HERCA
Heads of the European Radiological protection Competent Authorities

Facts and figures concerning the use of Full body scanners using X-Rays for security reason

presented by HERCA Working Group 2
to the Oslo HERCA plenary meeting on 30. June 2010

This report aimed only at providing a factual basis to the Heads of the European Radiological protection Competent Authorities during their plenary meeting on 30. June 2010, for discussing key issues associated to the possible introduction of Security Scanners as a measure for screening persons.

There has been significant interest in body screening technologies, particularly for use in airports since the failed terrorist attempt on a Northwest Airlines flight from Amsterdam to Detroit in December 2009 when a passenger tried to use explosive powder sewn into his underwear. Body screening technologies have been used since the 90's for custom purposes in some countries and quite largely in diamond mines. These technologies are now considered to increase security checking at airports.

I. Available body screening technologies

There is a range of different technologies that can be deployed for security screening of passengers.
Four types of technologies are today available, only two of them use ionizing radiations:

- **Back-scattered X-Ray** scanners: This technology uses low intensity x-rays to scan the body. The x-rays bounce off the skin and are then captured by detectors to collect data that can be used to generate images or for automated detection[1]. This technology has been examined by a number of independent technical bodies, and all conclude that the dose per scan is very low, about 0,1 microsievert/scan[2]. High quality images can be produced in 10 to 30 seconds. Cost per unit could be between $100 000 and $200 000[3] ;

- **Transmission X-Ray** scanners: This technology can also image objects concealed within the body. Government around the world occasionally use transmission X-Rays for Custom clearance purposes, using the technology to identify contraband within body cavities. High quality image can be produced in 10 to 30 seconds. The dose per scan can be 0,25 microsievert/scan, but can also be much higher. This technology has being implemented since the 1990's in South Africa and Namibia, to combat theft against diamond mines[4]. Cost per unit would exceed $200 000[2];

- **Millimeter wave back-scattered scanners**: These devices use the property of clothing and other organic materials to be translucent to some extremely high frequency

[1] *this technology is currently under development.*
[2] *Rapiscan Secure 1000 has been assessed by UK health protection agency (0.02 microsievert/scan), by German Physikalisch Technische Bundesanstalt (0.07 microsievert/scan) and by French Institute of Radiation and Nuclear Safety (0.11 microsievert/scan)*
[3] *Source : Aviation Security International, February 2010*
[4] *De Beers technology full body scanner operates at an absorbed dose of 6 microSievert per scan. The technology has been approved by the South African and Namibian Government Health Departments for its non-medical application.*

(millimeter wave) radio frequency bands. The millimeter wave is transmitted to the body. The wave energy reflected back from the body or other objects on the body is used to construct a three-dimensional image, which is displayed on a remote monitor for analysis. This technology can only detect objects concealed beneath clothing. It can produce high-quality images in 2 to 3 seconds. Cost per unit would be around $150 000[2]. Imaging using Thz frequency wave is also being developed;
- **Passive Millimeter/THz scanners**: Passive scanners make use of millimetre/terahertz frequency radiation naturally emitted by the body itself.

A description of implemented technologies is given in annex 1 to 3.

II. Use of body scanner in European Union and in the USA

HERCA WG2 has sent a questionnaire to the European Radiation Safety authorities. 15 answers have been received[5]. In addition, data from IACRS paper[6], from the Euratom Article 31 survey and from the *Communication from the commission to the European parliament and the council on the Use of Security Scanners at EU airports*[7] adopted by the European commission on 15th June 2010, have been used.

Full body scanners are in use in 6 countries:
- **Finnland** : Helsinki-Vantaa International Airport has decided in October 2009 to discontinue the use of the backscatter X-ray passenger scanner. After a year-and-a-half in use on an experimental basis, Finland's Civil Aviation Authority Finavia decided not to reapply for a licence for the scanner from the Radiation and Nuclear Safety Authority Finland. The Finnish government has however given its backing to the use of body scanners at airports in the beginning of 2010, if approved by the European parliament.
- **France**: one millimeter wave scanner is being tested at Paris Charles de Gaulles aiport;
- **Italy** : Rome's main airport Fiumicino is trying out Italy's first MM wave body scanner at a terminal that serves U.S. airliners since march 2010. A test at Milan's Malpensa airport will also soon begin.
- **Netherlands**: 15 millimeter wave scanners have been in use at Schipol Airport since 2006. 60 additional devices are being installed;
- **Poland**: A transmission X-rays scanner is in use in the prison of Piotrkow Trybunalski.
- **United Kingdom**: both millimeter wave and backscatter X-Rays devices are being used at Heathrow and Manchester airports and more are planned at other airports;

Additionally:
- **Germany** plans to use millimeter wave scanners in a pilot project in the second half of 2010;
- **Lithuania**: one transmission X-Ray scanner has been bought but has not been installed, due to the position of Radiation protection centre on the non-justification of the practice;
- **Ireland's** custom administration has confirmed that they are currently looking into the specifications and possible use of full body scanners in the long-term;
- **Switzerland** plans to test backscatter and millimeter wave technologies for one month in an airport;
- **European Union** legislature's administration had decided to acquire 6 backscatter X-ray scanners. The machines were acquired in 2005 and never used.

Use of X-rays body scanners for non-medical purposes is prohibited by law in:

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[5] *Austria, Belgium, Czech Republic, France, Germany, Greece, Iceland, Ireland, Lithuania, Netherlands, Slovenia, Spain, Sweden, Switzerland, United Kingdom*
[6] *Relevant facts regarding the use of ionising radiation screening devices in airports*
[7] *COM(2010) 311/4*

- **Austria**;
- **France**;
- **Germany**;
- **Italy**.

In **Ireland**, the legislation prohibits medico-legal exposures other than by direction of the court.

In the **United States of America**:

- There are 58 imaging technology units in use at 24 airports;
- In March 2010, the Transport and Security Administration (TSA) began deploying 450 advanced imaging technology units : 150 were bought in September 2009, 202 additional millimeter wave units and 100 backscatter units have since then been purchased by the US administration;
- In 2009, the TSA announced that whole body imaging would replace metal detectors at airport security chck points, using both backscatter (Rapiscan) and millimeter wave (Pro-Vision) technologies;
- In addition to the 500 units they are deploying now, the TSA budget includes $573 million to purchase a further 500 advanced imaging technology units and to operationally staff, operate and maintain 1000 units. With these 1000 units, the TSA estimates that they will be able to screen over 60% of all air passengers.

III. Whole body scanners using ionising radiation and international legislation

III. 1. Current European Legislation

The communication from the European Commission to the European Parliament and the Council on the Use of Security Scanners at EU airports published on 15. June 2010 gives an overview of the EU context :

- Under the EU legal framework for aviation security, Member States and/or airports are given a list of screening and controlling methods and technologies from which they must choose the necessary elements in order to perform effectively and efficiently their aviation security tasks.
- The current legislation does not permit airports to replace systematically any of the recognized screening methods and technologies by Security Scanners. Only a decision of the Commission supported by Member States and the European Parliament can be the basis for allowing Security scanners as a further eligible method for aviation security. However Member States are entitled to introduce Security Scanners for airport trials or as a more stringent measure that those provided for by EU legislation.
- The European Parliament, on 23 October 2008, adopted a resolution on the impact of aviation security measures and body scanners on human rights privacy personal dignity and data protection requesting a more in depth assessment of the situation. The Commission agreed to review these matters further and withdrew Security Scanners from its original legislative proposal. The draft regulation became Commission Regulation (EC) No 272/2009 to apply as of 29 April 2009, when the new set of aviation security legislation entered into force.

IV. Official statements about the justification of bodyscanners using ionizing radiation

IV.1 Czech Republic

The State Office for Nuclear Safety received in 2009 it's first request from an airport in the country for the approval of the use of X-ray machine for security control of persons. There was not a clear and strong signal from the side of potential user – airport - that the device is urgently needed for the current security improvement. Considering[8] that:

- *alternative techniques which enable a surface body control of persons and which can identify "suspicious" objects on the body exist;*
- *effective doses range from 0.1 to 10 microSv can be considered as very low but can't be taken for negligible in case of repeated exposures ;*
- *the bodyscan of pregnant woman and children could create stress, fear und misunderstanding, since nobody would be able to explain the very low level of risk, whilst excluding these groups could be not very effective in terms of security;*
- *it would be the first situation when people are deliberately irradiated without medical indication, creating a breach motivating for further introduction of the technique into other practices (stadiums, shopping centres, railway stations, factories, important buildings, etc..)*

The State Office for Nuclear Safety has considered the use of X-ray scanners at airports which represent a source of public exposure as **unjustified** from radiation protection point of view. Licence applications have until now been rejected.

IV. 2 France

Non-medical exposure of the public is not allowed by law in France. The Ministry of environment has however requested 2 technical reports, the first one on millimeter wave technology and the second one on X-ray backscatter technology, to assess risks for human health of those technologies and to formulate recommendations that could be made to passengers if the technology was being implemented.

The Radiation and Nuclear Safety Institute (IRSN) has published the *technical report on X-ray backscatter technology, based on the assessment of Rapiscan® Secure 1000*[9]. It concludes that :

- *The doses delivered by this technology are very low (The dose delivered per inspection is estimated between 0.07µSv and 0.11µSv. The dose delivered to foetus in early pregnancy is estimated to be about 0.05µSv);*
- *The manufacturer did not pay enough attention to the fact that the skin is not the only tissue exposed to I.R. Some low deep organs receive doses at the same order of magnitude (≈ 0.2 µGy);*
- *Control agents in the vicinity of the device could receive maximum doses in the range 0.3 – 1 mSv per year;*
- *The dosimetric impact of this technology is low but the radiation protection principles must apply.*

IRSN recommends that:

1) The justification principle must apply:
    - *this technology may be justified only if the psychosocial and health risk of an attack is considered higher than the risk of developing radiation-induced cancers in the general population and professionals involved;*
    - *Other technologies exist with comparable performance but without recognised impact (« millimeter waves »).*
2) The principle of optimisation is less important:
    - *A significant reduction in individual doses can probably not be expected, but the selection of individuals to be controlled could be optimise.*
    - *The collective dose concept must <u>not</u> be used (very low doses x very large number of individuals).*
3) Potential accident situations have to be taken into account:

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[8] *The use of X-ray for security control – Czech experience, Karla Petrová, Ivanka Zachariášová, State Office for Nuclear Safety, Prague, Czech Republic*

[9] *Available in French on the website www.irsn.fr*

- *the system has very high rates : disturbances or malfunctions may be detected very late in the absence of enough periodic controls;*
- *difficulties in interpreting the images (e.g. poor posture, movement during processing, ...) may lead the control agents to renew the passage of a traveller.*
- *In such situations, a potentially large number of people may be exposed to greater than the nominal dose.*

4) The public has to be well informed. The report gives some recommendations in this field.

IV. 3 Germany

The German Federal Office for Radiation Protection (Bundesamt für Strahlenschutz - BfS) has conducted an evaluation on aspects of radiation protection for whole-body scanners[10].

BfS considers advanced body imaging using X-rays as unjustified and will reject any license request. In addition, BfS considers that scientific knowledge of non-ionising radiation technologies doesn't allow it to make conclusions on health effects. Passive scanners have therefore been favoured since they don't add any artificial radiation to improve the contrast in the picture.

IV.4 Netherlands

The research institute TNO has performed an investigation into any health-related effects of the millimetre-wave security scan. The level of intensity of the security scan is considered to be "more than 6000 times lower than the standard level of intensity that is considered safe by both the Health Council of the Netherlands and according to European regulations in the field of public health."[11]
No statement has been made in relation with bodyscanners using X-rays.

IV.5 Justification of X-Ray Backscatter scanning systems in the United Kingdom

The Justification of Practices Involving Ionising Radiation Regulations 2004 (SI 2004/1769)(Justification Regulations) came into force on 2 August 2004. These regulations are applied to new practices utilising ionising radiation that arose after May 2000. Those practices in use prior to May 2000 are regarded as "existing practices" and are not required to go through the justification process required of new practices, although any important new information on their effectiveness and potential doses may prompt a review of their justification. X-ray backscatter scanning systems to detect concealed items were in use prior to May 2000 and have been considered as an existing practice.

The Department for Transport (DfT) announced in the beginning of 2010 the deployment of security scanners at Heathrow and Manchester Airports, and the intention to roll-out scanners nationally during 2010. An interim code of practice was published at the same time which ensured that the operation of security scanners would be mindful of privacy, health and safety, data protection and equality issues. The publication is based on the results of the risk assessments conducted by the Health Protection Agency, Centre for Radiation, Chemical and Environmental Hazards. This "*assessment of comparative ionising radiation doses from the use of Rapiscan secure 1000 x-ray backscatter security scanner*" was published in February 2010[12].

The agency estimates that the effective dose from one scan from an x-ray backscatter unit (single or double scan) is 0.02 micro Sv or less (worst case scenario). Thus, the total radiation dose from an

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[10] *available (in the German language) on www.bfs.de/de/elektro/papiere/body_scanner.html.*
[11] See : http://english.nctb.nl/Diverse_vragen_en_antwoorden/Security_Scan/index.aspx
[12] *Assessment of comparative ionising radiation doses from the use of rapiscan secure 1000 x-ray backscatter security scanner, Health Protection Agency, Centre for Radiation, Chemical and Environmental Hazards January 2010 - Axel MacDonald, Phil Tattersall, John O'Hagan, Jill Meara, Richard Paynter, Peter Shaw. Published 1. February 2010.*

examination (which might involve 2 or 3 scans) is less than that received from two minutes flying at cruising altitude, or from one hour at ground level.

Considering a dose constraint of 300 micro Sv/year to a member of the public from practices involving the deliberate use of ionising radiation sources, HPA considers that a passenger would need to be examined 5000 times before exceeding this constraint value (based on three scans per examination). It is concluded that the potential doses received from the use of a correctly installed and used x-ray backscatter body scanner are likely to be very low. Even in the case of frequent fliers the doses are unlikely to exceed 20 micro Sv/year.

HPA considers that the radiation doses from backscatter scanners are so low that the traditional radiation risk comparators, for example cancer risk may not provide the best illustration. HPA gives then a range of traditional and other comparators. 6 Rapiscan Secure 1000 x-ray backscatter body scans may have similar fatality risk as :

- 1.4 minutes flying at airline cruising height;
- Travelling 6 miles by commercial jet (ref. Harvard risk list);
- Travelling 0.3 miles by car (ref. Harvard risk list);
- Travelling 1.8 miles by car (ref. ROSPA UK data);

In comparison, average annual background radiation in the UK (effective radiation dose = 2.7 mSv) may represent the fatality risk arising from 16,600 X-Rays backscatter scans.

HPA addressed also the question of pregnancy : "*Whilst there are stages of pregnancy where a fetus is considered to be more susceptible to harm from radiation, the backscatter technology ensures that negligible doses are absorbed into the body (where the fetus is) and the fetal dose is thus much lower than the dose to a pregnant woman. Therefore for this comparison, which due to uncertainties only provides indicative risks, maternal and fetal dose can be considered the same. Similarly, because of the uncertainties at these low levels of exposure the risks to children, people with any type of illness or people undergoing any type of medical treatment are considered to be comparable to the risks to adults. Therefore this risk assessment applies to the whole human population.*"

IV.2 Justification of X-Ray Backscatter scanners in the United States

In 2002, the Health Physics Society published a radiation safety consensus standard, American National Standard Institute (ANSI) N43.17, "Radiation Safety for Personnel screening Systems Using X-rays"[13]. This standard established a limit for the effective dose from one scan of 0.1 μSv, also establishing a limit of no more than 0.25 mSv annual effective dose to an individual from any one security screening venue.

In 2003, the National Council on Radiation Protection and Measurement (NCRP) published its Commentary 16, "Screening of Human for Security Purposes Using Ionizing Radiation Scanning Systems", examining the potential radiation risk associated with security screening. The commentary provided recommendations for two distinct categories : "general use", with should adhere to an effective dose of 0.1 μSv or less per scan[14] and "Limited-use systems", which require effective doses per scan greater greater that 0.1 μSv but less than or equal to 10 μSv.
ANSI standard.

In July 2008 the Interagency Steering Committee on Radiation Standards (ISCORS[15]) developed a guidance document[16] to assist Federal agencies in determining when the use of ionising radiation

[13] *ANSI N.43.17-2002*

[14] *Dose per scan was increased to 0.25 μSv per scan in the revised version of 2009*

[15] *The ISCORS is an interagency body made up of those federal organisations having regulatory authority with respect to radiation protection issues, such as the U.S. Environmental Protection Agency, U.S. Nuclear Regulatory Commission, U.S. Department of Energy, U.S. Department of Defense, U.S. Department of Homeland Security, U.S. Department of Transportation, the Occupational Safety and Health Administration of the U.S. Department of Labour, the U.S. Department of Health and Human Services.*

[16] *http://www.iscors.org/doc/GSSHUIR July 2008.pdf*

for security screening of humans is warranted, based on basic radiation protection principles. The document outlines the process of selection of a security screening technology and justification of its use. The document provides guidelines and information for establishing a radiation safety program, base on the three radiation protection principles. Concerning justification, according to this document :

"the overall benefit must outweigh the risks associated with the chosen security screening method. Prior to conducting security screening of humans, the responsible executive should obtain legal advice and consider the operation, the current threat assessment, physical security, and cultural/social issue, to determine when security screening of humans is justified. An institution should gather sufficient information and data to properly carry out each of the following assessments :

1) define the need
2) evaluate options
3) evaluate privacy concerns
4) assess radiation risks from the technology and the net benefit of implementation
5) evaluate agency's ability to implement the practice.

After due consideration of the findings from the five steps listed above, the agency should document its decision process"

Many statements have more recently been published by federal agencies or scientific societies, after having evaluated backscatter technology.

American College of Radiology (ACR) (statement 8. Jan. 2010)

"*An airline passenger flying cross-country is exposed to more radiation from the flight than from screening by one of these devices. The National Council on Radiation Protection and Measurement (NCRP) has reported that a traveler would need to experience 100 backscatter scans per year to reach what they classify as a Negligible Individual Dose. The American College of Radiology (ACR) agrees with this conclusion. By these measurements, a traveler would require more than 1,000 such scans in a year to reach the effective dose equal to one standard chest x-ray.*" "*The ACR is not aware of any evidence that either of the scanning technologies that the TSA is considering would present significant biological effects for passengers screened.*"

Health Physics Society (HPS)

Use of ionizing radiation for security screening individuals, position statement of the Health Physics Society *(adopted 2003, revised 2009)*[17]

"The Health Physics Society believes that intentionally exposing people to low levels of ionizing radiation for security screening is justified if certain criteria are met. The key considerations are the net benefit to society and keeping individual doses as low as reasonably achievable (ALARA) while achieving the desired objective. Appropriate organizations should develop criteria for determining when the social benefits of public screening outweigh the risks associated with ionizing radiation exposure. The criteria should represent the consensus of professional, consumer, advocacy, labor, and business organizations; academic institutions; government agencies; and the general, public.

The Society's principal recommendations about the practice of security screening individuals by the use of ionizing radiation are:

1. The practice should be limited to those applications that result in an overall net benefit to society.

2. When the practice is used to screen members of the general public, screening systems and their use should conform to the requirements of ANSI/HPS N43.17[18]*. This Standard limits the reference effective dose delivered to the subject to 0.25 microsieverts (25 microrem) per screening. Additionally, a screening facility should not expose any individual to more than 250 microsieverts (25 millirem) reference effective dose in a year.*

3. Subjects should be informed of the radiation exposure."

Transport security administration (US Department of Homeland Security) :

[17] *http://www.hps.org/documents/securityscreening_ps017-1.pdf*

[18] *American National Standards Institute (ANSI) Standard N43.17-2009, "Radiation Safety for Personnel Security Screening Systems Using X-Rays or Gamma Radiation," August 2009.*

"*Backscatter technology was evaluated by the Food and Drug Administration's (FDA) Center for Devices and Radiological Health (CDRH), the National Institute for Science and Technology (NIST), and the Johns Hopkins University Applied Physics Laboratory (APL), and results confirmed that radiation doses are well below those specified by the American National Standards Institute. The amount of radiation from backscatter screening is equivalent to two minutes of flight on an airplane, and the energy projected by millimeter wave technology is 10,000 times less than a cell phone transmission.*"

<u>Food and Drug Administration[19]:</u>
"*FDA Commissioner Margaret Hamburg reassured lawmakers Wednesday that radiation from the new full-body security scanners being installed at U.S. airports is not a cause for concern.*" (Congress Daily 03/10/2010)

<u>National Council on Radiation Protection and Measurements</u> (at the request of the Food and Drug Administration (FDA)
Presidential Report on Radiation Protection Advice: Screening of Humans for Security Purposes Using Ionizing Radiation Scanning Systems[20]

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NCRP (1993) recommended that:
"…whenever the potential exists for exposure of an individual member of the public to exceed 25 percent of the annual effective dose limit as a result of irradiation attributable to a single site, the site operator should ensure that the annual exposure of the maximally exposed individual, from all man-made exposures (excepting that individual's medical exposure), does not exceed 1mSv on a continuous basis. Alternatively, if such an assessment is not conducted, no single source or set of sources under one control should result in an individual being exposed to more than 0.25 mSv annually."
(…)
General-use systems should adhere to an effective dose of 0.1 µSv or less per scan, and can be used mostly without regard to the number of individuals scanned or the number of scans per individual in a year. An effective dose of 0.1 µSv per scan would allow 2,500 scans of an individual annually (i.e., if each scan required 0.1 µSv) without exceeding the administrative control of 0.25 mSv to a member of the general public for a single source or set of sources under one control. Assuming 250 workdays per year, this would correspond to an average of 10 scans each day, a frequency that is unlikely to be encountered. An effective dose of 0.1 µSv (or less) per scan is consistent with the American National Standards Institute (ANSI) standard which recommends that value (or less) per scan for security scanners (ANSI, 2002).
(…)
This report recommends that the annual effective dose limit for public bystanders (i.e., individuals not undergoing scanning) should be the same as that for individual members of the public (i.e., 1 mSv for continuous or frequent exposure from all relevant sources), and should be implemented in the same manner as for individuals undergoing scanning by adhering to the administrative control of 0.25 mSv effective dose (or less) per year for a single source or set of sources at a given venue. This report also recommends that scanning systems be designed and installed in such a way as to allow the same level of control on effective dose for operators as for members of the general public.
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[19] *http://www.nextgov.com/nextgov/ng_20100310_7789.php?oref=rss?zone=NGtoday*
[20] *http://www.fda.gov/ohrms/dockets/ac/03/briefing/3987b1_pres-report.pdf*

Annex 1
Millimetre wave whole body scanner

Among the presented techniques for body scanner for security reasons, the so-called « mm-wave » is one, which falls actually out of the scope of HERCA, since it is not based on ionising radiation.

The basic principle behind the mm-wave technology relies in the use of waves with a frequency (around 30 GHz) between radiofrequency and infrared. For these frequencies, lightweight materials such as clothing fabrics are translucent, thus allowing detection of strange objects on the body of persons. The imaging software allows for high resolution images as well as a sufficient sensitivity to density differences. The imaging software and the operating procedures can easily deal with privacy issues of the persons by blurring part of the image, transferring the anomalies to a 3-D silhouette, etc… Moreover, current systems report not to store the data that is collected.

Concerning health effects, it can be shown that the scanners, as they apply a low energy – low density RF field to the body, that these waves do not penetrate human tissue. Moreover the RF energy deposited on the skin is several orders of magnitudes lower than common RF devices such as a cellular phone.
It is not clear though if these waves have an adverse effect on the skin of the body itself : conclusive reports on this issue are not available yet.

As for efficiency and detection sensitivity, such scanners are capable of detecting any strange object, usually called "anomaly" on the body of the scanned person. The use of such systems require either well trained operators or high performance automated systems, as well as specific training with respect to communication between the persons to be scanned and security officer. A specific procedure to remove all strange objects before entering the body scanner is mandatory to reduce the number of faulty detections.

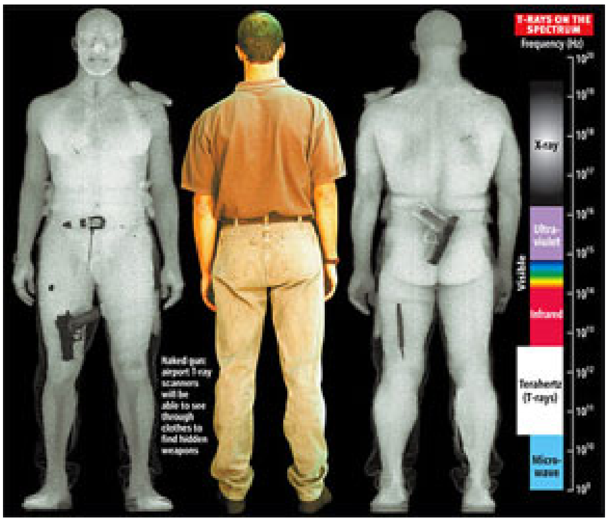
Typical throughput of mm-wave scanners could be about 250 persons per hour. Such scanners are already used throughout many European countries and Easter countries, and this not only in airports but also for assets protection of critical facilities.

With respect to regulation, it has to be noted that in many countries, licenses are mandatory since the device uses radiofrequencies. The range however is quite limited.

Major drawback of the system is that it can only detect objects on the body of a person: it is not capable of detecting items within the body.

Annex 2
Description of backscatter x-ray body imaging equipment.

A number of countries in Europe and elsewhere have trialled or deployed backscatter x-ray technology for aviation security purposes. In Europe, the most widely used type of backscatter scanner is the Rapiscan Secure 1000.



Rapiscan technology

This equipment uses a very low dose of x-rays to see through clothing to produce a greyscale image of the person being scanned for a trained operator to then study. The image viewing operator looks for anomalies which, because their properties are different to that of the body, appear on the screen in a different shade of grey, or an unexpected shape. The image of the body does not generally reveal features such as hair (head or facial), the facial features are not very sharp and as a result it is generally very difficult to identify an individual from their scanned image. Software is available that can blur facial features or intimate body areas, although the latter may not be helpful to the image viewer looking for concealed items and this arrangement would most likely result in a publically known vulnerability of the security procedures.

The backscatter system works by using a narrow x-ray beam that scans a person at high speed from left to right and top to bottom. A detector array collects the backscattered radiation from the person and an image is formed on a computer screen within ten seconds. Most of the radiation detected is scattered from the surface of the skin, which is why the backscatter is effective at imaging objects hidden under clothing only.

Modes of operation include a single scanner where the person being scanned is required to stand in two or more poses or a double scanner which simultaneously scans front and back aspects. The usual set-up for airport security is to have the person viewing the image located in a closed room away from the scanner. This ensures that the image cannot be overseen by other people and the image viewer cannot have sight of the passenger. The Rapiscan Secure 1000 does not currently have a commercially available automatic detection capability.

The image created by the backscatter is generally considered to be clearer and sharper than images created by other scanners, for example those using millimetre wave technology. Some security professionals find that the clearer image makes for quicker and easier interpretation of the image.

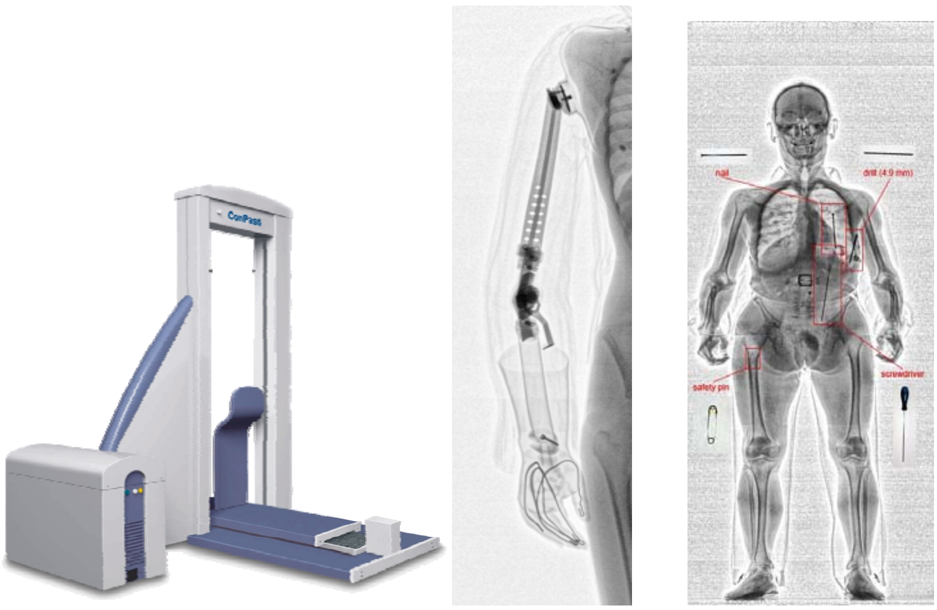
Annex 3
Description of X-ray transmission technology for body scanners

The purpose of X-ray transmission is the direct screening of humans to detect objects hidden within an individual's body or clothing. The system uses a narrow filtered and collimated X-ray beam, by which scans the person vertically from right to left 1700 times. The person to control passes through this beam and a radiographic image generated.

The system uses a potential of 155 kV and 0.6 mA, these conditions have been chosen by the operator for optimum image generation. Usually the reference effective dose per screening is 0.25 μSv. For special objects, for example diamonds, it needs a dose of 6 μSv.

This system is used in Poland in prisons, in the military in Russia and in diamond mines in Africa.

Unlike other body scanners like backscatter X-ray or millimeter wave, this system is also able to detect items inside the body.



Screening exemple (Adani company)

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Working methodology

HERCA Working group 2[21] has received early in 2010 the mandate from HERCA chairman M. Ole Harbitz to report on this item[22]. Chairman and co-chairman of the group first agreed on a questionnaire sent to all members of HERCA. 15 countries have answered to this questionnaire[23]. WG2 has additionally reviewed other reports, among others the *Information Paper* from the Inter-Agency Committee on Radiation Safety (IACRS), "*Relevant Facts Regarding the Use of Ionising Radiation Screening Devices in Airports"* (21/22 April 2010) and the recent *Communication from the commission to the European parliament and the council on the Use of Security Scanners at EU airports*[24] adopted by the European commission on 15th June 2010.

Based on the results of the survey and on these reviews, the working group met in Paris on 26th May. The meeting objectives were:
- to hear from bodyscanner manufacturers;
- to share facts and figures on use of advanced imaging technologies in Europe and in the United States;
- to discuss views, concerns and experience on this topic.

HERCA WG2 has agreed on this information paper, presented to the HERCA Oslo plenary meeting on 30. June 2010, which has initiated the process for adopting a common statement by the Heads of the European Radiological protection Competent Authorities.

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[21] *Following the reorganization of the HERCA working groups, WG2 concentrates on justification and optimization of non-medical activities. The group was entirely renewed since March 2010.*
[22] *Letter from Norwegian Radiation Protection Authority ref. 10/00352/OJH – 3. February 2010.*
[23] *Austria, Belgium, Czech Republic, France, Germany, Greece, Iceland, Ireland, Lithuania, Netherlands, Slovenia, Spain, Sweden, Switzerland, United Kingdom*
[24] *COM(2010) 311/4*