HUMAN PHYSIOLOGY
AS THE DETERMINING FACTOR IN PROTECTIVE CLOTHING DESIGN

an interview with Prof. Dr. Hein Daanen about fashion, technique and human factors science.

Protective clothing is designed to protect humans against risks like fire, chemicals or blunt impact. Although protective clothing diminishes the effects of external risks, it may hinder people in functioning and may also introduce new (internal) risks. Manufacturers are often not aware of the seriousness of those risks. Prof. Daanen, human movement scientist, postulates that knowledge on human physiology must be part of protective clothing design. After a career in protective clothing research that started about 25 years ago at TNO (NL) he is entitled to say things like that.

Haverenith of Loughborough University where with special techniques sweating of the human body is mapped. With this knowledge you can produce clothing with special properties on different spots of the human body to optimize cooling by evaporation of sweat. This technique is already considered for use in sports clothing by e.g. Adidas, Nike and Decathlon. It will be a good step to convince the manufacturers of protective clothing to adopt similar techniques for optimization of their products. Important is that they consider protective clothing as a system and not as a series of separate items. Hein thinks that this integration of fields of expertise will develop and is leading to better individually adapted protective clothing systems.

At the AMFI Hein is working with a team of researchers on virtual design of clothing and smart garments using a multidisciplinary approach. An important issue to solve is that smart protective clothing has to be in compliance with European legislation. European standards will help the manufacturers to produce certified products. However the present standardisation is not yet prepared to the use of new techniques integrated in textiles, because textiles and electronics make use of different European standards under CEN, CENELEC and ETSI. It is expected that close collaboration between the different European standardisation will soon make an end to this disharmony. If we then also develop functional standards instead of technical standards as it is now we open the door to innovations in protective clothing. The European project 'SmartFire' (www.smartfire.eu) is according to Hein a first good step forward in this process. Especially precommercial procurement (PCP) helps manufacturers to develop innovative products taking into account necessary research and standardisation of the products.

Another problem of the use of electronics mentioned by Hein is washing of the clothing. Electronics are 'allergic' for water and also the mechanical impact on the clothing during washing is a problem for the electronics in textiles. Working on other cleaning techniques may help in solving that problem, but that is a solution on the long-term because you have to replace the washing machines for other cleaning machines.

For the near future Hein foresees that despite the past period of 15 years off experimenting with smart garments in the coming 5 years commercial products will be produced for the market.

THE EFFECTS OF UNDERSHIRTS
ON RELEVANT PSYCHO PHYSIOLOGICAL PARAMETERS DURING EXERCISE, IN A CONTROLLED ENVIRONMENT WHILE WEARING PROTECTIVE GEAR

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In a study carried out by the University of Applied Sciences of Arnhem and Nijmegen (HAN), three different fabric types of undershirts were tested. The research focused on the effects of these shirts had on heat storage in the human body, specifically temperature, moisture sensation and ratings of perceived exertion (RPE Scale, Borg 1982).

The results of this specific test situation, showed no statistically significant effect of underwear on heat storage, temperature and moisture sensation or ratings of perceived exertion (RPE).

Introduction and problem statement
One of the roles of the Knowledge Centre of Hollands-Midden Fire Service, is to identify existing problems within the fire service sector and provide a structured approach to problem solving, in order to support the fire fighters in their jobs. Currently the topic of heat