

An Airport-Passenger-Screening System based on Emitted IR and Thermal Radiation

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This paper discussed health issues related to passenger-screening-full-body scan (backscatter-X-ray scan), currently implemented at selected airports in Europe and North America, and propose a safer system. In the full-body scan, X rays penetrate through clothes and Compton scattered to produce an unclothed image (which could be stored, although not stored during test runs) of the person being screened. Modern-image-processing systems can display this image as negative (looking like a body pattern) or positive (depicting the actual shape of face and body). In this process, it sets off millions of electrons on or near the skin. The scientific concerns arise from the fact that Compton scattering of X rays (ionizing radiation), sets of a very large number of scattered electrons. They could disturb fluid-electrolyte balance of the body. Backscatter-X rays, not only, expose passengers, but also, security guards, who have to stand exposed for a whole shift of passengers. Depending on the geometry of the source producing them, they may fall off as inverse square (spherical symmetry) or inverse (cylindrical symmetry). These X rays are stated to be of low intensity and medium energy (the cross section of Compton scattering is maximum at medium energy). The *nature* of damage depends on the energy of the photons interacting with the surface. The *extent* of damage depends on the number of photons (intensity) interacting with the surface. The operational requirements of the process (detection of weapons concealed anywhere on the body surface) demand that private body parts of the image not be blurred using filters, because that would defeat the very purpose of scanning. For this very reason, there is no provision of shielding of gonads in the backscatter-X-ray-screening system, which is a standard safety requirement in the clinical-X-ray procedures. Further, at some stage, the authorities managing the system would like to store the images for follow-up, investigation and evaluation of any security lapses discovered at a later stage as well as research purposes. Hence, the statement that the images are destroyed after processing seems not to be compatible with standard security and surveillance procedures. Presently, data are not available on false positives. However, it seems that these would be almost as many as for security gates, because many things, which are harmless, may look like potential threat on screen (a pen may be mistaken as a pen pistol). It has been pointed out that application of talcum powder on the skin may, also, produce false positives. As regards missed cases, the system would not be able to detect material, which has the same reflective properties as human skin. Also, since it is a surface-analysis technique (like moiré fringe topography and rasterstereography), it would not detect explosives contained inside the body and in the body folds (radiation dose is kept low enough to skim the body surface) as well as other contraband. This type of screening poses highest risk to infants, children, elderly people and pregnant women (the first three have weak immune systems; as for the last group, radiation may inflict permanent damage to the unborn child). An airport-passenger-screening system was proposed based on recording and display of IR (infra-red) and thermal radiation emitted by a prospective traveler. It was stated that this system had the potential to detect explosives and controlled substances hidden in clothes, on the person or inside the body (surgically-implanted bombs), if IR and thermal imaging were combined with advanced signal- and image-processing techniques, canine teams and pat downs. Since there was no radiation, which was *given to* body (only the radiation *given out* by the body was examined), there seemed to be no significant health concern arising from this procedure. Security systems would become more efficient and highly effective if explosive-trace detection was coupled, not only, with passenger-identification systems based on previously proposed (by the speaker) static- and dynamic-3-D-face-recognition systems, gait recognition, biometric identifiers, but also, the study of psychological traits. These might include face reading (people have employed statistical methods to study temperature distribution of face) and checking whether a person was heavily influenced by persuasive individuals or ideologies (using, say, NN graphs).

Keywords: Backscatter-X-ray screening (full-body scan), Compton scattering, infra-red, thermal radiation, explosive-trace detection

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