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Space suit technology protects workers from the effects of high heat

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The technology used in space suits to protect astronauts carrying out space walks in direct sunlight is now being used to develop protective clothing to safeguard firefighters and steel workers who often work in extremely hot and dangerous conditions.

In Europe alone, the inability to shed excess heat and moisture through clothing results each year in over 1500 heatstrokes. These can be fatal unless medical help is at hand.

Even more common, but less serious, are cases of heat stress. This affects an estimated 50 000 workers each year and increases the risk of injury at work due to loss of concentration. Even at a temperature 21° C workers wearing impermeable protective clothing can suffer heat stress when carrying out hard physical work.

Conceived within ESA's Technology Transfer Programme, the Safe&Cool system is developed by a consortium of six small and medium-sized enterprises (SMEs) from Italy, Belgium and Poland in cooperation with Italian Grado Zero Espace and CIOP-PIB, and coordinated by D'Appolonia.

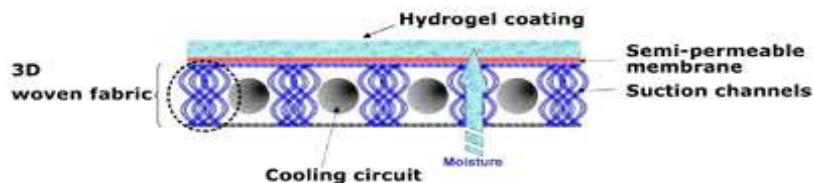
The cooling apparatus used in the project has been developed by Grado Zero Espace and has already been used successfully in clothing for Formula-1 McLaren mechanics and the Spanish Moto-GP rider, Sete Gibernau.



The Safe&Cool system makes use of three special technologies. Firstly a special 3D-textile structure is used in the thermal and moisture management layer. The second technology is the cooling apparatus derived from astronauts' suits. This enables liquid to be circulated through tubing inserted in cavities in the 3D-textile structure, creating 'blood vessels' for heat removal. A

water-binding polymer is the third technology and this will be added either as a coating or in the form of a powder dispersed inside the fabrics.

This polymer will absorb and bind excess moisture migrating through the semi-permeable membrane to maintain the temperature below a threshold controlled by the cooling apparatus. If there is a sudden temperature increase, arising from a burn flashover for example, and the cooling system cannot remove heat fast enough from the body, the polymer will release the liquid accumulated, reproducing the sweating process.



"If used for protective clothing this new material will make the working environment safer and better through reducing the risk of heat stress and heatstrokes for those operating in what can be dangerous and often stressful jobs" said Agnieszka Kurchewska, from the Polish Institute for Labour Protection, National Research Institute (CIOP-PIB).

"Producing protective suits based on the combination of these three technologies will increase the safety of those carrying out tasks in

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dangerous environments," says Pierre Brisson, head of ESA's Technology Transfer and Promotion Office. "This is another good example of how advanced technologies and concepts already developed for space - in this case to protect our astronauts - can provide innovative and advantageous solutions for people on Earth."

