

# Dressing up for space

How do you make space research more attractive for the non-space community and draw more people into this exciting future? One answer is to seek out unlikely collaborations and this is just what the European Space Agency (ESA) did for its 'Couture in Orbit' project in conjunction with the Design School of the Politecnico di Milano, Italy. In this case, students were inspired to produce cutting-edge design work, looking at what space adventurers might wear in the future and how it might be adapted to suit the needs of space-bound tourists.



**Benedetto Quaquaro**  
Technical Director  
of the Politecnico di  
Milano, Italy



**Annalisa Dominoni**  
Scientific Director  
of the Politecnico di  
Milano, Italy

**T**he NewSpace economy is looking for new ways of communicating space. In an age crowded with digital innovation mainly involving the movements of our fingers, the space community must find a new language to entice the public and help explain why space

research and its impact is so important.

Space exploration offers fantastic scenarios of experimentation that can be transformed and reinterpreted by the language of fashion – an area that is far removed from the scientific world and yet has an important role to play by finding new



Barry Macdonald

applications for clothing technologies that can enhance the comfort and performance of people who wear them.

ESA has already addressed this new dynamic with its Couture in Orbit project. To mark the missions of five European astronauts - from Italy, the UK, France, Denmark and Germany - between 2014 and 2016, it organised an innovative event in May 2016 at the London Science Museum involving a fashion school from each of the astronauts' home countries.

Students were invited to participate in this unique event by envisioning and creating everyday fashion for a tomorrow's world, where space travel is common and gravity is not a barrier. Students were also asked to design garments using what they perceive to be future space 'technology'.

It was also an opportunity to look at the role of technology in relation to fashion and how innovation is incorporated in its production processes. The fashion system has an important and strategic role in this area because, on the one hand, costumes are a strong behaviour catalyst able to drive lifestyles, thoughts and beliefs and, on the other hand, it involves innovation, research and technologies which take shape through smart materials and devices that are integrated into garments.

### Common language

The task of the designer in this context is to be a mediator between science and culture, finding a common language that can help the hi-tech research and industrial worlds communicate and collaborate. A 'design vision' might be a key to interpreting the signs of change in our society and translating them into new values and our task at Politecnico di Milano is to empower students with this vision.

It was suggested that ideas should combine aesthetic values with functional aspects involving potential new scenarios in society. With the guidance of ESA astronaut Samantha Cristoforetti, ESA suggested that the focus should also include health and nutrition.

The aim was to find a relationship between life in space and life on Earth, and connect the two environments, considering not only technological spin-offs but also practicality and emotional language.

Students were encouraged to come up with 'off-the-wall' ideas and applications. For instance, could a wearable cooling system be modified to gradually deliver fragrances instead? And could an innovative ESA patent for a 3D antenna be printed directly on textiles with conductive ink? With ideas like this in mind, there follows a

## The space community must find a new language to entice the public with and to help explain why space research and its impact is so important

description of how students sought to create and visualise their designs.

### 23.44° therapy garment (Roberta Fustinoni, Giorgia Presti and Sophie Ward)

The study was inspired by Seasonal Affective Disorder (SAD), a biochemical imbalance affecting mood resulting from the lack of sunlight in the winter months as a result of Earth's axis inclination of 23.44 degrees.

In some respects, this environment mimics living conditions inside the International Space Station (ISS) where artificial light is dominant. The study combined an analysis of problems that occur in space - such as the dimensional changing of the body, and psychological and behaviour alterations due to the confined and controlled environment - to create brain circuitry 'hacking' via wearable scents and interactive body transformation.

The idea of a soothing or stimulating effect on the mind and body was inspired by the cooling technology developed by the ESA Technology

◀ Food Keeper design by Sam Martin-Harper, Ravensbourne, UK.

▼ ESA's Couture in Orbit project concluded with a fashion show at London's Science Museum.





Transfer Programme (TTP) for astronauts' suits. This subsequently generated spin-offs in innovative protective clothing for firefighters, workers in smelting plants, Moto GP drivers and F1 technicians, to keep them cool when the heat is on.

Fifty metres of plastic tubing helped Italian fashion manufacturer Karada, together with the fashion designer Hugo Boss, when they were challenged to produce a thermo-regulating garment, offering fire protection and a comfortable working temperature for the whole team servicing the car. The result was a miniaturised air conditioning system, offering maximum comfort when working under extreme heat.

In the 23.44° project a similar set-up was employed whereby a plastic tubing structure

▼ Below: Based on cooling technology suit design, in this version vapours dissipate naturally on the surface of the garment to support mood changes in the wearer.

▼ Bottom: On the catwalk for ESA's Couture in Orbit project.



Politecnico di Milano



Barry Maedonald

was surrounded by a knitted tube and integrated into garments but, instead of water, as used for traditional cooling technology, fragrances are released in the form of steam.

The substances are in solid form within small tanks and melt with heat allowing vapours to dissipate naturally on the surface of the garments thanks to micro pierces in the plastic tubing. The effect of the substances on the wearer changes according to the goal, whether it is to provide a calming influence, increase attention, or alertness and energy. For example, it is possible to combine pharmaceutical substances with perfume essences such as vanilla, lavender and aniseed for relaxation, or orange and eucalyptus to boost energy and vitality.

## Food Keeper

(Alice Laurentin, Isabel Cristina Martinez)

This collection took inspiration from space food and packaging in microgravity and confined environments where sustenance is often in a freeze-dried and unattractive forms. Astronauts not only have to eat at scheduled times but may have to eat in almost perpetual movement, floating around the ISS unless anchored to a suitable surface.

Eating in a constant state of movement is not limited to space but is often experienced on Earth by people dashing around without adequate time to sit down and eat. The Food Keeper project proposes that garments should incorporate many different types of pocket to carry meals around while on the go.

Each item has a different function determined by various types of pockets with very large compartments; some are designed to conserve food and others to transport water. Cooling technology is another opportunity that can be implemented in this project, as drinking water through a tubing structure is not only functional but also aesthetically pleasing. The design allows for the incorporation of a small tank that can be filled and carried in a very unobtrusive way.

The style of clothing recalled the start of the Space Age in the 1960s by Pierre Cardin and André Courreges, with shapes and volumes of pockets reminiscent of lunar craters and made with padded and lightweight insulating material - Multi Layer Insulation (MLI) film.

This technology, which involves layers of aluminised mylar, is used for various applications in spacecraft thermal control. Here it is used to contain, transport and store food in the best state

possible while moving across the city. A principal goal of this project was to help young people regain the pleasure of eating food.

### Tourist in space

(di Agostina Issolio, Aleksandra Obradovic and Barbara Lopes de Oliveira)

This drew inspiration from the need to carry payloads and equipment on board orbiting space stations that have the least weight and volume and can be used and stored in a simple and fast way by the crew.

The project looked at satellites and their solar panel deployments, and combined Origami techniques to create a foldable clothing system. The system should be capable of changing shape and function according to different activities, behaviours and environments, while being efficient and easy to carry and store in a small space, whether that person is travelling for business or pleasure.

A zip system allows for the transformation of the garment, which also doubles as a sleeping bag, and is integrated with an internal layer of MLI which acts as a thermoregulation system..

The possibility to have a 'localisation system' printed on textile with conductive ink that works as an antenna, was another inspiration behind this project. The Optimized Antenna Elements Position and Dimensions patent by ESA is used in conjunction with antenna design. In addition to shaping a strong and recognisable graphic pattern, this solution allows the localisation, transmission and reception of signals when travelling.

### New developments

The extraordinary results presented in London have since generated over 100 million media feedback responses and this inspired us, along with ESA, to create a specific Higher Education Course called 'Fashion in Orbit' at Poli.Design (a consortium of the Politecnico di Milano). It is intended for those who want to develop innovative products in fashion and design who are inspired by space and technology research to find new applications and spin-offs for materials and textiles.

Such innovations will be of interest to the private sector too, as the NewSpace economy takes hold. While fashion in orbit may be perceived as an extreme example, it is reassuring to know that in some way something like this can aid the future of space exploration. ■

## The aim was to find a relationship between life in space and life on Earth connecting the two environments

### About the authors

**Prof Benedetto Quaquaro** is Technical Director of the Politecnico di Milano, Italy. A designer and curator of exhibitions in the fields of art and technology, he works closely with Annalisa Dominoni on projects for ESA to expand the potential of space research in the fields of fashion, products, services and communication.

**Prof Annalisa Dominoni** is Scientific Director of the Politecnico di Milano, Italy. Her activities are focussed on teaching, design and research on space and extreme environments to facilitate human missions in microgravity, and create new opportunities and spin-offs for space technology in the private sector. She is the Principal Investigator of the VEST (Marco Polo mission) and GOAL (Eneide mission) on the ISS.

▼ Food Keeper design by students from the Politecnico di Milano.

