

'Smart' Textiles for Solar Sails?

The European Space agency (ESA) launched its Innovation Triangle Initiative in March 2004. The goal was to speed up the turnaround time from an idea to a product by creating a close collaboration between inventors and developers. Today, 27 space projects have been validated, "**pioneering technology to explore other planets**." One of these projects is focused on smart new textiles, designed to be the basic building blocks of large structures to be deployed in space, such as future solar sails. Read more...

This specific project, completed in about nine months, combined the expertise in elastomers of the **Cavendish Laboratory** of Cambridge University in the UK, and the skills of two European companies, **NTE** in Spain, which already built large structures in space, and **Grado Zero Espace** in Italy for its knowledge of 'intelligent' textiles.

For example, below is a cooling jacket for astronauts who have to deal with high temperatures occurring during sun exposure in open space (Credit: Grado Zero Espace for its parent company, Corpo Nove). This jacket incorporates 50 meters of plastic tubing, each being 2 mm wide.



The company also designs I.O.W. (Intelligent Object to Wear), such as this motorbike jacket with its internal heating mechanism (Credit: Grado Zero Espace for its parent company, Corpo Nove).



Inside the jacket lining is a computerized microprocessor with hard disk (no bigger than a packet of cigarettes) which controls the body temperature over a series of electric heating pads.

Now, it's time to look in details to how 'smart' textiles can help space exploration, with some excerpts of the ESA news release.

In the future, huge 'sails' powered by solar particles could be used to push spacecraft through space, in the same way that sails power yachts through the sea. Solar sails would have to cover an area of at least 10 000 square metres and need ultra-light and extremely large rigid structures of booms to hold them in place, a feat difficult to realise with today's techniques.

The Italian company Grado Zero Space came up with the idea of using an 'intelligent' textile to construct the extremely light and very long deployable booms that would be needed. The textile would be created by combining state-of-the-art materials and technologies such as carbon nanotubes, novel rubber-like materials named 'nematic elastomers' and special three-dimensional warp-knitted textile-based membranes.

Nematic elastomer composites are prepared by spreading carbon nanotubes on to a rubber matrix, with the nanotubes pre-aligned in one preferential direction. Due to this alignment of the fibres, the material's properties are different along this direction. When an external electric field is applied, the nanotubes try to re-orient themselves and cause a change in shape of the whole rubber composite.

Finally, if you have an idea for a product which could be used in space, you still can submit a proposal to **[ESA's Innovation Triangle Initiative](#)** which can provide you with seed money up to 150K euros.

Sources: ESA news release, June 16, 2005; and various web sites

<http://www.primidi.com/2005/06/18.html>