

Chronically Sick and Disabled Persons Act 1970

*Research and Development Work
Relating to Assistive Technology
2001*

Presented pursuant to c.44 1970 Section 22

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Introduction

This report is produced pursuant to Section 22 of the Chronically Sick and Disabled Persons Act 1970. It outlines a selection of the research and development activity relating to assistive technology funded by the government in 2001. The work has been grouped into categories which were selected because of the quantity and quality of work undertaken in each one last year.

Full details of all the work funded are available on the Foundation for Assistive Technology (FAST) website (www.fastuk.org), together with information on research funded by other sources. Copies of the NHS Plan, National Service Frameworks and other Department of Health publications are available on the Department's website (www.doh.gov.uk).

The breadth of research in this field is constantly expanding, embracing not only the development of specific products but also systems, combinations of technologies, and interfaces to new mainstream technology, for example the world wide web.

Context of the report: Developments in legislation and government policy

There are at least 7 million people in the United Kingdom who are disabled and about 4 million of them use equipment services provided by the NHS or social services. The NHS Plan (July 2000) set targets to modernise service delivery by combining health and social care provision into single, integrated community equipment services by 2004, and to increase by 50% the number of individuals who benefit from these services. In November 2001 the National Implementation Support Team was launched to help local councils and NHS organisations plan to meet the targets.

The National Service Framework for Older People (March 2001) emphasises the important role of assistive technology in maintaining independent living. Early this year the Department of Health issued a call for research proposals to support implementation of the NSF, and proposals received are currently being assessed. In February 2001 plans for a new National Service Framework for Long Term Health Conditions were announced. This NSF will have a particular focus on the needs of people with neurological disease and brain and spinal injury. It will include services for people with epilepsy, multiple sclerosis, parkinson's disease and other similar conditions. The Department of Health is undertaking scoping and preparatory work involving a wide range of stakeholders. Current plans are to publish the NSF in 2004 with a 10-year implementation period from 2005.

Research included in this report also relates to technologies supporting access for disabled people to the built environment and to education.

The Disability Discrimination Act 1995 has given disabled people rights in the areas of employment and access to goods, facilities and services. Whilst employers have been obliged to consider making changes to the physical features of their premises since 1996, service providers, in addition to making reasonable adjustments to the way they deliver their services, may have to consider making physical adjustments to their premises from 2004. The Act also allows the Government to set minimum standards so that disabled people can use public transport easily.

The Special Educational Needs and Disability Act 2001 amends the Disability Discrimination Act 1995 to end the exemption of education from its provisions. The new Act places a duty on education providers to make reasonable adjustments to ensure that a disabled person is not prevented by their disability from enjoying the same educational experience as other students.

A new £10 million initiative managed by the British Educational Communications and Technology Agency commenced on 1 April 2002. The Communication Aids Project is innovative not only because funding has been made available to augment local education authority and school funding but also because of the project's integrated approach to the long-term needs of young people with a communication impairment.

The funding will provide additional equipment and technology for pupils who have significant communication difficulties. It will cover assessment of the pupil's needs, provision of assistive technology to meet the communication needs, training for teaching staff, the pupil and his or her parents, and ongoing review. During the lifetime of the project, the pupil's progress will be evaluated together with the effectiveness of the equipment and resources provided.

New developments in research funding

Extending Quality Life (EQUAL)

The fourth call by the Engineering and Physical Sciences Research Council (EPSRC) under the EQUAL initiative closed on 1 February 2002. This latest call invited expressions of interest to participate in consortia-based research aimed at extending the independence of older and disabled people. As well as bringing together multi-disciplinary research teams this call encouraged collaboration with non-academic partners such as service providers, charities and local authorities. This is being done to strengthen links between research and user communities and to identify barriers to the implementation of research outputs.

The EQUAL Research Network was launched in November 2001. The Network is based at Reading University and aims to develop the community of researchers who have been funded under the EQUAL initiative and to increase awareness of their work. To make the research more accessible the network has divided its activities into five broad categories: Accessibility, Hearing and Seeing, Design for All, Housing,

and Cognition, Dementia and Learning Disabilities. Further information is available on the Network's website (www.equal.ac.uk).

Integrated Healthcare Technologies (IntHeTech)

EPSRC has supported innovative manufacturing research for the healthcare sector by funding projects with collaborative contributions from industry and healthcare providers. In future, instead of funding individual projects, the programme will fund Innovative Manufacturing Centres and Healthcare Challenge Centres.

The healthcare centres currently under development are a Healthcare Training Technologies Centre and an Assessment of Medical Device Technologies Centre. A third centre focussed on Assistive Technologies is planned.

Health Technology Devices (HTD)

Two projects featured in this report are being funded through the MedLINK programme, which is now closed to new proposals. Following the success of MedLINK, a new programme will open to applications in June 2002. The Health Technology Devices (HTD) programme will support the development of new or improved technologies, including devices for use in social care. HTD will be supported initially with £12 million from the Department of Health and £1 million from the Scottish Executive. Further information can be found on the HTD website (www.healthtechnologyportal.org.uk).

Sixth Framework Programme (FP6)

The first calls for proposals under the EC Sixth Framework Programme (2002-2006) are likely to be issued later in 2002. It is expected that the Programme will fund research activities on systems for enabling access to information, for restoring function or compensate for disabilities, as well as research to underpin the formulation and implementation of EC policies relating to disabled people.

Public accessibility

Wheelchair Accessibility

Three EQUAL projects that have focussed on wheelchair accessibility concluded in 2001.

The Department of Civil Engineering at the University of Newcastle undertook the development of a telematics-based travel aid for wheelchair users in domestic and public environments. The system utilises a

contact-less smartcard infrastructure and a network of programmed destination routes. It issues guidance notes for the user including distance and best route to be taken. Following successful trials the system has been patented as SmartSign and a registered company established under that name.

The Nene Centre for Research at University College Northampton designed a system based on the Geographical Information System for modelling access for wheelchair users in urban areas, specifically Northampton. The purpose of the system is to provide planners with a tool for assessing the impact of their decisions on accessibility and to provide wheelchair users with better information on access opportunities and constraints. The project has constructed a route finding model which calculates and assesses wheelchair accessible routes within Northampton town centre. It operates through a menu-driven interface that requires no expert knowledge.

The Department of Bioengineering at the University of Strathclyde has developed a wheelchair virtual reality motion platform for use in evaluating wheelchair accessibility. The project aimed to develop a tool to aid architects in identifying the needs of wheelchair users at the design stage. The platform which has been created and evaluated provides adequate sensory information of many of the features associated with wheelchair use in the real world.

European projects to improve accessibility

Two new projects funded by the European Commission will address the needs of older and disabled people in the public environment.

The Department of Applied Computing at the University of Dundee is participating in a project to develop a toilet facility which will adapt automatically to the needs of older people or people with disabilities. The system will make use of smart card technologies and advanced mechatronics. The Department of Applied Computing will contribute to the user requirements and user evaluation stages of the project by developing computer-conducted interviews for users to elicit their requirements and views.

The Technology Innovation Centre in Birmingham and Anglia Labels Ltd are among the partners involved in another European project which will integrate existing text-to-speech and barcode reading technology into a low cost handheld device. The device will be able to translate a barcode into audible speech. This means of accessing information without the need for additional human intervention could provide reading impaired people with greater freedom.

Telecare

Advances in information and communication technologies (ICT) are increasingly being harnessed to facilitate independent living for older and disabled people. Telecare uses ICT to deliver health and social care directly to the home, for example through the sensing of falls or hypothermic conditions.

Through the Integrated Healthcare Technologies (IntHeTech) Sector of the Innovative Manufacturing Initiative, EPSRC has awarded a grant of over £0.4 million to look at the most effective approaches to telecare, including ways to improve value for money and customer satisfaction.

The University of Sussex's Science and Technology Policy Research Unit is working with Bournemouth Community and Mental Health NHS Trust, Surrey Social Services and a range of industrial partners to evaluate service users' needs and conduct live trials of the most relevant telecare applications. The project is scheduled to complete in June 2003.

InfraRed Integrated Systems Ltd. in collaboration with BT, the University of Liverpool and the Victoria University of Manchester have been funded by the Department of Health to develop a Smart Inactivity Monitor using Array Based Detectors (SIMBAD) to detect falls, and give an automatic alarm response to unpredicted inactivity. Using thermal imaging techniques a monitor to track movement has been developed. Areas and times of inactivity are pre-determined and when an inactive spell happens unexpectedly (for example a fall) an alarm summons help. The project focussed initially on the activity of one person in one room. Now the technology is being developed further to broaden the scope of its application.

The Millennium Home project run by the Brunel Institute for Bioengineering, funded by EPSRC, the Department of Health and other partners, is testing a telecare system. A technology test home on the campus of Brunel University has been occupied at night for 18 months, 10 pilot homes in Greenwich are being set up and some are already occupied by typical tenants. Negotiations with other organisations to establish clusters of pilot homes are in progress.

Navigational aids for people with visual impairment

Sound Foresight Ltd has been awarded a grant through the Department of Trade and Industry's Smart scheme to conduct a feasibility study and to develop an ultrasonic navigational guide. The "Batcane" emits ultrasound signals in the way bats do to manoeuvre their way around obstacles in the dark. The device has been inserted into a cane which sends out and receives ultrasound pulses. Echoes from objects within 2-3 meters are encoded, and the position relayed to the user via a tactile relay unit that vibrates with a frequency and amplitude that is proportional to the distance of the object. The vibrations are transmitted to the fingers of the user creating a 'tactile map' of the environment. Trials using functional prototypes have been conducted in partnership with agencies including Guide Dogs for the Blind (UK) and the American Council for the Blind (US). It is anticipated that the product could be available by the end of 2002.

A large proportion of blind people are elderly and, with increasing age, infirmity can prevent the use of common mobility aids such as long canes and guide dogs. This can result in a loss of personal autonomy and an increased dependence on carers. The Department of Computer Science at the University of Dublin has headed a European funded project to develop an intelligent robotic mobility aid with navigational and

physical support to warn of and avoid obstacles ahead. With unsupervised control the system navigates, avoiding obstacles within its sensor range. With shared control the system minimises the risk of collision by making small adjustments to the user's path.



The device is sensitive to both static and moving obstacles. In June 1999 a prototype won the Paralyzed Veterans of America design award at the annual conference of the Rehabilitation Engineering Society of North America in California. The product "Guido" was launched at Rehacare 2001 in Dusseldorf, Germany and is available from Haptica, Ireland.

People with visual impairments can encounter barriers when accessing public buildings or can be at greater risk whilst in them. Two projects funded by EPSRC under the EQUAL initiative have addressed these issues.

The School of Biomedical Sciences at the University of Leeds and the Centre for Visual Environments at the University of Salford have developed an auditory navigational beacon to assist the safe evacuation of older, blind and visually impaired people from a building in an emergency. Trials of the navigational beacon technology were conducted in conjunction with the Maritime and Coastguard Agency in 2001, evaluating the evacuation of two smoke filled ships. Following the trials it has been proposed that the technology be adopted by the International Maritime Organisation.

The Transport Research Institute at Napier University have designed an Auditory Location Finder ("ALF") which will give blind and visually impaired people information about their location in a building via a signal sent by beacons. A prototype device and beacons have been developed and a test site established for the system. Work to establish the nature and format of information required by users is underway.

Technologies to assist deaf and hearing-impaired people

Sign language and lip-reading support

Deaf and hearing-impaired people can be restricted by the shortage of interpreters available to them. The National Endowment for Science Technology and the Arts (NESTA) have recently funded Radiate Video Communication Ltd. and a number of companies managed by deaf people to develop a system for instant access to a centre of British sign language interpreters using videophone and videosever technology. A call centre has been established and a trial completed. An information video has been produced and a marketing programme implemented. The service will provide a British sign language interpreter on

demand, charged by the minute, and other service providers will have the opportunity to pre-record information in British Sign Language.

The Independent Television Commission, Televirtual Ltd, the University of East Anglia, the Post Office and the Royal National Institute for Deaf People (RNID) are participating in a European funded project ("VisiCAST") to develop a virtual interpreter. A Text and Sign Support Assistant known as "TESSA", based on technology for the synthetic production, transmission, and storage of sign language has been developed.



TESSA has recently won a gold medal and the overall IT award at the British Computer Society's Information Technology Awards. Further development of the speech recognition software and the inclusion of additional languages is planned.

The Department of Phonetics and Linguistics at University College London and the RNID are participating in a European project to develop a talking face which will be controlled by the incoming telephone speech signal. The talking face will facilitate speech understanding by providing lip-reading support. This method works with any telephone and is cost-effective compared to video telephony and text telephony that require compatible equipment at both ends.

Self-administered hearing test

The hearing of many older people deteriorates gradually. Sometimes there is a reluctance to accept that hearing ability has declined, or to undertake a hearing test. In other cases there are difficulties attending test centres. The School of Psychology at Cardiff University and the University of Wales College of Medicine are being funded by EPSRC under the EQUAL initiative to develop a self-administered hearing test for older people.

The project started in July 2001 and will develop and assess a hearing test that gives reliable objective measures of hearing difficulty, yet is self-administered using the patient's own audio equipment. The objective is to produce an audio cassette with a speech-in-noise test on it. The patient will self-administer the test, writing down a list of words presented verbally in background noise.

Communication support for deaf-blind people

A project addressing the communication needs of deaf-blind people is receiving a grant of £460,000 from the Cabinet Office and HM Treasury's Invest to Save Budget. This budget provides a source of 'venture capital' for public sector providers who want to join forces to improve services through innovative means. The project is developing a unified tool to bridge the communication barrier between deaf-blind individuals and the society they live in. It is intended that the tool will be universally applicable to all existing communication languages such as Braille.

Technologies to assist people with communication impairments

Controlling electrical devices around the home

Dysarthria is an acquired speech disorder and some people with dysarthric speech are also motor-impaired. The combination of speech and physical disability can make it difficult to interact with the environment.

Voice recognition systems are generally of limited use to people with speech impairments. However, a project led by the Department of Medical Physics and Clinical Engineering at Barnsley District Hospital has shown how this type of software can be adapted for specific uses. They are being funded by the Department of Health to develop a software application which will allow disabled people with dysarthria to control common electrical devices around the home by voice.

This project has developed a software application which integrates three functions: real time visual feedback to assist speakers to improve the consistency of their vocalisations; speech recognition capability with improved tolerance to speech variability; the ability to tailor the needs of the client, to modify the feedback as training proceeds and to construct new "recognisers" incrementally as data is collected. An additional outcome of the project has been to create a data recorder that records a list of chosen words.

New screen for a communication aid

Morphonics, a company which develops augmentative and alternative communication devices, has received a Smart Micro project award from the Department of Trade and Industry towards the development of a communication aid with a large screen allowing a variety of access methods ("Morpheus"). The portable, lightweight screen can operate for a full day between battery recharges. Prototypes are being developed and are planned for completion in summer 2002.

Communication system for Intensive Care Units

The need for a device to assist patients with temporary loss of speech in an Intensive Care Unit situation has prompted the development of a situation-specific augmentative and alternative communication system.

The Department of Applied Computing at the University of Dundee has been funded by EPSRC to develop a communication system ("ICU-Talk") for patients in an Intensive Care Unit who, because of their condition or treatment, are unable to speak. The system is based on "TalksBac" an augmentative communication system designed specifically for adults with acquired dysphasia.

The ICU-Talk system has been made in conjunction with the Medical Physics Department at Ninewells Hospital. A working system, now in operation, contains a core database of phrases and questions which are frequently used by patients in intensive care. It has a choice of two interface designs and a computer interview to be completed by relatives. It will automatically generate personalised phrases and questions to be added to the core database.

Access to the World Wide Web

The ACE (Aiding Communication in Education) Centre in Oxford is involved in several European projects which focus on the inclusion of people with communication impairments. One of these projects is an initiative to make web and e-mail based technology more accessible to people with communication, language and/or cognitive impairment (World Wide Augmentative and Alternative Communication Project – WWAAC). The project will develop preliminary standards for syntax and semantic text/message encoding, tools for text support (i.e. a message conversion between symbols and symbols and symbols and text), with speech output. It will also develop support tools for web browsing and mail box handling. Guidelines and tools for information presentation for the target groups on the web will be produced.

Functional Electrical Stimulation

Some conditions and acquired injuries such as spinal cord injury can result in an interruption of the neurological pathway from the brain to the muscles. Functional Electrical Stimulation (FES) is a means of producing useful movement in paralysed muscles. Electrical impulses cause controlled muscular contractions and can be applied through electrodes which are either attached to the skin or implanted.

A new network (FESnet) funded for two years by EPSRC will focus on a range of emergent FES applications and will promote research and technological development in this field. FESnet, which is based at the Department of Mechanical Engineering at the University of Glasgow, believes there is currently a lack of industrial input on some issues, and therefore a shortfall in transfer to clinical use.

The aims of the network are to facilitate the flow of knowledge and people between universities, clinical and industrial partners, to stimulate the formation of new inter-disciplinary research collaborations, to promote clinical evaluation of new technology and encourage clinical uptake, and to pursue technology transfer through industrial partners.

Power assisted cycling for paraplegic people

The Department of Mechanical Engineering at the University of Glasgow have been funded by EPSRC to work with the Queen Elizabeth National Spinal Injuries Centre and University College London to develop

a 'hybrid' cycling system to allow people with paralysed legs to use their own muscles, assisted by an electric motor, to propel a tricycle.

The muscles of paralysed legs are stimulated to contract by electrodes on the skin. This stimulus must arrive at the correct time and is achieved using an electronic sensor rigged up to the chain ring of the tricycle. This receives information about the pedals' position and angular speed, feeding data to a computer behind the seat. This in turn produces the signals for stimulating the muscles.

Pressure transducers provide data to enable the computer to calculate the mechanical work done by the muscles. Using a feedback loop the power output provided by the cyclist is kept constant, so that fatigue is minimised and it is possible to continue cycling for longer.

It is hoped that FES cycling could improve cardiopulmonary fitness and help to reduce the risk of the secondary medical conditions which commonly affect paraplegic people.

Implantable nerve stimulator for the treatment of dropped foot

Dropped foot is a chronic condition characterised by the inability to raise the foot during the swing phase of walking. Current treatment consists of the fixation of the ankle joint by a brace, or electrical stimulation via electrodes on the skin surface.

Finetech Medical Ltd working with the Department of Medical Physics and Biomedical Engineering at Salisbury District Hospital were funded by the Department of Health to develop an implantable nerve stimulator for the treatment of dropped foot. The stimulator consists of an implant, which is placed under the skin of the leg, and external equipment (a transmitter, belt, charger and switch).



The foot switch located under the heel detects when the heel leaves the floor during walking. A signal is then sent along the wire connecting the heel switch to the transmitter and the transmitter becomes active, transmitting power and signals to the implanted receiver. The level of stimulation on each channel is set by adjustment of the transmitter.

The signals are transformed by the receiver and result in electrical pulses being delivered to nerves supplying muscles around the ankle. Soon after the heel touches the ground again, the stimulation is switched off, in readiness for the next time that the heel leaves the ground.



A transmitter, receiver, cable and electrode suitable for long term implantation have been developed. Ten implants, have been carried out and proof that the nerve is not damaged by implantation of the device ascertained. An initial survey of patients indicates a positive response to the implants. An application for "ce" approval (to ensure the product meets European legislative standards) will be made in 2002.

Disability Equipment Evaluation Programme

The Medical Devices Agency (MDA) manages an evaluation programme on equipment designed to assist elderly and disabled people on behalf of the Department of Health. The programme of work is currently carried out at 3 Disability Equipment Assessment Centres (DEACs) based within the NHS. The studies are based on both patient trials and technical testing where appropriate.

The results of this work are published by MDA as a series of evaluation reports. These comparative evaluations are designed to enable purchasers and prescribers of equipment for elderly and disabled people to make informed choices by helping them identify the product(s) which best match(es) the needs of an individual user or of a group of users.

Evaluation work currently in progress covers the following topics:

- Bed grab handles
- Showers for people with disabilities
- Bed and chair raisers
- Reusable and disposable all-in-one pads for children
- Electrically powered profiling bed frames
- Static pressure reducing mattresses

Recently a few of these evaluation reports have been re-written as consumer guides and are available from Ricability (www.ricability.org.uk):

- Ins and Outs of Bathing – a guide for disabled & elderly people
- Bath boards and seats
- Wheeled walking frames
- Textphones – an evaluation

Written and edited by:

Sue Quinton and Moira Mitchell
FAST
Mary Marlborough Centre
Windmill Road
Headington
Oxford OX3 7LD
www.fastuk.org



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www.doh.gov.uk/research

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