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Usability in Public Services and Border Control

New Technologies and Challenges for People with Disability

Giuliano Pirelli
European Commission
Joint Research Centre

Passports, Identity Management and Access Control

Security Technology Assessment Unit

Institute for the Protection and Security of the Citizen

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European Commission
Joint Research Centre
Institute for the Protection and Security of the Citizen

Contact information
Address: Centro Comune di Ricerca
Via Enrico Fermi 1, Ispra (VA) 21020 ITALY

E-mail: Giuliano.Pirelli@jrc.ec.europa.eu
Tel.: +39 0332 785113
Fax: +39 0332 785469

http://www.jrc.ec.europa.eu

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Abstract - As new security technologies are introduced in public services, such as border control and mass transportation systems, their accessibility for the disabled needs to be evaluated. A large part of the population is directly or indirectly concerned with disability of permanent or temporary nature.

This report starts with a brief overview of the scale of disability and associated challenges and puts them in the context of the public policy on disability. In particular it highlights two existing policies: the EU Transport Regulation on the Disabled Air Passengers and the UN Convention on the Rights of Persons with Disability, both of which are of relevance to mass transportation.

The report then analyses the usability challenges in public services and border control, including the issues of accessibility, safety and communication. These need to be addressed in future policy proposals. Technical support to the present and future policies related to disability complying public services is seen as a potentially important role for JRC. This is illustrated through a review of relevant JRC projects: VOICE, SESAMONET and Secure Airport.

New technologies in public services can be viewed by the disabled from two perspectives: assistive technologies and neutral technologies. The assistive communication technologies were adopted in projects VOICE and SESAMONET to improve accessibility in public services. On the other hand, the use of biometric identification in airports and border control is to enhance security for all and therefore it is assumed to be neutral, with respect to disability. This assumption was investigated in the Secure Airport project.

Keywords - disability, usability, accessibility, security, safety, biometrics, assistive technologies, airport, border control, mass transportation, transportation systems, policy

1. INTRODUCTION

"… a society, in which disabled people are fully included, is a better society for all."

European Disability Forum [1].

Definition: As defined by the World Health Organization, a disability (resulting from an impairment) is a restriction or lack of ability to perform an activity in the manner or within the range considered normal for a human being [2].

A similar definition is given by the UK Disability Discrimination Act, as reported in Section 1.4. (after Figure 1.). A shift from a medical model to a social / Human Rights model is indicated by the UN Convention on the Rights of Persons with Disabilities, presented in Section 2.2.

1.1. Current Trends

Recent studies have highlighted a number of demographics trends in Europe, which must be born in mind when considering the introduction of new technologies in large scale public applications.

Taking into account the needs of people with disability, not only is an obligation, but adds different ways of perceiving problems and **finding solutions for all users**: ramps for people with physical impairment are used for luggage, simplified web pages for people with visual impairment are used for small screens of mobile phones, the small dot on button 5 for the blind is used in darkness or when touch typing, TV captioning and screens in bus or metro with stations' names for people with hearing impairment are used in noisy situations and by foreign users.

The specific needs of the elderly and of people with disability have to be considered in order to allow a *design for all* approach in the aspects related to the data's privacy and to the travel documents' identity controls, checked by manual or automatic readers.

With increased levels of threats to public transportation system in recent years, there is now heightened emphasis on risk mitigation by deploying new security technologies for identification, detection and surveillance. Airports are a good example where the goal of security enhancement is being pursued aggressively by the deployment of mass spectrometry and biometric technologies.

It is often the case that when security is the main focus, ethical and social concerns are often forgotten in the false belief that the latter are an impediment to the security objectives. Nevertheless, new technologies may be used in defining a smarter process design rather than just automating existing tasks. Thus may ensure greater acceptability by the end users while satisfying the functional and security objectives.

1.2. The Challenges for Disability

The average age of the population is continuing increasing. The group of **elderly people** is often characterized by good experience of life and availability of money, which they wish to spend and **fully participate in the social file**: travelling, using the Internet, taking the best profit of the new available technologies, of course if all of them will be of easy access.

Due to an average **longer expectation of life**, in some cases also a larger number of elderly people will be affected by some form of disability. On the other side, the progresses in the medical field allow people to survive to severe accidents or difficult birth, in some cases with different limitations or disabilities.

The so called ***Silver Economy*** concept recognizes the importance of designing systems usable by the elderly [3]. It requires long term development and sustainability of social and care services, assistive technologies and accessibility of these services, with encouragement in order to improve the quality of services. It seems like that even if older people do not view themselves as disabled, they increasingly come together with this group in order to reinforce the lobby pressure.

1.3. Nature of Disability

For such reasons, the distinction between people with or without disabilities is becoming less sharp. Moreover, a large number of people without a **permanent disability** might suffer, at some point in life, from **temporary disabilities**, e.g. due to temporary impairments: broken legs, plastering, crutches, wheelchair, broken or wet or lost glasses, less concentration and longer reaction time due to lack of prescribed drugs, reduced vision or reduced hearing or increased reaction time due to fatigue, jet lag or illnesses, pregnant ladies, parents travelling with many children, language or communication problems, etc.

In this report, the concept of disability is used in a large comprehensive sense, including permanent disability and temporary disability or temporary impairment.

It should be highlighted that while people with permanent disability know their limits and use at best their potentialities and their technical aids, people with temporary disability are more vulnerable themselves and may cause greater problems to other persons.

1.4. The Scale of Disability

It is quite difficult to use a unique common definition of disability and a common reference schema, since each country has collected slightly **different statistical data, which can hardly be compared** and used in a single table. Nevertheless, we have to be aware that a very large part of the population in directly or indirectly concerned by disability.

According to the European Disability Forum, disabled people represent **50 millions of persons in the European Union** (10% of the population). One in four Europeans has a family member with a disability. People with reduced mobility represent more than 40% of the population [4].

A similar information is provided also by Eurostat: **44.6 millions** persons aged 16-64 living in private households in **25 European countries** (15.7% of the population) stated that they had a long-standing health problem or disability (LSHPD) [5].

Figures of the same order are available **also for the USA**: 54.4 millions people, about one in five residents of the USA (19%) report some level of disability. Among those with a disability, **35 millions** (12%) are classified as having a **severe disability**. Among those with disabilities, 31% with severe disabilities and 75% with non-severe disabilities are employed, compared with 84% of people in this age group without a disability. A portion of people with disabilities - 11 millions aged 6 and older - need personal assistance with everyday activities [6].

These data are presented in Table 1 and Figure 1.

	population	number of people with disability	% of people with disabilty in the population	number of people with severe disability (USA) or reduced mobility (EU)	% of people with severe disabilty in the population	number of people with severe disability needing personal assistance	number of people within 16-64 years with disability
USA	300	54	19 %	35	12 %	11	
EU	500	50	10 %	45			16

Table 1: *Population and people with disability in USA and EU (millions)*

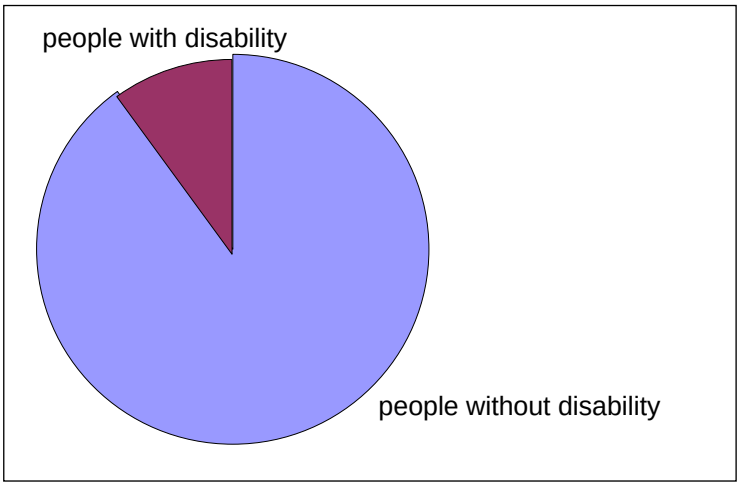


Figure 1: *Population and people with disability in EU*

In order to have a rough idea of the distribution on the different forms of disabilities, it is preferable to refer to a single country, thus allowing easier comparisons of different approaches in collecting the statistic data. In the UK alone an estimated 14% of the population has some form of disability [7].

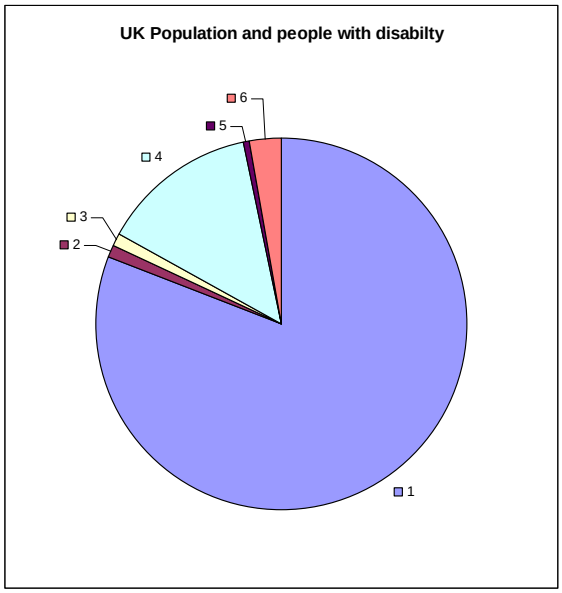
Figure 2 and Table 2 show the distribution of different forms of disability in the UK:

- The UK Disability Discrimination Act (1995) defines a disabled person as someone with "a physical or mental impairment which has a substantial and long-term adverse effect on his (sic) ability to carry out normal day-to-day activities". Disabilities are diverse and range in severity. They may be either visible or invisible, or both. The key types of disability relate to problems with mobility, sensory mechanisms, learning and communication difficulties, mental health issues and hidden disabilities like diabetes, epilepsy and heart disease. Many of these forms of disability are treatable or may be alleviated by broader changes in social perceptions [8].
- The term *disabled person* covers people with a wide range of disabilities and health conditions - from a visual impairment to arthritis, cancer, multiple sclerosis, heart disease, depression, Downs Syndrome and diabetes. There are over 10 millions disabled people in Britain; of which, 4.6 millions are over State Pension Age and 0.7 millions are children. Disability increases with age: only 10% of adults aged 16-24 are disabled, while one third of people between the age of 50 and retirement age are disabled [9].
- It is estimated that there are about 9.8 millions people in the UK with some form of disability - one in seven of the population. At the last count, in 1996, there were 750,000 wheelchair users in the UK. In 2002-03, 19% of men and 13% of women reported having hearing difficulties. In terms of hidden disabilities, there are about 1.8 millions diabetics in the UK and over 350,000 people with epilepsy, for example [10].

- According with the Royal National Institute of the Blind (RNIB), about 152,000 people are on the register of blind people, and 155,000 on the register of partially sighted people. 24 % of all registered blind people who have an additional disability are also deaf [11].
- According with the Royal National Institute of the Deaf (RNID), 9 millions adults are deaf or hard of hearing, of which: 8.3 millions with mild to moderate deafness and 700,000 with severe to profound deafness; 2.5 millions aged 16 to 60 and 6.5 millions aged over 60 [12].

	number of people with disability	number of people in working age with disability	number of people in pension age with disability	numb er of wheel -chair users	number of deaf people	number of hearing impaired people	number of blind people	number of partially sighted people	number of diabetics people (hidden disability)	number of people with epilepsy (hidden disability)	number of parking badges for people with disability
UK	10.100	6.700	4.600	0.750	0.700	8.300	0.150	0.150	1.800	0.350	2.300

***Table 2**: People with disability in UK (millions)*



UK population and people with disability (millions)

1: Population without disability (50)
2: Wheelchairs users (0.7)
3: Deaf people (0.7)
4: Hearing impaired people (8.3)
5: Blind or partially sighted people (0.3)
6: Hidden disabilities: diabetics (1.8)

***Figure 2:** UK Population and people with disability*

When considering the problem from the point of view of the **difficulties encountered in travelling**, the available statistics often indicate the number of people who do - within some limits - travel, but can hardly consider the larger majority who cannot travel, due to the existing barriers. Therefore, when considering share of the disabled in public transport, it is fair to assume that a larger majority of the disabled are unable to travel due to the existing barriers [13].

The following data in UK are provided by the Disabled Persons Transport Advisory Committee (DPTAC) [14]:

- Disabled people are unable to use 70% of buses and 40% of the rail network. Almost 50% of disabled people list transport as their main local concern and feel their employment opportunities have been reduced because of poor public transport. 60% of disabled people have no car in the household, compared with just 27% of the general population who have no car. Compared with the general public as a whole, disabled people travel a third less

often. 60% of the rail network is inaccessible to disabled people according to the Strategic Rail Authority [15].

- The number of **parking badges** for disabled people (Blue Badges) on issue in England stands at **2.3 millions** [16].

2. PUBLIC POLICY ON DISABILITY

2.1. The EU Transport Regulation on the Disabled Air Passengers' Rights

The European Union has extensive laws for mobility rights and equal treatment of the disabled passengers. This includes right to boarding, assistance, mobility equipment and accessible information.

On 5 July 2006, the European Union adopted a new Regulation concerning the rights of disabled persons and persons with reduced mobility when travelling by air [17]. The regulation entered into force on 26 July 2008 [18].

The Regulation provides for compulsory assistance to persons with reduced mobility (the costs will be spread on general public), no reservation can be refused on the ground of disability; some exceptions are possible though (for serious security reasons), operators and airport managers must ensure that the staff has appropriate assistance training, enforcement bodies will need to inform public on how to fill in complaints.

The overall principle and aim of the Regulation is to protect any passenger with reduced mobility or sensory impairment, intellectual disability or any other cause of disability, age or psychological problems, and whose situation needs appropriate attention and the adaptation to his or her particular needs of the service made available to all passengers. The following aspects of the Disabled Air passengers' Rights are particularly defined:

- **Boarding:** An airline shall not refuse, on the ground of reduced mobility or disability, to accept the reservation of a person or to embark a person, except for safety reasons established by national, Community or International law (which should be publicly available in accessible formats) or if the size of the aircraft or its doors makes the embarkation or carriage of a disabled person physically impossible. If boarding is denied, the disabled passenger has the right to be informed about the reasons thereof, and to receive re-imbursement or re-routing.
- **Assistance**: A disabled passenger has the right to receive assistance, which must be adapted to his/her specific needs. 48 hours before departure prior notification is nevertheless required. If the passenger does not notify his or her needs, the airline shall however do all efforts to assist the person anyway in order to allow the person for travelling. The assistance, to be supplied by a person who has undergone through disability awareness and disability equality training, will be provided from the point of arrival at the airport (with the transport mean chosen by the disabled passenger) or, if the passenger prefers, from the check-in desk, to the point of departure of the airport of arrival; the assistance will be provided at no additional charge and be seamless.
- **Mobility equipment and assistive devices:** Thanks to the new Regulation, the disabled has the right to bring mobility equipment and assistive devices and/or to travel with his or her assistance dog in the cabin. In case of lost or damage during the trip, compensation will be provided according international, Community or national law. Unfortunately, such legislation does not yet exist at national or European level. The European Commission is currently analysing the issue. In the meantime, the Montreal Convention is applied, meaning that passengers with disabilities are only guaranteed compensation to a certain amount, which does not necessarily cover the full expenses of the passenger.
- **Accessible information:** Essential information, provided at airports an on board the aircraft, should be provided in accessible formats for disabled air passengers, according to their needs.

- **Complaints:** In case of discrimination, the disabled passenger can contact the managing body of the airport, or the airline concerned, depending on where and by whom the discrimination occurred. In case of no satisfaction, the person can address the enforcement bodies that will be set in each Member State.

2.2. The International Convention on the Rights of Persons with Disabilities

The Convention was agreed by an Ad Hoc Committee of the UN General Assembly in New York on 25 August 2006. On 30 March 2007, the Convention has been opened for signature. The European Community has signed the Convention as a State Party. Following ratification by the 20th party, it came into force on 3 May 2008. To date, 50 countries are parties to the convention, while a further 93 have signed but have not yet ratified.

The Convention aims to promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities, and to promote respect for their dignity. The Convention will cover 650 millions people in the world, including 50 millions in the EU alone [19].

The adoption of the Convention embodies the paradigm **shift from charity to rights, from a medical model to a social / Human Rights model**. Disabled people are no longer considered as victims or patients, they are **persons with rights and a full role to play in society**.

This achievement is a success for the EU. In May 2004, the Council mandated the Commission to negotiate on behalf of the Community on matters falling under Community competence. Community competence mainly stems from legislation adopted on the basis of Article 13 of the EC Treaty, which enables the Community to take action to combat discrimination based, *inter alia*, on disability. Despite the sensitivity of the issue, the constructive and active role played by the Commission during the negotiations was valued and recognised by all EU partners.

The successful conclusion of these negotiations constitutes a landmark for the **European Community** in that it will, **for the first time ever, become party to a comprehensive UN human rights convention**. The Convention should mean a revision of all existing legislation, policies and programmes to ensure that they are in compliance with its provisions. It will also mean new legislation in many areas. It implies that all existing and future European Directives, Regulations and programmes, will need to be in line with the Convention.

3. USABILITY ISSUES IN BORDER CONTROL

Definition: "Usability is the effectiveness, efficiency and satisfaction with which a *specified set of users* can achieve a *specified set of tasks* in a particular environment." [20] (The specified *set of users* and *set of tasks* are presented with more details in the Annex, in Section 6.4.3.).

3.1. Usability Challenges in Biometric Access Control

Usability of biometrics has received attention in recent years with their increasing use in commercial and government applications. Early lead was taken by NIST in the area of biometric usability standards, user interaction models and sample quality / usability relationship [21].

User acceptance requires that the users perceive the real need and the system's utility e.g. convenience for them. Reliability of recognition and data security can establish trust in a biometric system. Conversely, problems with usability will diminish the confidence. The system's acceptance also depends on personal attitudes and minorities may be particularly sensitive in this field [22]. Context also matters in the acceptance of biometrics: using biometrics in passports is considered to be more useful than using them for monitoring work hours [23].

Nadel has highlighted procedural considerations in biometric usability; these include factors such as information, guidance and ergonomics [24]. Fondeur stresses features like autonomy, fault tolerance, minimum habituation adaptability and performance [25]. Lack of commonly accepted methods and metrics or for biometric usability was also recognized. Proceedings of a recent usability workshop provide an excellent overview of this topic [26].

3.2. System's Convenience

3.2.1. Accessibility

Physical accessibility for people with reduced mobility is now becoming a norm; however access to information systems by the disabled is not fully explored. Nevertheless, the latter aspect is particularly important to ensure a regular flow of passengers in the airport, since a good communication and information system may speed up all the activities: check-in, identity controls, hand luggage checks, reaching the gates, boarding the plane. Biometrics in access control combines the physical and information domains, e.g. when biometric identification is used in the end-to-end air travel process [27].

***Figure 3**: Hand luggage control at Milan Malpensa airport*

3.2.1. Safety in Emergency Situations

A person with sensory or cognitive impairment or under linguistic barriers **may react in an unexpected way or just not react at all**. A deaf person might continue his way since he cannot hear a normal appeal, or will not open a bag or will not take out an un-allowed object

(for instance a pair of scissors) or do so in a too quick or dangerous way, being frightened by the unforeseen situation. This may give rise to a security or safety issue or exacerbate an emergency situation, such as during evacuation. A practical challenge is therefore how to **communicate effectively to all users in an emergency** as well as in normal situations?

Someone will consider the presence of people with disabilities as an **ethic problem** and will feel the need to provide them with **additional help**, in order to save an individual life, even before that of other users.

Someone else will consider their presence as a **pragmatic problem** and try avoiding that they may in some way be an **obstacle for others** and delay the main flow in an escape lane, confusing other people with requests of information and help. There is a concrete risk that a wheelchair follows down and blocks an emergency exit, or that a blind person looses his way or that a deaf person follows his own *visual logic* since he or she cannot listen to messages from the loudspeakers.

3.2.2. Awareness and Training

Three layers may be considered: awareness, information and training.

- **Awareness**: to think that there are people with disabilities and that there may exist specific problems in applying standard security controls on them, as well as problems for their safety, particularly in emergency situations.
- **Information**: on different kinds of disabilities and different kinds of technical aids wered or used by them, e. g. risk of warming up a metal prosthesis or deregulating or destroying a electronic prosthesis by intense magnetic field and of possible interferences in the other sense (the assistive device may disturb the control equipments).
- **Training**: on how to select people to submit to a special control and on how to perform such control, considering that the large majority of the passengers declaring themselves as people with disability will really have such a disability, while some of them may be, in exceptional circumstances, kamikaze wearing explosives inside the technical aids or prosthesis.

Some information and basic training or **awareness** raising would be beneficial for all involved **personnel**.

3.2.3. Accessible Communication: Redundant Information Systems

Information systems are not perfect nor are the people using them. Therefore information provision to users in a process needs to be designed on the basis of cognitive limitations as well as expectations of the end users. Design factors to consider are:

- *what* would the different users *wish* to know (content);
- what they *need* to *know* (relevance);
- *when* people need such *information* (timeliness);
- *how they* will best *understand* it (communication channel);
- how *they* will *remember* it (retention for later use);
- what information needs to be *repeated* (re-enforce).

With respect to the disabled, the above factors need to be considered for the specific modes of disability. Therefore the communication channels in a public service context need to be adapted to diverse disability profiles.

Redundancy is often one of the solutions that may help in providing more complete and more efficient information. This is valid also in supporting people with disability in their travelling process and in the identity controls.

In order to help overcoming usability needs in access control, different supports should be made easily available: a general pamphlet, a short video-clip, information via loudspeakers, information on a screen, via radio or television. Often people miss a part of each channel of information: redundancy may provide the missing pieces of information in a different format as well as on a different moment. In stations or airports, in noisy situations, in different languages, it is difficult to understand the full information from loudspeakers. The information on the screens is more detailed and available for longer time.

People with some limitations do not get the full information. Blind people or people with visual impairment have to relay only on audio information, while deaf people or people with hearing impairment have to relay only on visual information. For them, as well as for people with communication problems (just only with limited knowledge of a foreign language) this **re-ensuring redundancy** is lost and the partially got pieces of information generate uncertainty, insecurity, typically in unfamiliar situation. **This uncertainty affects of course the directly concerned person, but also all the other users** as well as the services' providers and the whole system: a lost passenger may delay the entire queue and, in some cases, the departure of a flight. (Some of these aspects are presented with more details in the Annex, in several tables in Section 6.4.).

Sometimes, some media are out of order, while others work well: often in emergency situations television broadcasts and television receivers do not work properly, while radio broadcasts and radio receivers may continue working for a longer time. If the mobile phone may be still working, emergency messages might be ignored, not being put in good evidence (different sounds or vibration).

In many cases, the information in stations and airports is first announced by loudspeakers and then published on screens and panels after a few seconds or minutes. This means that the information is treated twice, due to a lack of a globally conceived information system. The information might be generated in an easier way in a written form, and be at the same time shown on all the screens and pronounced by text-to-voice synthesisers connected to the loudspeakers.

In some cases, a precise piece of information is shown on a large table on a screen full of lines and looses its visibility, immediacy and warning aim: flashing lights might be used for *small* but important changes, as the last minute change of a train's track (but exaggeration of blinking looses its visibility and disturbs the users).

It often happens that a form has to be filled in rather quickly: terms used in it may appear more difficult, due to specific vocabulary or specific syntax and may require more time or receive a wrong answer.

For many people there is an *obvious* association of deafness and the use of **sign language**. On the contrary, while a considerable number of deaf people use sign language, an even more considerable number of them **do not use it** and the large majority of people with (medium) hearing impairment do not know it at all. Subtitling or just simple written messages may ensure a better comprehension. In many cases, lips reading may be sufficient, but this is easier in the user's mother tongue.

4. POLICY SUPPORT BY JRC

4.1. Motivation in Public Services and Border Control

Research in this area may contribute improving the quality of life of all citizens and their access to the Information Society. The work will aim at fostering the inclusion and at empowering from the security standpoint a portion of the population that is currently, at least partially, excluded and that might be exposed to gratuitous security risks. There is the potential for a significant activity of harmonisation of national initiatives, identification of best practices, assessment and demonstration of technologies, and awareness raising, in a complex and multilingual field, which exactly corresponds to the JRC's role.

4.1.1. Relevant Projects

The JRC's contribution to disability aspects, which started ten years ago with the VOICE Project funded by Directorate General Information Society and the participation to the InterService Group on Disability (ISGD), chaired by Directorate General Employment and Social Affairs, continued with the support of Directorate General Enterprise in the CENELEC Normalisation Committee and in collaboration with Directorate General Education in the MOISE Project. Further activities were developed in the European Year of People with Disabilities 2003 and later on with the contribution to the SESAMONET Project and the *Towards Secure Airport* Project, described in the Annex.

The activities moved from the area of people with hearing impairment to address a larger spectrum of problems. The field of applications was further extended to that of Assistive Technology devices, considering the difficulties encountered by people with other disabilities, as well as by elderly and disadvantaged people, in view or their Inclusion / Exclusion in the social life. This deals with situations in which a citizen cannot effectively interact with an ICT-mediated environment, and more generally with all citizens, who can some time in their lives have a temporary or a permanent disability.

New initiatives are taking into account aspects of safety and security related to disability in the new IPSC's Actions, as BORSEC (Border Security) and SCNI (Security of Critical Networked Infrastructures). New initiatives also in different JRC's Units are confirming the correct prevision in this area, where the research has to start several years before a clear request by the policy decision makers. The common thread of the different activities should be considered as an important awareness raising action and support to new ideas and challenges in the field of Research and Disability.

4.2. Possible initiatives

4.2.1. Impact of Border Security Measures on People with Disability

An integrated border management needs to be based on a uniform procedure for the control of people, including those with special needs / equipment. Some conceptual aspects should be considered as well as the possible delivery and use of a special disability card or documents in a standard or procedural way. More precisely:

- Use of biometrics to speed up checks and provide more reliability;
- Information stored on the ePassport, or preferably on a personal data card;
- Multi-function identity documents (e.g. identity + disability / medical needs).

This will involve analysis of usability of biometrics in identity documents, as:

- Issuance of ePassport (including enrollment);
- Control of identity: assisted or automated verification;

- Acceptance by the users;
- Difficulties for the controllers;
- Particular problems, standards, interoperability.

Some specific aspects in the use of data should be further analysed, as:

- Data management;
- Data flow;
- Data storage;
- Privacy aspects.

A theoretical overview and indication of specific points will involve a few associations of people with disabilities for user needs analysis or user tests. Such initiatives may require several meetings, due to the different communication difficulties (no telephone for the deaf, no images for the blind) and some dedicated information set (pamphlet or videos for the deaf or Braille printing for the blind). Larger meetings or conferences, with subtitling for the deaf and audio-description for the blind may be necessary for a visibility and awareness raising process, as well as participation to standardisation bodies' activities or developing and performing technical tests on specific equipment.

4.3. Harmonistation - Standardisation

4.3.1. Definition of Assistive Technology Devices

People needing special medical care or people with disabilities use a wide range of new equipments. Many policemen or border security controllers are not familiar with them or even do not know them at all. Therefore they cannot judge the ways of use of them, as well as of risks of damaging or destroying the visible external equipment or even generate serious consequences on the invisible internal coupled equipment and possibly on some vital functions (pace-makers, cochlear implants).

Dealing with disability related problems is difficult due to the lack of a common rule in defining and trusting **certificates of disability status and of wearing technical aids**. On which basis, for instance, the security staff in an airport may select the people who should avoid electronic controls since they wear a pace maker or a cochlear implant or a metallic prosthesis? Which categories of aids should be considered in order to perform the appropriate security checks? Which kind of documents should demonstrate their status and certify the use of prosthesis or medical devices?

This puts on the floor the need of a **European Disability Card** and/or a **European Medical Aids Wearing Card**. The first step in this direction is a study in view of a harmonisation in the field. The ISGD agreed on the importance of the topic, within the limits of the EC's direct competence in this field, which at present in more under the Member States' competence and in their mutual recognition agreements.

4.3.2. Technical / System issues

An aspect to be considered is that of trusting the oral declarations of the users, about their disabilities and their need of technical aids. Even a written document provided by them will generate a similar problem of trust. Even if delivered and stamped by hospitals or disability associations or national authorities, it is difficult to verify the source in a quick way. The formats and languages of the documents certifying a disability are quite different in different countries. A harmonisation in this field is necessary in order to give them a more official value and make them more comparable and easier understandable in a shorter time.

A European or international *disability card* or *technical aids user card* would help the users to get an appropriate assistance, and the police to perform the appropriate checks. If this

international card will be equipped with RFID, it could send an information to the checking equipment, which will in turn send back a warning to avoid the gate (or switch off the control, if the RFID is well trusted).

4.3.3. Technical Certification of Assistive Devices

In case of wearing technical aids for disease or impairment, the users should know whether they may pass through the normal controls or may be affected by magnetic field. The border controllers should know whether the control equipment may interfere, deregulate or destroy such aids; therefore they should know which users should avoid the normal line and how to perform a special check.

If the medical equipment can be detached from the holder, as in the case of hearing aids or the external part of a cochlear implant, should such equipment pass through the x-ray or magnetic field checks? Who should write down a set of specifications and operational limits?

Each aid or medical equipment may be accompanied by a factory's notice and the owner may have a hospital's notice. Which kind of documents should certify the use of prosthesis or medical devices and describe the main features of such aids and the danger of interference between them and the control equipment?

4.4. Usability of Biometrics in Identity Documents - Open Questions

The proposals presented in this Section 4. are part of the results of the research Adaptive Multimodal Biometrics for Advanced Trusted Traveler Paradigm, described with more details in the Annex (Section 6.4.). The study has brought up new questions on the challenges of usability and security in the context of the passengers with disability. We highlight a few of them here:

- **Electromagnetic interference:** Risk to assistive medical implants such as pacemakers and cochlear implants due to EM interference of the detection devices at security checkpoints.
- **Explosives:** Risk of hiding explosives or other items of security threat in wheel chairs and other belongings; risk of explosion due to personal oxygen container prescribed on medical grounds.
- **Certification:** Who should certify / prescribe the use of medical devices on-board for a passenger and what is an acceptable form of certification / prescription in all EU countries? Who should certify the quality of medical equipment - what are the requirements for such certification? International Forms with medical information, as MEDIF / FREMEC (Frequent Traveller's Medical Card) are provided by the airlines companies to manage some practical information and probably to defend themselves in case of problems with the passengers, more them defending the latter, who in principle need more help.
- **Automated control:** What are the design criteria for the accessibility of eGates for a range of passengers with disability as well as the elderly? What are the procedures for emergency evacuation and how they are built into the design of eGates?
- **Data protection and privacy:** May the users with disability be known a priori (in the booking procedure or in airports)? Should this information be included in the electronic passport, in order to speed up the controls? The information stored on the ePassport may be completed by additional information, preferably stored on a personal data card, creating in such a way multi-function identity documents (e.g. identity + disability / medical needs).

5. CONCLUSIONS

As new security technologies are introduced in public services, such as border control and mass transportation systems, their accessibility for the disabled needs to be evaluated, since a large part of the population is directly or indirectly concerned with disability. This report highlights the importance of the topic and the dimension of the problem. It proposes an awareness raising process and analysis of possible ways for helping elderly people and people with disabilities to obtain the best assistance from new technologies, avoiding creating new barriers due to difficulties of use or incorrect or incomplete initial conception.

There are policy challenges in promoting equal access for all to mainstream products and services. These challenges require accessibility norms or standards for services of general interest, promoting social inclusion and equality of opportunities, by using the potential of new technologies and spreading examples of good practice. Use of many new systems requires some form of technical awareness. As a result, such systems may inadvertently create new classes of *disabled people*, i.e. users that are unable to use new equipment properly. Therefore, information technologies may generate new cases of *technical disability*. This is particularly true when the users need to use new technologies infrequently or in unusual complex situations, such as travelling in an unknown context, under stress and fatigue.

With increasing flux of novel security technology in mass transportation systems, and air transport processes in particular, the challenge of usability is recognized. This report has analysed these issues in the context of users with disability in an idealized process of Simplifying Passenger Travel (SPT). The report presented a common framework for analyzing security risks and inconvenience for the disabled in the SPT process and showed that it allows examining the two aspects in a balanced way. The framework can be used to devise risk-managed inspection policies for the disabled passengers with assistive devices.

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6. ANNEX

6.1. InterService Group of Disability

The InterService Group of Disability (ISGD) is chaired by Directorate General Employment and Social Affairs. It holds a few Group meetings each year and organises a few events, as the European Day of People with Disabilities on the 3 December of every year, a High Level Group meeting as well as an other conference in the Member State holding the EU semester presidency.

The Group transmits to all Directorate Generals a few proposals of InterService Consultations on topics related to disability and takes note of the activities and progresses in each Directorate General. Some of these achievements are inserted into the Commission Communication on the follow up of the **EU Disability Action Plan** (DAP) which is transmitted by the EC to the EP [28]. Thus ensures visibility to all Directorates General activities potential as well as opportunities of further contacts [29].

The ISGD was created more than 10 years ago, at the time when JRC-ISIS (previous name of an Institute partially replaced by IPSC) started the VOICE Project. Therefore IPSC represented the JRC for several years. After the end of that project, the Directorate of Programme and Resource Management (PRM) was asked to represent the JRC and, upon their request, IPSC collaborated for the technical aspects related to the VOICE and SESAMONET Projects. It contributed to the ideas and the texts proposed on discussion on definition of policies, providing technical remarks and suggestions on the applications aimed at helping people with disabilities. It underlined the importance of Research in Assistive Technology and presented the VOICE and SESAMONET Projects' results and the BORSEC (Border Security) and SCNI (Security of Critical Networked Infrastructures) Activities' objectives.

The aspects related to disability acquired an increasing importance at JRC, thanks also to the regular transfer of information ensured in both directions: reporting to JRC on the other Directorates General activities and underlining in the ISGD the importance of Research in this area. The experience gained and the awareness raising process stimulated, helped in considering the Information Society security aspects of citizens with special needs.

In parallel to that, contacts have also been maintained with two groups chaired by Directorate General Information Society: INCOM (INclusive COMmunications Committee, sub-group of the COmmunications COMmittee COCOM, review of the EU regulatory framework for electronic communications) with the purpose to concentrate on the use and the access to electronic communications by users with disabilities, and the Ad-Hoc Group on Communications Access for People with Disabilities of TCAM (Telecommunications Conformity Assessment and Market Surveillance Committee: accessible communication and accessible user interfaces). These Groups considered the aspects of accessibility of the emergency 112 telephone number by people with hearing impairment (idea to which IPSC contributed in previous meetings).

A new larger activity will be related to the recently **United Nations Convention** on the Rights of People with Disability, with the request for each Directorate General to verify to which extent new rules might come into force, in order to highlight possible synergies or conflicts with EC regulations.

6.2. VOICE Project

The VOICE Project aimed at the promotion of **automatic recognition of speech** in conversation, conferences, television broadcasts and telephone calls. It started in 1996 at JRC-ISIS and developed prototypes of user friendly interfaces allowing an easier use of

commercial products in translating the spoken voice into PC **screen messages and subtitles**. This is a powerful help for people with hearing impairment, reducing the gap between them and the hearing world [30].

Presentation of the VOICE Project to a group of school teachers, interested in using the prototype in the classroom for allowing deaf students to attend the lessons with their hearing colleagues. A slide is projected on the left screen by the speaker, who is speaking into a microphone connected to a PC: the text generated by the speech recognition system is converted into subtitling lines on the PC screen and projected on the right wall-screen, under the speaker's image taken by a video-camera. (JRC-Ispra, February 1998)

Figure 4: *Presentation of the VOICE Project*

This Project achieved significant results in years 1996-07 and provided a better definition of the requirements of people with special needs. It was then sponsored and funded by the DG-XIII-TIDE (previous to Directorate General Information Society) in years 1998-2000. Through the project, more than one hundred **workshops** were organized in order to develop an awareness raising process on the potentialities of voice-to-text recognition systems. Approximately 6,000 participants attended the workshops, in which a **prototype of automatic subtitling**, developed for this aim, was presented and used for live subtitling of speeches, as demonstration of feasibility and validation on the field. The subtitling system has been used in several **schools** in order to transmit to all the students of a class the same information, by the same words, in the same moment.

Videoconference system with automatic live subtitling. A deaf user communicates with a colleague speaking to a microphone connected to a PC: the text generated by the speech recognition system is converted into subtitling lines and overlaid onto the correspondent's video image. (JRC-Ispra, January 2000)

Figure 5: *Videoconference system with automatic live subtitling*

In years 2001 and 2002 the activities addressed the harmonisation of **television subtitling**, in collaboration with the European Broadcasting Union and the CENELEC Normalisation Committee, with the support of Directorate General Enterprise.

The Conference "eAccessibility by Voice: VOICE Recognition supporting people with hearing or other disabilities", held at Ispra in Varese, Italy, was one of the closing events of the European Year of People with Disabilities 2003. The Conference brought together representatives of European countries, television broadcasters, Associations of people with disabilities and many experts from all over Europe.

In the following years, a collaboration was established with the Department of Interdisciplinary Studies in Translation, Languages and Cultures (SITLeC) of the University of Bologna at Forlì, more precisely with the Subtitle Project (La formazione dei sottotitolatori: progettazione di un modello di qualità nei sottotitoli) and the SALES Project (Sottotitolazione Simultanea per l'Autonomia Linguistica, l'Emancipazione e la Sicurezza dei Sordi). As member of the scientific committee we collaborated to the International Conference on Real Time Intralingual Subtitling and Re-speaking (Forlì, 2006), continuing raising the broadcasters and professional subtitlers' awareness of the potential of speech-to-text technology in the production of real time subtitles to the benefit of the deaf.

As result of that, interpreters of the University of Forlì achieved a good level of performance in the use of the VOICE system, thanks to which they live-subtitled several conferences (conference on Cochlear Implants, Turin, 2007; AFA conference and mess, Cantù, 2007). The professional interpreters used speech to text technology - for the first time in Italy - to produce real-time subtitles of all the speeches and debates, thus facilitating the participation of people with hearing impairment and their integration in mainstream society, assuring them a high level of autonomy.

Figure 6: *Re-speakers at work for live subtitling*

On October 2007, the **European Broadcasting Union** organised in **Geneva** a conference "Teletext & Subtitling" on the latest development among the EBU Member organisations, in Subtitling, Access Services and a new improved Teletext for Digital TV. EBU invited the Member organisations and the VOICE Project with the aim of discussing the existing strategies and future opportunities. All agreed that Teletext remains a widely used and most successful service, with a strong potential for the future. Teletext news and programme information are valuable content: short and up-to-date, narrow-banded and suitable for multiple distribution channels; their content production is often included in digital workflows for the distribution over mobile services and the internet.

The VOICE Project also collaborated with the Centre de Recherche Informatique de Montréal (CRIM) for the First **Canada-Europe e-Inclusion Symposium** and video-conference with the Canadian and European Partners of the IST-EC 2 project on March 2007 [31].

The results of the VOICE Project and new applications for identity controls have been presented to and discussed with associations of people with disabilities, particularly in the **International Congress** *A Global Community of Communication*, **Vancouver**, 2-6 July 2008, organised by the Canadian Hard of Hearing Association and the International Federation of Hard Of Hearing People.

6.3. SESAMONET Project

The SESAMONET (SEcure and SAfe MObility NET) Project's is a RFID and GPS based guidance system for visually impaired people. The Project's objective was the development of an integrated electronic system to increase mobility of people with visual disabilities and their personal safety and security, by identifying a secure path to walk through predefined areas. This was done through the use of mature and proven technologies (RFID - Radio Frequency Identification, antennas, Bluetooth, etc.) that had to be integrated for this specific application.

The system is based on three main components: an electronic path made of RFID tags, a custom-designed walking cane, and a smart phone or PDA (Personal Digital Assistant). The custom-designed walking cane is adapted to work with SESAMONET but retains all the tactile characteristics of a standard white cane. Each RFID tag is associated to a message or a small beep. Each micro-chip sends position signals via a dedicated walking stick to a smart phone containing information about the location, and a recorded voice - via a Bluetooth headset - guides the visually impaired person along the route. The system describes the environment and warns the user if there is a potential danger such as a road crossing or a step. Furthermore, the system can activate electro-mechanical devices (such as traffic lights) on

behalf of the user. The prototype system uses RFID micro-chips embedded in the ground. The microchips can be recycled from the electronic tracking of cattle. The technical aspects have been patented by the EC [32].

The electronic path is a *non-visual* sequence of landmarks, where each landmark bears information that helps the user to gain knowledge regarding the environment; for this reason it can be used in all those situations where the users are in a situation of difficulty or danger. As it works independently from electric power or GPS, SESAMONET can be installed both in external and indoor environments (e.g. parks, shopping centres) and thus can contribute to improved mobility for those who suffer from visual impairments. Since the electronic path can also be read by RFID-enabled cell-phones, in dangerous situations such as blackouts or fires in indoor location (i.e. galleries or public buildings) it can be a valid mean of guiding people towards safe locations or emergency exits.

In collaboration with the municipal authorities of Laveno, a full scale pilot project of about two kilometers path along the lakeshore - starting at the railway station - has been equipped with microchips wrapped in ceramic cells and embedded at 65 cm intervals. An other path has been equipped at the Parco Prealpi Giulie and the system has been demonstrated at the eInclusion Conference held in Vienna on November 2008. Other new paths are being set up.



Figures 7-8-9: Using the SESAMONET path in Laveno

6.4. Towards Secure Airport Project

The experience acquired by the previously described projects helped in extending the application field to other technical means and considering also other difficulties in communication, security and safety, encountered by elderly people or people with disability.

6.4.1. Adaptive Multimodal Biometrics for Advanced Trusted Traveler Paradigm

In 2008, IPSC performed a project that analysed the usability of security technologies in an airport departure process. Follow on research will focus on the usability of the new EU biometric passport [33].

The study's objectives were**:**

- To develop formal concept of a secure airport and define an Advanced Trusted Traveler (ATT) paradigm based on adaptive multimodal biometrics;
- To investigate the requirements of a cross-border technical infrastructure for multimodal biometrics for air travel process;
- To identify usability issues, including those of the disabled, regarding biometrics based ePassport and trusted traveler cards.

The main achievement of the project in its first year was the definition of a *Secure Airport Concept:* development of a probabilistic model for the security of airport passenger departure process based on SPT Ideal Process Flow [34].

The Project examined the Usability Issues, developing a study of usability requirements through workshops and meetings with airport operators and users: definition of a framework for the assessment of passenger departure process; process metrics of security and (in)convenience for a number of disable user profiles.

The task of identifying the security requirements for an airport has been undertaken from both practical and theoretical perspectives. From a practical point of view, two meetings have been organized with experts from the airport authority SEA and a visit was made to Milan Malpensa airport, where a range of security measures involved in passenger processes was viewed and discussed.

6.4.2. A Framework for Usability and Security Assessment

Definition: "Usability is the effectiveness, efficiency and satisfaction with which a *specified set of users* can achieve a *specified set of tasks* in a particular environment." [20]

Initial scoping of the study of the usability issues in air travel process has been carried out in the light of the previous work on general biometric usability already carried out by NIST in the USA [21].

We illustrate our methodology for a novel model for usability assessment on a case study of passenger departure process at airports for which we have chosen IATA / SPT ideal process as the formal process definition.

In the present research, the scope of the usability study was to examine the accessibility of the disabled and elderly passengers to the passenger departure process, with or without biometric identification. The study concentrated on the impact of border security measures on disabled people, particularly in the phase of the identity controls. On one side, the use of biometrics is expected to speed up checks and provide more reliability, on the other side, the risk of non acceptance of the system by the users might limit its general use.

6.4.3. The Analytical Framework

Referring back to the definition of usability, in the present research the specified *set of users* consisted of the different types of disable passengers as well as the elderly, while the specified *set of tasks* were the main passenger tasks involved in the airport passengers' process. The specific *usability context* was set by the Simplified Passenger Travel process for seamless airport journey. Figure 10 shows a high level abstraction of the SPT process model.

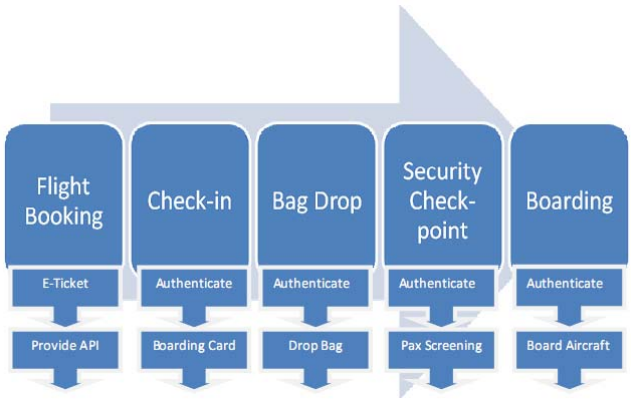

Figure 10: *High-level abstraction of the Ideal Process Flow Departures Process (Passenger's view)*

On the other hand, security is defined in terms of the risk posed to the assets by the threats that may be natural or man-made. When developing a framework for common security and usability analysis, we need to take into account the primary stakeholders: the citizen on one hand and authorities on the other. This is shown in Table 3.

Citizen with disability	***Usability***	The citizen may face specific **inconvenience** due to the choice of technologies or the design of the process in which they are deployed.	***What is the relationship between risks and inconvenience in a system?***
	Assistive Needs	Authorities are responsible for offering assistance as per the needs of a person with disability	Authorities may perceive specific security **risk**s from a person with specific profile
		Obligations	***Security***
		Authorities responsible for a Service	

Table 3: *A framework for concurrently analyzing usability and security for persons with disability*

An analytical framework was developed for a joint usability-security assessment along the process dimension. A table, in the form of a spreadsheet, considered the inconvenience encountered by users with different abilities all along the typical situations encountered by them in the airport passenger process. Table 4 shows the task / user profile matrix used in the analysis.

	Sensorial disability: blind	Sensorial disability: deaf	Mental disability: psychological	Physical disability: motor	Elderly	Temporary disability
Scheduling a flight						
Booking a flight						
Approaching the airport						
Check in						
Communications						
Passport control						
Emergency escape						
Reaching the plain						
Flight						
Luggage control						
Leaving the airport						

Table 4: *Scope of usability study in the SPT process with respect to a range of user profiles*

The **rows** in Table 4 represent the **tasks** in the normal progression order encountered by the passengers, from the initial stage of scheduling and booking a flight online, by telephone or at a travel agency, to the practical problems eventually encountered in reaching the airport, parking and starting the check-in procedures and baggage drop. Particular attention was then paid to the next steps of identity controls, by human personnel or by automatic e-gates as well

as hand luggage controls. Then the next steps: reaching the security gate, passing the final boarding controls, going onto the plane, flight, disembarkation, arrivals controls, baggage collection and exit from the airport.

The **columns** in Table 4 represent different **types** of disability: from visual or hearing or mental disability, to motor disability, as well as the problems related to the elderly or passengers with temporary impairment, such as being pregnant or using crutches or travelling with several children.

6.4.4. Analysis of the SPT Process - Results

By filling in the matrix presented in Table 4, it started becoming a tool for collecting information, organizing ideas and suggesting possible solutions.

As anticipated, the table's rows presented the tasks in the normal progression order encountered by the passengers, while the table's columns presented different types of disability. Each intersection in the table, i.e. each cell, represented a particular context of user / task pair in the SPT process. For a selected set of cells, usability problems were identified from the passengers' point of view as well as potential security problems from the operators' point of view. After a first iteration, the matrix was then refined, extending the numbers of rows and columns in order to consider more different cases.

The spreadsheet was first populated with analytical information in a qualitative form. A quantitative evaluation of this information was then carried out to identify various factors contributing to passenger inconvenience as well as the security risk to the departure process. This method was repeated for selected user profiles. A partial snapshot of the resulting analysis is shown in Table 5; more details are provided in Table 6. The inconvenience and risk factors were quantified on a scale of 1-5 and aggregated on a *per-profile* and *per-process* stage basis. (1 indicates a least inconvenience or security risk, while 5 indicates a most inconvenience or security risk).

Care was concentrated on the usability aspects related to biometrics and disability and particularly to communication problems, often underestimated in many situations. The difficulties that have been highlighted should contribute at fostering the inclusion and at empowering from the security standpoint a portion of the population that is currently, at least partially, excluded and might be exposed to gratuitous security risks.

The user needs in mass transport - at airports and railways stations - and the security aspects have been discussed with a few members of associations of people with disabilities and in meetings and workshops at the airports of Malpensa and Berlin Schoenfeld (April, June 2008), at the international congress *A global world of communication* in Vancouver, organised by the Canadian and the International association of people with hearing impairment (2-6 July 2008), and at the EDIS conference *Management of transport networks and management of security in ports, airports and railways* in Genoa (18 September 2008).

This highlighted a set of threats and open questions, previously indicated in Section 4.3.4., as risks (of electromagnetic interference to medical implants, or of hiding explosives or other items of security threat in wheel chairs and other belongings, or of explosion due to personal oxygen container prescribed on medical grounds) and on roles for certification and control (who should certify / prescribe the use of medical devices on-board; what are the design criteria for the accessibility of eGates for a range passengers with disability as well as the elderly?).

6.4.5. Harmonistation, Standardisation, Definition of Assistive Devices

As anticipated in Section 4.3.1., people needing special medical care or people with disabilities use a wide range of new equipments. Many policemen or border security controllers are not familiar with them or even do not know them at all. Therefore they cannot

judge of their use, as well as of risks of damaging or destroying them and they need up-to-date information in order to decide when to avoid personal examination.

An additional risk has to be analysed: that of interference between the equipment used for the security checks and the assistive devices used by the passengers, as pace maker, cochlear implants, hearing impaired prosthesis. The interference risk has to be investigated in both directions: the assistive device may be disturbed (de-calibrated or even destroyed?) by the electromagnetic fields or x-Rays controls, while, at the same time, it also may cause some problems to the checking systems. In some cases, interference during the flight with the on board guidance system has also been considered as possible.

Sensorial Disability: Hearing (permanent)				
	deaf **with internal equipment** (cochlear implant		deaf or hard of hearing **with external equipment** (hearing aids)	
	inconv.	*sec.risk*	*inconv.*	*sec.risk*
body control: frontal clear communication or unpredictable reactions; electromagnetic interference	5	3	3	2
bags control: frontal clear communication or unpredictable reactions; electromagnetic interference	3	3	3	3
identity control: no voice recognition systems; no voice-guided semi-automatic systems	1	1	1	1

Table 5: *Quantification method for security risk and passenger inconvenience for a passenger profile (partial set). For extended set, see Tables 8-9*

Results for a set of the most significant cases were plotted in a graphical form, thus helping in redefining with more precision the previous data and any correlations between different sets. Figure 11 shows a specific user profile evaluation set of the departure process for inconvenience and security risk. The situation that has been analysed considers a conventional passport control. Further analysis will concentrate on the biometrics passport controls at eGates.

These data underlined a significant difference between the passengers' feelings of inconvenience and the security risks. Users with assistive aids, as pace makers or cochlear implants, of course attach the greatest importance to their equipment, both the implanted part and the external one. From the point of view of security, the risk is rather limited, mainly related to possible magnetic interference or hidden explosives.

This situation is unbalanced, since it may bring to a superficial control, sufficient to reduce the security risk, but dangerous for the user: for instance only a passenger with pace maker may avoid the electromagnetic controls, while a passenger with cochlear implant has to insist in order to avoid such controls that might deregulate the implant; sometimes the external part of the assistive devise may be passed through X-rays control with a similar risk; also hygienic aspects should be more considered in manipulating personal medical devices. For this reason, the figures previously indicated were normalized, increasing the level of the security risk in order to indicate not a real greater risk but a need for greater attention.

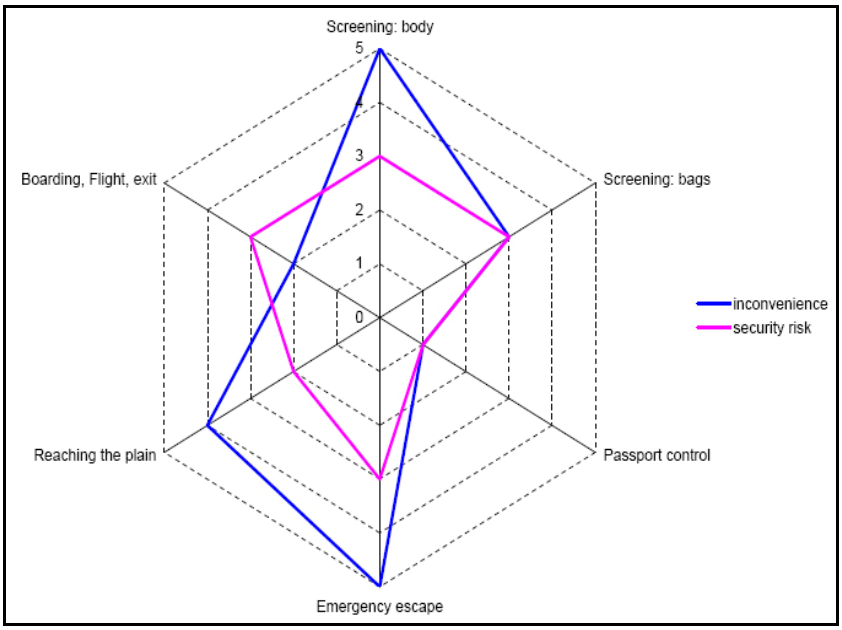

Figure 11: *Security risk and inconvenience profile of the SPT process for passengers with cochlear implant*

For the above reasons, the matrix was expanded by further information, separating the responsibility of the security controllers and that of the airport's handlers. This allowed a more precise interpretation of different situations form the point of view of the passenger and his feelings of inconveniences, in such a clearer way as to better define the same situations from the point of view of what the airport's authorities should do.

Separating the responsibility of the security controllers and that of the airport's handlers doubled the number of columns. In order to limit its proliferation, further distinction within the data registered into the latter two columns - i.e. security risk or need of special care for accessibility - was presented only by using a set of colors for the different concerned actors, as indicated in Table 6:

- either the passengers' feelings of inconvenience (blue for values 5-4-3 / azure for values 2-1) with respect to the security risks (pink for values 5-4-3 / rose for values 2-1),
- or the passengers' need for help in order to overcome barriers or the passengers' need for help in order to overcome barriers (dark green for values 5-4-3 / light green for values 2-1) with respect to the obligation of providing some additional help (brown for values 5-4-3 / beige for values 2-1).

-: not applicable	marks from 5 (max) to 1 (min); no strict correspondence between passenger's inconvenience and security risks					0: no additional problem
	passenger's equipment, with risk of damage, and requiring additional security control					
	passenger's inconvenience (worried about personal risks)					
	5: passenger has an internal equipment	4: external equipm linked to the internal	3: external equipm	2:	1:	
	security risk (metal, explosives, electromagnetic interference)					
	5: passenger's equipm: explosives / interference	4:	3:	2:	1: risk reduction in control's level	
	passenger requiring help to overcome physical barriers					
	passenger's inconvenience (difficulties in overcoming physical barriers)					
	5: physical or visual impairment	4: hearing impairment	3:	2: access web site or telephone call center	1: limited additional difficulties	
	security risk (limited risk, but special help needed)					
	5: equipment or staff to help overcoming	4: written info and staff to help	3:	2: accessible web site and call center	1: risk reduction in control's level	

Table 6: *Quantification method for security risk and passenger inconvenience*

On the other side, examining more steps in the passenger process added a considerable number of rows and the dispersion on too many situations created difficulties in comparing the numeric values attributed to different but similar cases. In order to limit the data to analyse in the rows, some simplification had to be made: concentrating on situations in the departure process and making the hypothesis that a similar situation in the arrival or transfer passenger control could be defined by the same numeric value (e.g. hand luggage security checks for the first or the second flight; same difficulties in reaching the airport as well as leaving from it, etc.).

Finally, all the numeric values in Table 6 have been re-attributed in a more standardized way, easier to be presented to the airport's authorities: for instance, level 5 for each passenger with an implanted assistive device or with a physical or visual impairment. Applying this approach to the *tasks* and *types* (rows and columns) indicated in Table 7, a large matrix was generated, part of which is indicated in Table 8. These values have then been applied to the final table, part of which is presented in Table 9. As previously indicated, the situation that has been analysed considers a conventional passport control. Further analysis will concentrate on the biometrics passport controls at eGates: a first hypothesis is shown in the 3 last rows of the "Secure Area" in Table 9, highlighted in grey color.

Rows:

PREPARATION
- Scheduling a flight
- Booking a flight
- Approaching the airport

DEPARTURE
- Check-in
- Web check-in
- Kiosk check-in
- Mobile phone boarding card
- Baggage drop

SECURE AREA
- Screening: body
- Screening: bags
- Identity control
- Identity control: fingerprints
- Identity control: eyes iris
- Identity control: voice recognition

BOARDING
- Emergency escape
- Reaching the plain
- Boarding, flight, exit

EXIT
- Reaching the airport
- Transfer
- Passport control
- Luggage (all=drop)
- Exit airport (all=approaching)

Columns

on several pages, grouped by the following sets of user profiles:

Sets:
- Physical disability: Motor
- Medical, Other Physical
- Psycho, Miscellaneous
- Sensorial Disability: Visual
- Sensorial Disability: Hearing
- Biometrics: eGate

For each set, a few sub-sets:
- with internal assistive device
- with external control of the internal assistive device
- with external assistive device
- without any assistive device.

For each sub-set two columns:
- passengers' inconvenience (or need for help to overcome barriers)
- security risk (or special care for accessibility).

Table 7: *Detailed structure of the Task / User matrix*

Needs of elderly people and people with disabilities in a Secure Airport *versus when and where the problem arises: possible consequences and solutions*										
1min - 5max	**Sensorial Disability: Hearing**									
	permanent						**temporary**			
	with int. equipm. (deaf with cochlear implant)		**with ext. equipm.** (deaf or hard hearing with prosthesis)		**no equipm.**		**with ext. equipm.** (broken or lost hearing aids)		**no equipm.** (hears inflammation)	
	inconv	*sec. risk*	*inconv*	*sec. risk*	*inconv*	*sec. risk*	*inconv*	*sec. risk*	*inconv*	*sec. risk*
PREPARING A FLIGHT										
Scheduling a flight: accessible call center; relay service	*1*	*0*	*1*	0	*1*	0	*1*	0	*1*	0
Booking a flight: web site: ok; tel: accessible call center; travel agent: ok	*1*	*0*	*1*	0	*1*	0	*1*	0	*1*	0
Approaching the airport	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
DEPARTURE PROCESS										
Check-in: only written messages	*2*	*1*	*2*	*1*	*2*	*1*	*2*	*1*	*2*	*1*
SECURE AREA ACCESS										
Screening body: frontal clear communication or unpredictable reactions; electromagnetic interference	5	3	3	2	1	2	1	2	1	2
Screening bags: frontal clear communication or unpredictable reactions; electromagnetic interference	3	3	3	3	1	2	1	2	1	2
Identity control: no voice recognition systems; no voice-guided semi-automatic systems	1	1	1	1	1	1	1	1	1	1
MOVING IN THE AIRPORT, BOARDING										
Emergency escape: light indicators	5	3	5	3	5	3	5	3	5	3
Reaching the plain: clear info on delays and changes of gates	4	2	4	2	4	2	4	2	4	2
Boarding, Flight, exit	2	3	2	3	2	3	2	3	2	3
LANDING, EXIT										
Reaching the airport: only written messages	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Luggage and passport control: frontal clear communication or unpredictable reactions	1	2	1	2	1	2	1	2	1	2
Transfer: clear info on delays and changes of gates	*4*	*2*	*4*	*2*	*4*	*2*	*4*	*2*	*4*	*2*
Exit airport	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Table 8: *Needs of people with hearing disability in a Secure Airport - (part of the initial table)*

Needs of elderly people and people with disabilities in a Secure Airport *versus when and where the problem arises: possible consequences and solutions*																
		Physical disability: Motor														
		permanent									**temporary**					
		with int eq (metal prosthesys)	*incon v*	*sec risk*	**with ext eq** (wheel chair, crutches)	*incon v*	*sec risk*	**no equipm** (no hands, finger, fingerprints)	*incon v*	*sec risk*	**with ext eq** (wheel chair, crutches, plastering)	*incon v*	*sec risk*	**no equipm** (difficulties or slow moving)	*incon v*	*sec risk*
PREPARATION	Scheduling a flight		*1*	*1*	accessible web	*2*	*2*	accessible web	*2*	*2*	accessible web	*2*	*2*	accessible web	*1*	*1*
	Booking a flight	provide info; accessible web site	*1*	*1*	provide info; book local eq; access. web	*2*	*2*	accessible web	*2*	*2*	provide info; book local eq; accessible web	*2*	*2*	accessible web	*1*	*1*
	Approaching the airport	parking, ramps, elevators *(=temp no eq)*	*2*	*0*	parking, ramps, elevators	*5*	*5*	parking, ramps, elevators	*2*	*0*	parking, ramps, elevators	*5*	*5*	parking, ramps, elevators	*2*	*0*
DEPARTURE	Check-in		*2*	*1*		*4*	*1*		*2*	*1*		*4*	*1*		*2*	*1*
	Web check-in		*2*	*1*		*2*	*1*		*2*	*1*		*2*	*1*		*2*	*1*
	Kiosk check-in		*2*	*1*		*2*	*1*		*2*	*1*		*2*	*1*		*2*	*1*
	Mobile phone boarding card		*2*	*1*		*2*	*1*		*2*	*1*		*2*	*1*		*2*	*1*
	Baggage drop		*3*	*1*		*5*	*1*		*3*	*1*		*5*	*1*		*3*	*1*
SECURE AREA	Screening: body	metal, explosives	*5*	*5*		*3*	*5*		*2*	*2*		*3*	*5*		*2*	*2*
	Screening: bags	metal, explosives (accessories)	*2*	*2*		*3*	*5*		*2*	*1*		*3*	*5*		*2*	*1*
	Identity control		*2*	*1*		*2*	*1*	no fingerprints recognition	*2*	*1*		*2*	*1*		*2*	*1*
	Identity control: fingerprints		*2*	*1*		*3*	*2*	not applicable	-	-		*3*	*2*		*2*	*1*
	Identity control: eyes iris		*2*	*1*		*3*	*2*		*3*	*2*		*3*	*2*		*2*	*1*
	Identity control: voice recogn		*2*	*1*		*3*	*2*		*3*	*2*		*3*	*2*		*2*	*1*
BOARDING	Emergency escape	ramps, elevators no ectricity	*2*	*1*	cars, elevators, ramps	*5*	*5*	cars, elevators, ramps	*2*	*2*	cars, elevators, ramps	*5*	*5*	cars, elevators, ramps	*3*	*1*
	Reaching the plain	cars, elevators, ramps	*2*	*1*	cars, elevators, ramps	*5*	*5*	cars, elevators, ramps	*2*	*2*	cars, elevators, ramps	*5*	*5*	cars, elevators, ramps	*3*	*1*
	Boarding, Flight, exit	cars, elevators, ramps	*2*	*1*	cars, elevators, ramps	*5*	*5*	cars, elevators, ramps	*2*	*2*	cars, elevators, ramps	*5*	*5*	cars, elevators, ramps	*3*	*1*
EXIT	Reaching the airport	cars, elevators, ramps	*2*	*1*	cars, elevators, ramps	*5*	*5*	cars, elevators, ramps	*2*	*1*	cars, elevators, ramps	*5*	*5*	cars, elevators, ramps	*3*	*1*
	Transfer		*2*	*1*		*5*	*5*		*2*	*1*		*5*	*5*		*3*	*1*
	Passport control		*2*	*1*		*2*	*1*	no fingerprints recognition	*2*	*1*		*2*	*1*		*2*	*1*
	Luggage *(all=drop)*		*3*	*1*		*5*	*1*		*3*	*1*		*5*	*1*		*3*	*1*
	Exit airport *(all=approach.)*	elevators, ramps, parking	*2*	*0*		*5*	*5*		*2*	*0*		*5*	*5*		*2*	*0*

Table 9: *Needs of people with motor disability in a Secure Airport - (part of the final table)*

European Commission

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Abstract

As new security technologies are introduced in public services, such as border control and mass transportation systems, their accessibility for the disabled needs to be evaluated. A large part of the population is directly or indirectly concerned with disability of permanent or temporary nature.

This report starts with a brief overview of the scale of disability and associated challenges and puts them in the context of the public policy on disability. In particular it highlights two existing policies: the EU Transport Regulation on the Disabled Air Passengers and the UN Convention on the Rights of Persons with Disability, both of which are of relevance to mass transportation.

The report then analyses the usability challenges in public services and border control, including the issues of accessibility, safety and communication. These need to be addressed in future policy proposals. Technical support to the present and future policies related to disability complying public services is seen as a potentially important role for JRC. This is illustrated through a review of relevant JRC projects: VOICE, SESAMONET and Secure Airport.

New technologies in public services can be viewed by the disabled from two perspectives: assistive technologies and neutral technologies. The assistive communication technologies were adopted in projects VOICE and SESAMONET to improve accessibility in public services. On the other hand, the use of biometric identification in airports and border control is to enhance security for all and therefore it is assumed to be neutral, with respect to disability. This assumption was investigated in the Secure Airport project.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.