

ACCESS TO INFORMATION  
TECHNOLOGY BY USERS WITH  
DISABILITIES

INITIAL GUIDELINES

OCTOBER 1987

On October 21, 1986, the Department of Education (ED) and the General Services Administration (GSA) were directed by Congress (Public Law 99-506) to develop agency procurement guidelines to ensure access to electronic office equipment by individuals with disabilities. This report presents initial management and procurement guidance to federal agencies. It was developed jointly by DOE and GSA in consultation with an advisory committee and individuals from the electronics industry, agencies, and the disabled community. The principal authors of this report were:

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## EXECUTIVE SUMMARY

In 1986, Congress mandated that agencies formally assume responsibility for ensuring that electronic office equipment, whether purchased or leased, be accessible by individuals with disabilities. This document details the implementation plan for this statute (Section **508, P.L. 99-506**) together with the initial management and procurement guidance to agencies regarding electronic equipment accessibility. This guidance also provides early information to industry regarding the direction in which the government is moving.

Significant productivity and human resource benefits accrue to government, industry, and individuals with disabilities when standard information technology can be readily enhanced to support all users. Current microcomputers can be adapted to accommodate the special access requirements of most users with disabilities. In addition, many emerging access technologies used by individuals with disabilities today e.g., voice input/output and enhanced keyboard and monitor capabilities, may be beneficial to all users as the technologies mature.

In **1984**, the National Institute on Disability and Rehabilitation Research of the Department of Education (ED) established a Government-Industry Task Force to identify ways of designing computers to make them usable by a larger portion of the population. Also in 1984, the General Services Administration (GSA) established the Interagency Committee for Computer Support of Handicapped Employees and the Clearinghouse on Computer Accommodation to advance the management and use of information technology in order to promote the productivity and achievement of Federal employees with disabilities.

These joint ED and GSA guidelines reflect the firsthand experiences of these agencies during the past three years, as well as consultation with the electronics industry, other agencies, and the disabled community during guidelines development. The guidelines address management responsibilities and functional performance specifica-

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tions for achieving accessibility. It is anticipated that these guidelines and all related activities will continue to evolve in the years ahead as information technology advances and as the government gains additional experience in applying technology to meet the requirements of individuals with disabilities.

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# I. INTRODUCTION

**In 1986, Congress** re-authorized the Rehabilitation Act of 1973, as amended, (Public Law 99-506) adding Section 508 on electronic equipment accessibility ". . . to insure that handicapped individuals may use electronic office equipment with or without special peripherals." Congress has mandated that guidelines for electronic equipment accessibility be established and adopted and that agencies shall comply with these guidelines with respect to electronic equipment, whether purchased or leased.

The initial guidelines that follow address management responsibilities for electronic equipment accessibility and functional performance specifications. The guidelines interpret Congress' intent to mean that future Government procurements and leasing of equipment shall assure electronic accessibility such that: the disabled end user shall have access to the same data bases, operating, and application programs; shall be equipped with adaptive programs and devices to support his or her disabilities; shall have computing capability not appreciably less than that of non-disabled end users in the same position and office; and shall be supported in manipulating data so as to attain end results equivalent to the non-disabled user. Electronic equipment which is part of a telecommunications system shall permit disabled end users to transmit and receive messages in a form amenable to their disabilities and having a content comparable to messages transmitted by non-disabled end users.

The above shall apply to all Government agencies, and an agency's lack of accessible electronic office equipment shall not be a rationale for denying employment, promotion, or transfer.

To achieve the intent of Congress, the Government shall establish accessibility policies and procedures for planning, management, procurement, and compliance which complement current information resources management activities, and management practices generally. This first version of the guidelines is an initial step. It is intended to set a tone and to provide early guidance to industry on the

direction in which the Government plans to move in the months and years ahead. As experience is gained, and as technology emerges, these guidelines will continue to evolve.

Providing electronic equipment accessibility for individuals with disabilities who have special needs is an idea whose time has come. Of all the electronic office equipment technologies, microcomputers may have the greatest current and long term potential for individuals with disabilities. While many individuals with disabilities will not need special equipment, others will. Due to the inherent flexibility of microcomputer technology, many users with vision or motor impairments, who cannot benefit from commonly used computer displays or keyboards, have alternatives readily available e.g., large print and braille displays, spoken input and output, and keyboard enhancement and replacement products. Fueled by this potential of microcomputer technology in the office, there is action in many areas.

Executives and others working independently in central agencies, line agencies, in Congress, and in industry have taken important actions to begin to provide electronic equipment accessibility to individuals with disabilities. The Rehabilitation Act of 1973, as amended, is serving as a catalyst to provide a comprehensive and longer range view of the possibilities.

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## 11. BACKGROUND

In 1984, the National Institute on Disability and Rehabilitative Research (NIDRR), the Office of Special Education and Rehabilitative Services, Department of Education, in conjunction with the White House, took the initiative to begin a process of bringing computer manufacturers, developers, and consumers together to address the question of access and use of standard computers and computer software by persons who have disabilities.

An initial meeting was held on February 24, 1984, at the White House. The objective of the meeting was to familiarize the companies with access problems and to solicit their support in a cooperative effort to address the problems. The meeting resulted in recognition of the problems, and a request by the manufacturers for more information about disabilities, current barriers to the use of standard computers, and solution strategies that the manufacturers should consider.

Subsequent to this meeting, briefings were held with manufacturers, and a White Paper was developed and distributed in preparation for a second meeting on October 24-25, 1985. This meeting consisted of a one and one-half day work session followed by a reporting session at the Rayburn Building on Capitol Hill. Computer firms represented included Apple, AT&T, Digital Equipment Corp., Hewlett Packard, Honeywell, IBM, and Tandy Corporation.

As a result of this second meeting, a Government/industry task force was formed. Now, two years later, the task force continues to work to identify ways that industry can improve the design of computers so that they will be usable by a larger portion of the population.

Additional information about task force achievements and participants is available from NIDRR.

### III. AUTHORITIES AND RESPONSIBILITIES

Section 508 of Public Law 99-506 places new responsibilities on the Department of Education and the General Services Administration. These new responsibilities along with related responsibilities from earlier legislation include:

Department of Education-"The Secretary, through the National Institute on Disability and Rehabilitation Research (NIDRR) and the Administrator of the General Services, in consultation with the electronics industry, shall develop and

establish guidelines for electronic equipment accessibility designed to insure that handicapped individuals may use electronic office equipment with or without special peripherals." The deadline for establishing the initial guidelines is October 1, 1987. The guidelines are to be periodically revised as technologies advance or change.

General Services Administration-The Administrator of GSA, under the Federal Property and Administrative Services Act of 1949, as amended, publishes and codifies uniform policies and procedures pertaining to information resources activities by Federal or executive agencies (as applicable) and by Government contractors as directed by agencies. Under Section 508 of Public Law 99-506, the Administrator of GSA will assist the Secretary of Education in the development of the guidelines noted above. In addition, the Administrator is charged with adopting guidelines for electronic equipment accessibility after September 30, 1988.

Section 508 of P.L. **99-506** refers to "electronic equipment, whether purchased or leased," directs the ED and GSA to develop electronic accessibility guidelines, and then directs GSA to adopt the guidelines "for Federal procurement of electronic equipment." Procurements initiated after September 30, 1988, shall comply with the guidelines.

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## IV PURPOSE

This document has five purposes:

1. Identify the recent activities in this area
2. Provide a broader framework for meeting the needs of individuals with disabilities now and in the future as the electronics industry advances
3. Provide guidance to agency management in determining the needs of end users with disabilities and acquiring electronic equipment to satisfy these needs

4. Detail the implementation plan for Public Law **99-506**, Section **508**, on Electronic Equipment Accessibility
5. Encourage industry to meet the needs of the disabled community through standard products, over the longer term

## V CURRENT RESOURCES

In recent years, many individuals have initiated independent action to assist individuals with disabilities to capitalize on the potential of electronic office technology. The Government currently has the following resources and interested parties should contact the programs directly. In March 1984, the Administrator of GSA established the Interagency Committee for Computer Support of Handicapped Employees (ICCSHE). Twenty-three agencies are represented on the committee. They meet quarterly to exchange information on progress and problems in advancing Information Resources Management (IRM) activities to support employees with disabilities. Half of the member agencies have completed internal directives establishing general policy and procedures for providing computer support to their handicapped employees. The directives establishing this responsibility within their IRM offices were modeled after an internal order that established a similar responsibility within GSA and also created a Governmentwide Clearinghouse on Computer Accommodation (COCA).

ICCSHE assists GSA by developing proposals addressing management and procurement areas where attention and guidance is suggested. Through four working groups, ICCSHE, sponsors annual Governmentwide symposia, collaborates with federal laboratories to facilitate technology transfer, and participates in exchanges with counterpart organizations in other countries.

Individual agencies are implementing computer support activities and sharing their accommodation solutions with COCA, which serves as a central point of information

exchange and networking among agencies. Examples of some ongoing agency activities follow.

The Department of Defense (DoD) has established Coordinators for Computer Support of Handicapped Employees in each major DoD component. The Office of the Assistant Secretary of Defense, Force Management and Personnel is responsible for this initiative.

A Computer Support Committee has been formed at the Department of Health and Human Services and special funds for purchases of accommodation technology are being set up within the services. The Social Security Administration has established a Special Terminal and Adaptive Resources (STAR) Project as part of their Systems Modernization Plan. A task force is working to provide accommodation equipment that will allow disabled employees in all field offices to use the new automated claims system.

The Information Technology Center (ITC, FTS 233-5525) of the Veterans Administration has developed a program to enable their disabled employees to use personal computers. Through interagency agreements, consultation and training are also available to employees of other Federal agencies.

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The Internal Revenue Service is developing a requirements contract for accommodation-related equipment, technical staff are available to assist with accommodation needs, and strategies are being reviewed to improve access to print information by visually impaired employees. GSA's Clearinghouse on Computer Accommodation (COCA, FTS 523-1906) was established in January 1985. This technical resource center assists agencies as they establish support services and responds to individual accommodation requests Governmentwide. COCA provides demonstrations of accommodation products and strategies at their center, 18th and F Streets, N.W, Washington, D.C. In addition, COCA gives presentations at agency conferences and seminars and provides formal training in computer accommodation through the GSA Training Center. COCA also maintains a data base of accommodation solutions received from agencies. Several agencies are implementing COCA's data base program to maintain their own inventory of agency equipment and expertise. COCA is currently preparing a man-

ager's handbook, *Managing End User Computing for Users with Disabilities*, that will be published in November 1987.

On April 27, 1987, GSA published Bulletin 48 in the Federal Information Resources Management Regulations System (FIRMR). This outlines the responsibilities of agencies to provide for the special computer accommodation needs of employees with disabilities when replacing existing computer systems. In the future, GSA plans to consider the development of a schedule of contractors to assist agencies when they need help to integrate end users with disabilities into the information technology environment.

In summary, there is a great deal of activity which has preceded and led to these guidelines. We anticipate that these guidelines and all other activities will continue to evolve in the years ahead as technology improves and as the Government gains further experience in adapting technology to the special needs of individuals with disabilities.

## VI. GUIDELINE PROPOSALS

These proposals address management responsibilities for electronic equipment accessibility and functional performance specifications for input, output, and documentation. Under the law, each agency must provide electronic equipment accessibility as detailed in the guideline proposals after they are adopted by GSA.

### A. Definitions

1. Electronic Equipment Accessibility-is defined as the application/configuration of electronic equipment in a manner that accommodates the functional limitations of individuals with disabilities so as to promote productivity and provide access to work-related and/or public information resources.

2. Federal Information Resources Management Regulations (FIRMR)-are regulations promulgated by GSA

that address the management, acquisition, and use of certain automatic data processing equipment, records and telecommunications resources by Federal and executive agencies.

3. Handicapped Individuals or Individuals with Disabilities -means individuals with impairment(s) that result in a functional limitation with regard to the use of electronic office equipment.

4. Special Peripheral-is defined in Section 508 as "a special needs aid that provides access to electronic equipment that is otherwise inaccessible to a handicapped individual."

## **B. General Policy**

Handicapped persons and persons who are not handicapped shall have equivalent access to electronic office equipment. Provision of equivalent access shall include but shall not be limited to:

Ensuring that end users with disabilities can access and use the same data bases and applications programs as other end users;

Ensuring that end users with disabilities shall be supported in manipulating data and related information resources to attain equivalent end results as other end users; and

Ensuring that when electronic office equipment is part of a telecommunications system, that end users with disabilities can transmit and receive messages in a manner that supports their disability related needs and provides the capability to communicate with end users on their system.

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## **C. Management Responsibilities**

The single official for Information Resources Management, under the Paperwork Reduction Act of 1980, should assign an individual the responsibility to implement these guidelines. This individual would be responsible for keeping the agency in step with Federal policies as they evolve over time. This would include making agency IRM and procurement managers aware of their responsibilities, building ac-

cessibility requirements into procurements, and ensuring that technical support capabilities are available to introduce new equipment. The single official should ensure that appropriate progress is being made through triennial review program inspections.

To assist agencies to perform these responsibilities, GSA is developing a manager's handbook, *Managing End User Computing for Users with Disabilities*, which identifies the range of disabilities and current strategies to augment computer systems for accessibility. The greater need, however, is to encourage agencies to identify the requirements of their users with disabilities in order to achieve solutions during acquisition planning and procurement. The functional performance specifications below will help address this need.

#### **D. Functional Performance Specifications**

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The functional performance specifications which follow are a combination of accessibility strategies which exist today, and additional strategies that would improve accessibility in the future. They are not an exhaustive list. The purpose of the specifications is to define an initial and basic level of accessibility, to be modified over time, to ensure that information technology, leased or purchased, is available to users with disabilities. Many of these specifications will prove useful to all end users.

Depending on the needs of the end users of each agency, all or part of these specifications will be included in agency procurement documents as requirements for demonstrable features. The Government will welcome vendor creativity in responding to the functional requirements. In keeping with Federal procurement policy, each vendor will determine how to best satisfy these requirements. Vendor solutions may range from third-party hardware and software provided capabilities to hardware "built-ins" and operating system enhancements. Solutions residing in the vendors' hardware and software will have the greatest value to Government. Layering, which is the inclusion of additional levels of software between the end-user and the operating

system or other general purpose software, may provide the necessary functional solutions today, but in the future could adversely impact the ease of maintaining software currency at the operating system level, reduce the mobility of the employee(s) to utilize equipment at different sites within an agency, and result in additional expense. As a result, vendors proposing layered solutions should recognize the Government trend in this area. Layered solutions will be evaluated on a case by case basis to determine their effect on the overall information processing needs of the agency.

In an era of increasing dependence on screen graphics and graphic images, our emerging requirement is to utilize established standard industry code from which screen information can be extracted, interpreted, and presented in speech or tactile form. This requirement recognizes the economic need to maintain the usefulness of all our trained human resources without permitting technology growth to exclude any class of users.

To accommodate future employees and provide systems support for current employees, solicitations should request pricing (perhaps on an hourly call-in availability basis throughout the life of the contract) for the services of vendor systems engineers who will be available to advise, assist, and resolve any communications or interfacing problems implicit in providing electronic office equipment access.

In the future, it is the Government's expectation that emerging functional and technical specifications may be provided in the standard product line. The specifications may also evolve, with experience to become Federal standards. Initially, industry should consider the specifications as indicators of current and future functional requirements for information technology equipment. It is recognized that some of the specifications are complex and/or require research and development. These draft specifications may be amended after the public comment period.

The specifications below are organized by functional requirement(s) associated with input, output, and documentation. This organization reflects the major areas that need to be addressed during agency acquisition planning and procurement. Managers who are determining accommodation strategies for an individual employee with a

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disability should consult the GSA manager's handbook, *Managing End User Computing for Users with Disabilities* or call COCA or ITC for assistance.

## 1. Input

Access problems concerning the input interface to a micro-computer differ by the type and severity of the functional limitation of the employee. Some users with disabilities are capable of using the keyboard if it can be modified slightly. Users with more severe disabilities require an alternate input strategy.

### a. Modified Standard Keyboard Controls

The minimum access requirement for users of a modifiable, but standard keyboard, could be achieved by providing the following capabilities:

(1) **Multiple Keystroke Control.** Currently there are numerous common functions on the computer that require multiple, simultaneous key strokes (e.g., to reboot CTRL + ALT + DEL must all be depressed at the same time). Multiple keystroke control would enable the user to execute a sequential option in which multiple keystrokes could be entered serially (e.g., to reboot a user could depress CTRL, then ALT, then DEL).

(2) **Keyboard Repeat Rate.** Currently the computer generates repetitions of a character if the key is held down. This is a problem for those users without sufficient motor control of their fingers to conform to the repeat tolerances of the keyboard. This feature would give the user control over the repeat rate. The user could extend the keyboard tolerances or turn off the repeat function completely.

(3) **Input Redundancy.** Currently numerous programs use a mouse as one of the input options. As the use of graphics increases so will dependence on the mouse as an input device. Some users with motor disabilities cannot use a mouse.

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This feature would provide an emulation of the mouse using the keyboard and/or other suitable alternative input devices, e.g., joy stick, trackball, voice input, and touchpad. In effect, any movement control executed through the mouse could also be executed from alternative devices.

(4) Toggle Keystroke Control. Currently toggle keys are employed which require visual feedback to know if a key is on or off. This feature would provide an alternative mode that does not require visual feedback to know the status of any toggle key.

#### b. Alternative Input Device

The capability to connect an alternative input device would be available to the user who is not able to use a modified, but standard keyboard. This feature would supplement the keyboard and any other standard input system used. The alternative input capability would consist of a physical port (serial, parallel, game, etc.) or connection capability so that an accommodation aid could augment the keyboard or replace it. The computer would regard this device as its keyboard and the user would be able to input any valid keystroke combination (e.g., CTRL + ALT + DEL) available from the regular keyboard. This alternative input capability would also support the mouse emulation described above.

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#### c. Keyboard Orientation Aids

There are several different keyboards available for current personal computers. To orient a visually impaired user to a particular keyboard, a set of tactile overlays should be available to identify the most important keys (e.g., ESC, ENTER, CTRL, ALT, and several key letters and numbers). The tactile overlays might be keycap replacements or transparent sticky tape with unique symbols to identify the various keys. To assist a motor disabled user, a keyguard should be available

to ensure that the correct keys are located and depressed. A keyguard is a keyboard template with holes corresponding to the locations of the keys.

## 2. Output

Output in this section will address auditory output capability and monitor display.

### a. Auditory Output Capability

The auditory output capability on current personal computers is sufficient to beep and play music. Some users with disabilities, however, may require speech capability. For speech to be generated on today's computers, a speech synthesizer is required. The capability to support a speech synthesizer must continue to be available in future generations of computers or this capability must be internalized through an upgrade of the computer's internal speaker. Regardless of the methodology chosen, the volume should be adjustable by the user and a headset jack should be available.

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### b. Information Redundancy

Currently, several programs use the speaker to beep warnings or errors to the user. Some programs do not have the capability to present the warning visually to the hearing impaired user. This feature would allow the user to have information redundancy by presenting a visual equivalent of the beep on the monitor. This might be accomplished by either a manual screen indicator (i.e., the user would have to indicate that he has seen the warning indicator by entering a key sequence to remove the indicator from the screen) or an automatic screen indicator (i.e., the warning would be presented for a period of time and then removed automatically).

### c. Monitor Display

The requirement to enhance text size, verbally reproduce text, or modify display characteristics is crucial

for some users with disabilities. To ensure that this access continues the following capabilities are required:

(1) Large Print Display. This feature increases the size of a portion of the screen for the low vision user. The process might use a window or similar mechanism that allows magnification to be controlled by the user. The user could invoke the large print display capability from the keyboard or control pad for use in conjunction with any work-related applications software. If applications software includes graphics, then enlargement of graphics should also be available.

(2) Access to Screen Memory for Text. The capability to access screen memory is necessary to support the speech and/or tactile braille output requirement of many blind users. Currently, blind users are able to select and review the spoken or braille equivalent of text from any portion of the screen while using standard application software. The access to the contents of the screen must continue to provide third party vendors the ability to direct it to an internal speech chip, a speech synthesizer on a serial or parallel port, or a braille display device.

(3) Access to Screen Memory for Graphics. Information that is presented graphically also needs to be accessed from screen memory in such a manner that as software sophistication improves, it may eventually be interpreted into spoken output.

(4) Cursor Presentation. Where cursors or other indicators on the screen blink, the end user should be able to adjust the blink rate. This feature accommodates persons with seizure disorders who may be sensitive to certain frequencies of flashing light.

(5) Color Presentation. Where colors must be distinguished in order to understand information on the display, color-blind end users should be able to select the colors displayed.

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### **3. Documentation**

The vendor will maintain a copy of all current user documentation on a computer, and will be responsive in supplying copies of this documentation in an ASCII format suitable for computer-based auditory screen review or braille.

## **VII. IMPLEMENTATION**

To develop and implement these guidelines several actions have been and are planned by GSA and NIDRR.

1. A consultant was employed to develop broad strategic concepts.
2. In May 1987, 23 companies were requested to provide input to assist in the development of the guidelines.
3. On June 29, 1987, a second letter and the first draft of the guidelines were sent to the same companies that received the initial letter. Comments were requested.
4. A two day conference was held on July 15-16, 1987, to discuss the concepts. Representatives from Government, industry, and the disabled community participated in the conference.
5. GSA and NIDRR worked together to prepare this guidelines document.
6. An advisory committee was convened on August 25, 1987, to help improve this document. ICCSHE also serves in an ongoing advisory capacity.
7. On September 30, 1987, this document will be released to provide early guidance to agencies.
8. Beginning in October 1987, agencies will be invited to work with GSA and NIDRR to implement the guidelines on a pilot basis.
9. In mid-1988, GSA will release a version of the guidelines for comment by agencies, vendors, and employees with disabilities.

10. In the remainder of fiscal year 1988, GSA will reconcile comments, and seek a consensus on the form of the FIR-MR regulation and bulletin.
11. On September 30, 1988, GSA will publish the FIRMR regulation and bulletin.
12. GSA and NIDRR will work together over the years to complete the actions identified in the "Current Resources" section of this document.
13. GSA and NIDRR will work together after 1988, to update the FIRMR regulation and bulletin as the technology improves and as Government and industry learn more about providing computer accessibility to employees with disabilities. ICCSHE will continue to serve in an ongoing advisory capacity.
14. A forum will be scheduled for December 1, 1989, with federal managers, vendors, and disabled employees to review the first year's experiences.
15. The advisory committee will be reconvened on April 1, 1990, to assess the September 30, 1988, issuances relative to the current technology.

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## APPENDIX A

### **PUBLIC LAW 99-506-OCTOBER 21, 1986**

#### **100 STAT. 1807 99th Congress**

#### **AN ACT**

To extend and improve the Rehabilitation Act of 1973.  
Section 603. ELECTRONIC EQUIPMENT ACCESSIBILITY.

(a) ELECTRONIC EQUIPMENT ACCESSIBILITY.-  
Title V of the Act is amended by inserting after section 507 the following new section:

"ELECTRONIC EQUIPMENT ACCESSIBILITY"

"Section 508. (a)(1) The Secretary, through the National Institute on Disability and Rehabilitation Research and the Administrator of the General Services, in consultation with the electronics industry, shall develop and establish

guidelines for electronic equipment accessibility designed to insure that handicapped individuals may use electronic office equipment with or without special peripherals.

"(2) The guidelines established pursuant to paragraph (1) shall be applicable with respect to electronic equipment, whether purchased or leased.

"(3) The initial guidelines shall be established not later than October 1, 1987, and shall be periodically revised as technologies advance or change.

"(b) Beginning after September 30, 1988, the Administrator of General Services shall adopt guidelines for electronic equipment accessibility established under subsection (a) for Federal procurement of electronic equipment. Each agency shall comply with the guidelines adopted under this subsection.

"(c) For the purpose of this section, the term 'special peripherals' means a special needs aid that provides access to electronic equipment that is otherwise inaccessible to a handicapped individual."

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"(b) CONFORMING AMENDMENT.-The table of contents of the Act is amended by inserting after item "Sec. 507." the following new item:

"Sec. 508. Electronic equipment accessibility."





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Carl Brown is Director of the Office of Adapted Computer Technology for the California Community Colleges Chancellor's Office and Director of the High Tech Center for the Disabled. In 1979 he established the Carmel Unified School District's first computer courses and went on to organize and direct the computer science program at The York School in Monterey in 1981-85. In 1983 Mr. Brown established the first High Tech Center for the Disabled, at Monterey Peninsula College, and recently received a grant from the U.S. Department of Education, Fund for the Improvement of Postsecondary Education, to continue his innovative work in adapted computer technology. He is the President of ComputerTalk, a computer consulting firm, and is the author of a series of college textbooks on microcomputers published by Brooks/Cole Publishing Company. Mr. Brown has presented at numerous national conferences on high technology for the disabled.

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