.

- e) User-definable pronunciation exceptions dictionary.
- f) Auditory review toggle on/off for speech. (Note: auditory review shall include a cursor locator command available at any time.)
- g) Automatically "speak" whenever a system message or error message is received.
- h) Adjustable rate and pitch of the voice output controllable from the keyboard.
- i) Adjustable speaking rate from a range of 120 wpm (words per minute) to at least 280 wpm.
- j) User-definable processing of numbers and punctuation.
- l) Headset (headphones).

1.4.6. Braille Output System. The Offeror shall provide all necessary hardware and software for generating Braille hard copy output (Grade I and Grade II) that meets the standard put forth by the Library of Congress and the Braille Authority of North America from a printer that is fully compatible with the proposed workstation. The Braille Output System proposed shall at a minimum provide the following functions:

- a) Print speed of not less than 40 characters per second.
- b) Print a minimum of 20 characters (Braille cells) per line.
- c) Print a maximum of 25 lines per page.
- d) Production on paper from 8 1/2 by 110# weight printer paper to 100# weight high quality Braille paper.
- e) User definable settings for page length and paper width.

## 1.5 Telecommunications.

1.5.1. Telecommunications Device for the Deaf (TTY/TDD). The Offeror shall provide an integrated TDD/TTY that is compatible with the proposed workstation. The TDD/TTY proposed shall at a minimum provide the following functions:

- a) Carry an approved FCC rating.
- b) Transmit/receive Baudot signals at a speed of 45.5 baud, half-duplex, and ASCII asynchronous at a speed of 300 baud (minimum), full duplex, and support originate & answer mode.
- c) Call progress monitoring via line status indication (i.e.; detection of off-hook, dial tone, busy, connected TDD or ASCII).
- d) Telephone line interconnection via RJ-11C.
- e) Direct dialing, pulse or tone, from the keyboard.
- f) Determine incoming communications mode (Baudot or ASCII) and answer in appropriate communications mode without operator intervention.
- g) Unattended answering of incoming calls.
- h) User definable storage and transmission of outgoing messages in Baudot or Asynchronous ASCII.
- i) User definable receipt, storage, and printing of incoming messages.
- j) User definable phone number directory.
- k) Automatic disconnect (hang up) when line drops or carrier is lost regardless of call origination.
- l) User definable system configuration options including; number of rings before hang-up, auto-answer vs. manual, TDD mode vs. Asynchronous ASCII, and default detection mode.
- m) Concurrent operation of TDD/TTY software/firmware with other programs (runs in background mode).
- n) Identification of incoming calls by the display of a flashing "ring" message or flashing the entire screen.
- o) User definable parameters for exiting an application, answering a call, and returning to an application without disrupting the application.
- p) Direct interface to optional signaling device (i.e. flashing light, vibrating beeper).

## **1.6 Required Support for Future Needs**

The Contractor shall provide systems engineers and/or other experts on an hourly call-in basis to advise and assist the Government in resolving any communications or interfacing problems that arise during the provision of any additional enhancement capabilities not addressed in the mandatory requirements section and to analyze the potential of future access capabilities that are determined by the Government to meet the access requirements of users with disabilities.

## **C. Sample language for "Manuals and Publications" - SECTION C**

ASCII or Grade II Braille Documentation.

The Offeror must be able to provide copies of all documentation required by this contract in machine-readable media compatible with proposed access equipment or in Grade II Braille hard copy, as required by the Government. Braille hard copy documents shall be prepared in accordance with English Braille (American Edition) and the Library of Congress Instruction Manual for Braille Transcribing. These publications are available from: American Printing House for the Blind, 1839 Frankfurt Avenue, P.O. Box 6085, Louisville, KY 40206. The documentation must be available in the stated form within 30 days (or whatever number is required by an agency) of receipt of a written request from the Government.

The Offeror shall explain in his proposal what arrangements shall be made for production and delivery of both types of specialized documentation required over the life of the contract.

## **D. Sample language for "Training" - SECTION C**

The Offeror shall be responsible for training individuals to productively use all hardware and software to be delivered. The Offeror shall develop a training plan that incorporates the needs of users with disabilities into the overall user training program. Such training shall include system level and end-user training. This training shall be available throughout the life of the contract. All training courses and instructional materials shall be accessible by persons with disabilities. This may require the use of sign language interpreters for hearing impaired persons; captioned video tape; Braille or large print material for visually impaired persons; equipment (computer) accommodations; and satisfactory physical or architectural accommodations for mobility impaired persons.

## **E. Sample language for "Facilities" - SECTION C**

All facilities shall be accessible to persons with disabilities. See Uniform Federal Accessibility Standard (UFAS). Contact the Architectural & Transportation Barriers Compliance Board (Access Board) telephone (202) 272-5434.

## **F. Sample language for Technology Refreshment Clauses - SECTION H**

Substitutions of FIP Resources to Accommodate Users with Disabilities.

The Offeror shall offer FIP resources becoming available after contract award which offer improvements in technology which better provide for the needs of users with disabilities. If the Government elects to do so, it may evaluate the offer, and accept for substitution of equipment covered in the contract but not yet delivered. Any such proposal should contain the general information required by the clause entitled "Engineering Changes" (or whatever

technology refreshment clause is included in the contract). Such equipment/software offered after award must meet all specifications of the basic contract. When substitution of such enhanced technology is made without charge to the Government, or as a planned part of the contract (e.g. planned upgrade), manuals and publications as required by the contract shall be provided to all addressees (in the stated quantities) affected by the change without charge to the Government (unless other payment arrangements are made by the agency in the solicitation). [The agency should include any needed evaluation criteria for enhancements in Section M.]

## **G. Sample language for Subjective Technical Factors - SECTION M**

### **1. Comprehensiveness and Adequacy of Offering.**

- a) Evaluation of Offeror's understanding and sensitivity to access-related issues.
- b) Evaluation of integration of users with disabilities requirements into overall proposal.

### **2. Provision of required deliverables/services to ensure accessibility.**

**3. Offeror Personnel Experience.** Evaluation of Offeror's ability to provide quality personnel expertise (i.e. number and skill level of personnel with experience) in the provision and integration of accessible technology.

## Appendix B

# Federal Programs for Information Technology Accessibility

## General Services Administration (GSA), Center for IT Accommodation (CITA)

Since 1984, CITA has served as a model demonstration center for advancing accessible information environments, services, and management practices in order to stimulate the government-wide capacity-building needed to meet statutory requirements. The Center provides technical consultation, presentations, training, and assistance to federal agencies and also serves as a pilot demonstration site and market need/market utilization conduit between federal agencies and laboratories, universities and industry.

CITA facilitates a network of Federal employees with disabilities and their support personnel that provides early customer feed back on new service delivery technologies and practices. Coordinating with CITA and this network, the Information Technology Accommodation (ITA) Working Group, is now a part of many agency programs.

### Current projects underway include:

- o working with Government Printing Office, National Institute of Standards and Technology, and Internal Revenue Service to ensure development of electronic document services that are accessible
- o providing guidance on developing accessible CD-ROMs
- o developing a tutorial to assist blind users becoming oriented to Windows
- o preparing a CITA handbook as a model for universal accessing electronic document preparation
- o evaluating Internet browsers, including Mosaic and Lynx to enhance the access modes supported

## Department of Veterans Affairs Microcomputer Training Program for Persons with Disabilities (MTPPD)

(MTPPD) serves persons with disabilities within and outside the Department. MTPPD also supports the Department's Nationwide Office Automation for the VA (NOAVA) implementation to ensure employees with disabilities receive equal access to NOAVA OA systems and platforms.

The MTPPD program provides training to employees within the VA and from other federal agencies. The cost-reimbursable training addresses both adaptive technology and common application packages. Other program services include consultations, tours, equipment demonstrations, and product evaluations. Document scanning and

converting services, including braille, are available to agencies on a cost-reimbursable basis.

Susan Boaz  
810 Vermont Avenue, NW  
Mail stop: 0411/200B  
Washington, DC 20420  
Phone: 202 535-6542  
Fax: 202 273-6555  
Internet: SUEBOAZ@NETCOM.COM  
Compuuser: 74404,1446-Susan Boaz

## **Department of Commerce (DoC) Committee on Resources for Electronic Accessible Technology to End Users (CREATE)**

CREATE is the vehicle responsible for planning and coordinating Department-wide activities in increase awareness of accessible technology issues and explore ways to ensure that the information environment is usable by people with disabilities. CREATE hosts the Accessible Computer Technology Exhibit hosted annually in October to increase awareness and effective use of commercially available products and services that accommodate people with disabilities.

Zoe McDonald  
1401 Constitution Avenue, NW  
Room 6899  
Washington, DC 20230  
Phone: 202 482-3201  
Fax: 202 482-0411  
Internet: ZoeMcDonald@DOC.GOV

## **Department of Agriculture (USDA) Technology Accessible Resources Gives Employment Today (TARGET) Center**

The Accessible Technology Program has established the TARGET Center to support USDA employees nationwide and other federal agencies. TARGET provides evaluations, demonstrations, resource information, needs assessments, and training on accessible technology. The center uses open systems concepts to highlight accommodation solutions available on personal computers. TARGET demonstrates how accessible technology optimizes productivity and job retention of career employees by reducing worker compensation costs and disability retirements from end-user computer injuries.

Ophelia Falls  
USDA Target Center  
AG-Box 7676  
Washington, DC 20250  
No Internet or E-mail

## **Department of Defense Computer/Electronic Accommodations Program(CAP)**

Detailed information about the CAP program is available on the [Office of the](#)

## **Internal Revenue Service Computer/Telecommunications Accessibility Program (CAP)**

The Computer/Telecommunications Accessibility Program (CAP) was established to ensure the IRS makes electronic information accessible to people with disabilities. CAP assists the managers and employees in selection and procurement of appropriate adaptive technology. The CAP office works with acquisitions and procurement personnel to ensure that accessibility is included in information technology procurements. CAP has a demonstration center with adaptive equipment.

T. J. Cannady  
CAP Team  
1111 Constitution Avenue, NW  
Room 3416 ARFB  
Washington, DC 20224  
Phone: 202 927-4321 or 202 927-2834  
Fax: 202 927-9368 No Internet

## **National Security Agency Center for Computer Assistive Technology (CCAT)**

The National Security Agency's CCAT provides demonstration of assistive technology devices and professional resources for agency employees with hearing visual or physical limitations. The goal of the center is to provide assistance and identify alternative solutions for persons with disabilities.

Mayer Max  
Phone: 301 688-6961F

**Job Accommodation Network The Job Accommodation Network (JAN) is an international toll-free consulting service that provides information about job accommodations and the employability of people with functional limitations. JAN also provides information regarding the Americans with Disabilities Act (ADA).**

Federal IT Accessibility Programs / September 5, 1998



## Appendix C



# U.S. Government TDD/TTY Information

## PREFACE

The Telecommunications Accessibility Enhancement Act of 1988 (Public Law 100-542) tasks the General Services Administration (GSA) with assuring that the Federal Telecommunications System is fully accessible to speech- and hearing-impaired individuals. To carry out this responsibility the Federal Information Relay Service (FIRS) was established in 1989.

The FIRS relays calls to/from members of the speech- and hearing-impaired community and is accessible nationwide. It enables Federal employees to conduct official duties and for the general public to conduct business with the Federal Government. Many of you are either users of the Federal Information Relay Service or have employees who have benefited from using this vital service that allows communications between hearing and speech- and hearing-impaired individuals.

Another requirement of Public Law 100-542, is for GSA to publish and maintain a directory of TDD (Telecommunications Device for the Deaf) numbers. In addition to the published U.S. Government TDD Directory, information is available on-line via the GSA Automated Federal TDD Directory. You will find information on using this service under the section entitled TDD USAGE.

Developing the database and keeping it as accurate as possible is a difficult task. Your assistance in keeping us posted about the validity of these listings is needed. If there has been an omission or if a change is necessary, please inform us immediately using the form provided in the directory.

Thank you for your support in helping to ensure telecommunications equality for the speech- and hearing-impaired in working for or dealing with the Federal Government.

## TDD USAGE

A *Telecommunications Device for the Deaf (TDD)* generally consists of a keyboard, display screen, and a modem on which a telephone is placed. Teletypewriters (TTY) were the original communication devices used by individuals with hearing or speech impairments. Important TDD Shorthand expressions are:

- GA Go Ahead, meaning your turn to type
- SK Stop Keying, meaning good-bye
- HD Hold On
- PLS Please

OIC Oh, I see  
CUL See You Later  
U You  
Q Question

## **WHEN TO CALL THE FEDERAL INFORMATION RELAY SERVICE (FIRS):**

1. If you use a Telecommunications Device for the Deaf (TDD) and need to reach a Federal agency or program that does not have a TDD
1. If you are a Federal employee who uses a TDD and your job requires you to contact an office that does not have a TDD
1. If you do not have a TDD but need to get in touch with a Federal employee who uses a TDD

## **THE FEDERAL INFORMATION RELAY SERVICE (FIRS)**

Call 1-800-877-8339

## **AUTOMATED FEDERAL TDD DIRECTORY**



Call 1-800-877-8845

Updated Federal TDD listings can be found in the Automated Federal TDD Directory. Listings submitted after April 18, 1994 are not found in this book, but may be found in the automated version of the TDD Directory.

To use the Automated Directory, follow the instructions provided when you call.



## Appendix D

## Public and Non-Profit Resources



This is a list of public and non-profit agencies which provide information or services related to information technology access for persons with disabilities. It is provided by the Center on Information Technology Accommodation (CITA) at the General Services Administration. We want to keep it as accurate as possible. If you find anything in this list which is not accurate, please send mail to [quentis.scott@gsa.gov](mailto:quentis.scott@gsa.gov).

- The American Council of the Blind (ACB)  
The American Council of the Blind  
1155 15th Street, NW, Suite 720,  
Washington, DC 20005  
(202) 467-5081 (800) 424-8666 FAX: (202) 467-5085
- **American Foundation for the Blind** - A non-profit organization founded in 1921 and recognized as Helen Keller's cause in the United States, the American Foundation for the Blind (AFB) is a leading national resource for people who are blind or visually impaired, the organizations that serve them, and the general public. The mission of the American Foundation for the Blind is to enable people who are blind or visually impaired to achieve equality of access and opportunity that will ensure freedom of choice in their lives.
- The Archimedes Project... providing leverage for individuals with disabilities through information technology, from the Center for the Study for Language and Information Stanford University
- Assistive Technology On-Line. At the Applied Science and Engineering Laboratories (ASEL) at the University of Delaware and the A.I. Dupont Institute. The purpose of Assistive Technology On-Line is to provide a wide range of information on AT to consumers, family members and professionals.
- AsTeR - Audio System for Technical Readings Project by T.V. Raman. Demonstration and technical information.
- The Cornucopia of Disability Information, intended to serve as a community resource for consumers and professionals by providing disability related information, via an internet **Gopher**, in a wide variety of areas.
- Do-It Gopher server - The Do-It program at the University of Washington, with partial funding from the National Science Foundation, has compiled a concise listing of mailing lists, newsletters, newsgroups, and gopher servers containing information of interest to people with disabilities.
- Equal Access to Software and Information EASI, an affiliate of the American Association for Higher Education, is dedicated to disseminate up-to-date information about providing equal access for persons with disabilities to

computing and information technology. EASI provides both E-mail Workshops and on-site seminars on Adaptive Computing to universities, colleges, schools, businesses and non-profit organizations and assists them in making information technology accessible with the use of state-of-the-art adaptive computing technology.

- ICADD - The International Committee on Accessible Document Design is chartered "to develop and encourage the document transformations that print disabled persons are working toward. Members of this committee are working to ensure that the emerging HTML standards include enhanced accessibility for print disabled users.
- Library of Congress, National Library Service for the Blind and Physically Handicapped (NLS)
- National Association of the Deaf  
Wooland Executive Center  
1218 Reidville Rd. Suite I  
Spartinburg, SC 29306  
(803) 576-9303 (voice)  
(803) 576-9175 (TTY)
- The National Federation of the Blind The National Federation of the Blind  
1800 Johnson Street  
Baltimore, Maryland 21230  
410-659-9314
- The National Rehabilitation Information Center, (NARIC) is a library and information center on disability and rehabilitation. Funded by the National Institute on Disability and Rehabilitation Research (NIDRR), NARIC collects and disseminates the results of federally funded research projects. The collection also includes commercially published books, journal articles, and audiovisuals.
- Royal National Institute for the Blind (RNIB) in London.
- Contact information for Technology Related Assistance Act (Tech Act) State Programs
- The Technology Accessment Program at Gallaudet University conducts research and demonstration projects on visual technologies for deaf and hard of hearing people.
- Trace Research and Development Center at the University of Wisconsin at Madison.



## Appendix E



# Legislation and Policies on Information Systems Accessibility

There are several laws and policies, which address information systems technology as it relates to persons with disabilities.

Among them are:

- Laws

- Americans With Disabilities Act of 1990
- Rehabilitation Act Amendments of 1992 Section 508.
- Technology-Related Assistance for Individuals with Disabilities Act Amendments 1994
- Telecommunications Enhancement Act of 1988

- Policy

- OMB Circular A130
- Accessibility White Paper
- Microcomputer Procurement System and PC Benchmarking
- Accessible Software Design Criteria
- 508 Guidelines
  - Federal Information Resources Management Regulation (FIRMR) Excerpts
  - Access Related FIRMR Bulletins

This page is maintained by the Center for IT Accommodation. We plan to add the text of all of these laws/policies. Any comments, suggestions, fixes, additions, and other feedback are most welcome. Feel free to contact us by mail or phone.



## Appendix F

# CODE OF FEDERAL REGULATIONS ON REASONABLE ACCOMMODATION

## *Title 29, Section 1613.704*

a. An agency shall make reasonable accommodation to the known physical or mental limitations of a qualified applicant or employee unless the agency can demonstrate that the accommodation would impose an undue hardship on the operation of its program.

b. Reasonable accommodation may include, but shall not be limited to: 1) Making facilities readily accessible to and usable by handicapped persons; and 2) job restructuring, part-time or modified work schedules, acquisition or modification of equipment or devices, appropriate adjustment or modification of examinations, the provision of readers and interpreters, and other similar actions.

c. In determining pursuant to paragraph (a) of this section whether an accommodation would impose an undue hardship on the operation of the agency in question, factors to be considered include: 1) The overall size of the agency's program with respect to the number of employees, number and type of facilities, and size of budget; 2) the type of agency operation, including the composition and structure of the agency's work force; and 3) the nature and cost of the accommodation."

## *Title 29, 1614.203 Rehabilitation Act*

(a) *Definitions.* (1) *Individual with handicap(s)*, is defined for this section as one who:

(i) Has a physical or mental impairment which substantially limits one or more of such person's major life activities;

(ii) Has a record of such an impairment; or

(iii) Is regarded as having such an impairment.

(2) Physical or mental impairment means:

**(i) Any physiological disorder or condition, cosmetic disfigurement, or anatomical loss affecting one or more of the following body systems:**

Neurological, musculoskeletal, special sense organs, cardiovascular, reproductive, digestive, respiratory, genitourinary, hemic and lymphatic, skin, and endocrine; or

**(ii) Any mental or psychological disorder, such as mental retardation, organic brain syndrome, emotional or mental illness, and specific learning disabilities.**

(3) *Major life activities* means functions, such as caring for one's self, performing manual tasks, walking, seeing, hearing, speaking, breathing, learning and working.

(4) *Has a record of such an impairment* means has a history of, or has been classified (or misclassified) as having, a mental or physical impairment that substantially limits one or more major life activities.

(5) *Is regarded as having such an impairment* means has a physical or mental impairment that does not substantially limit major life activities but is treated by an employer as constituting such a limitation; has a physical or mental impairment that substantially limits major life activities only as a result of the attitude of an employer toward such impairment; or has none of the impairments defined in paragraph (a)(2) of this section but is treated by an employer as having such an impairment.

(6) *Qualified individual with handicaps* means with respect to employment, an individual with handicaps who, with or without reasonable accommodation, can perform the essential functions of the position in question without endangering the health and safety of the individual or others and who, depending upon the type of appointing authority being used:

(i) Meets the experience or education requirements (which may include passing a written test) of the position in question; or

(ii) Meets the criteria for appointment under one of the special appointing authorities for individuals with handicaps.

(b) The Federal Government shall become a model employer of individuals with handicaps. Agencies shall give full consideration to the hiring, placement, and advancement of qualified individuals with mental and physical handicaps. An agency shall not discriminate against a qualified individual with physical or mental handicaps.

(c) *Reasonable accommodation.* (1) An agency shall make reasonable accommodation to the known physical or mental limitations of an applicant or employee who is a qualified individual with handicaps unless the agency can demonstrate that the accommodation would impose an undue hardship on the operations of its program.

(2) Reasonable accommodation may include, but shall not be limited to:

(i) Making facilities readily accessible to and usable by individuals with handicaps; and

(ii) Job restructuring, part-time or modified work schedules, acquisition or modification of equipment or devices, appropriate adjustment or modification of examinations, the provision of readers and interpreters, and other similar actions.

(3) In determining whether, pursuant to paragraph ©(1) of this section, an accommodation would impose an undue hardship on the operation of the agency in question, factors to be considered include:

(i) The overall size of the agency's program with respect to the number of employees, number and type of facilities and size of budget;

(ii) The type of agency operation, including the composition and structure of the agency's work force; and

(iii) The nature and the cost of the accommodation.

(d) *Employment criteria.* (1) An agency may not make use of any employment test or other selection criterion that screens out or tends to screen out qualified individuals with handicaps or any class of individuals with handicaps unless:

(i) The agency demonstrates that the test score or other selection criterion is job-related for the position in question and consistent with business necessity; and

(ii) OPM or other examining authority shows that job-related alternative tests, or the agency shows that job-related alternative criteria, that do not screen out or tend to screen out as many individuals with handicaps are unavailable.

(2) An agency shall select and administer tests concerning employment so as to insure that, when administered to an applicant or employee who has a handicap that impairs sensory, manual, or speaking skills, the test results accurately reflect the applicant's or employee's ability to perform the position or type of positions in question rather than reflecting the applicant's or employee's impaired sensory, manual, or speaking skill (except where those skills are the factors that the test purports to measure).

(e) *Preemployment inquiries.* (1) Except as provided, in paragraphs (e)(2) and (e)(3) of this section, an agency may not conduct a preemployment medical examination and may not make preemployment inquiry of an applicant as to whether the applicant is an individual with handicaps or as to the nature or severity of a handicap. An agency may, however, make preemployment inquiry into an applicant's ability to meet the essential functions of the job, or the medical qualification requirements if applicable, with or without reasonable accommodation, of the position in question, i.e., the minimum abilities necessary for safe and efficient performance of the duties of the position in question. The Office of Personnel Management may also make an inquiry as to the nature and extent of a handicap for the purpose of special testing.

(2) Nothing in this section shall prohibit an agency from conditioning an offer of employment on the results of a medical examination conducted prior to the employee's entrance on duty, provided that: all entering employees are subjected to such an examination regardless of handicap or when the preemployment medical questionnaire used for positions that do not routinely require medical examination indicates a condition for which further examination is required because of the job-related nature of the condition, and the results of such an examination are used only in accordance with the requirements of this part. Nothing in this section shall be construed to prohibit the gathering of preemployment medical information for the purposes of special appointing authorities for individuals with handicaps.

(3) To enable and evaluate affirmative action to hire, place or advance individuals with handicaps, the agency may invite applicants for employment to indicate whether and to what extent they are handicapped, if:

(i) The agency states clearly on any written questionnaire used for this purpose or makes clear orally if no written questionnaire is used, that the information requested is intended for use solely in conjunction with affirmative action; and

(ii) The agency states clearly that the information is being requested on a voluntary basis, that refusal to provide it will not subject the applicant or employee to any adverse treatment, and that it will be used only in accordance with this part.

(4) Information obtained in accordance with this section as to the medical condition or history of the applicant shall be kept confidential except that:

(i) Managers, selecting officials, and others involved in the selection process or responsible for affirmative action may be informed that an applicant is eligible under special appointing authority for the disabled;

(ii) Supervisors and managers may be informed regarding necessary accommodations;

(iii) First aid and safety personnel may be informed, where appropriate, if the condition might require emergency treatment;

(iv) Government officials investigating compliance with laws, regulations, and instructions relevant to equal employment opportunity and affirmative action for individuals with handicaps shall be provided information upon request; and

(v) Statistics generated from information obtained may be used to manage, evaluate, and report on equal employment opportunity and affirmative action programs.

(f) *Physical access to buildings.* (1) An agency shall not discriminate against applicants or employees who are qualified individuals with handicaps due to the inaccessibility of its facility.

(2) For the purpose of this subpart, a facility shall be deemed accessible if it is in compliance with the Architectural Barriers Act of 1968 (42 U.S.C. 4151 et seq.) and the Americans with Disabilities Act of 1990 (42 U.S.C. 12183 and 12204).

(g) *Reassignment.* When a nonprobationary employee becomes unable to perform the essential functions of his or her position even with reasonable accommodation due to a handicap, an agency shall offer to reassign the individual to a funded vacant position located in the same commuting area and serviced by the same appointing authority, and at the same grade or level, the essential functions of which the individual would be able to perform with reasonable accommodation if necessary unless the agency can demonstrate that the reassignment would impose an undue hardship on the operation of its program. In the absence of a position at the same grade or level, an offer of reassignment to a vacant position at the highest available grade or level below the employee's current grade or level shall be required, but availability of a vacancy shall not affect the

employee's entitlement, if any, to disability retirement pursuant to 5 U.S.C. 8337 or 5 U.S.C. 8451. If the agency has already posted a notice or announcement seeking applications for a specific vacant position at the time the agency has determined that the nonprobationary employee is unable to perform the essential functions of his or her position even with reasonable accommodation, then the agency does not have an obligation under this section to offer to reassign the individual to that position, but the agency must consider the individual on an equal basis with those who applied for the position. For the purpose of this paragraph, an employee of the United States Postal Service shall not be considered qualified for any offer of reassignment that would be inconsistent with the terms of any applicable collective bargaining agreement.

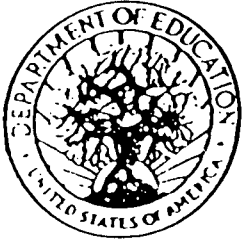
(h) *Exclusion from definition of "individual(s) with handicap(s)".* (1) The term "individual with handicap(s)" shall not include an individual who is currently engaging in the illegal use of drugs, when an agency acts on the basis of such use. The term "drug" means a controlled substance, as defined in schedules I through V of section 202 of the Controlled Substances Act (21 U.S.C-812). The term "illegal use of drugs" means the use of drugs, the possession or distribution of which is unlawful under the Controlled Substances Act, but does not include the use of a drug taken under supervision by a licensed health care professional, or other uses authorized by the Controlled Substances Act or other provisions of federal law. This exclusion, however, does not exclude an individual with handicaps who:

(i) Has successfully completed a supervised drug rehabilitation program and is no longer engaging in the illegal use of drugs, or has otherwise been rehabilitated successfully and is no longer engaging in such use;

(ii) Is participating in a supervised rehabilitation program and is no longer engaging in such use; or

(iii) Is erroneously regarded as engaging in such use, but is not engaging in such use.

(2) Except that it shall not violate this section for an agency to adopt or administer reasonable policies or procedures, including but not limited to drug testing, designed to ensure that an individual described in paragraph (h)(1)(i) and (ii) of this section is no longer engaging in the illegal use of drugs.



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