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## ***WATER RECYCLING SYSTEMS***

## ***FOR THE ANTARCTIC CONCORDIA STATION***



Water is a crucial issue in space as well as on Earth. For many years the European Space Agency has been driving R&D all over Europe in order to develop innovative and original systems for water and waste recycling. Systems based on physical-chemical processes are already in service on board the International Space Station; others like 'MELISSA' (Micro-Ecological Life Support Alternative) are based on microbial degradation and will be used during long-term spaceflight, such as a planetary mission to Mars.

With the help of ESA's Technology Transfer Programme, some of these water recycling methods will be implemented in the Concordia station.

### Aurora Programme

The objective of the Aurora Programme is first to formulate and then to implement a European long-term plan for the robotic and human exploration of Solar System bodies holding promise for traces of life.

The Programme will also provide for the missions and technology necessary to complement those planned in the existing ESA and national programmes, in order to bring about a coherent European framework for exploration and to progressively develop a unified European approach.

### The Concordia Station

Concordia is a new scientific base in Antarctica built cooperatively by the French Polar Institute (Institut Polaire Français - Paul Emile Victor IPEV) and the Italian Antarctic Programme (Programma Nazionale di Ricerche in Antartide, PNRA).

Located on the Antarctic high plateau, the Concordia Station provides a unique environment for research in glaciology, astronomy, atmospheric sciences, earth sciences and remote sensing, as well as biology and medicine.



### Synergies with Space Exploration

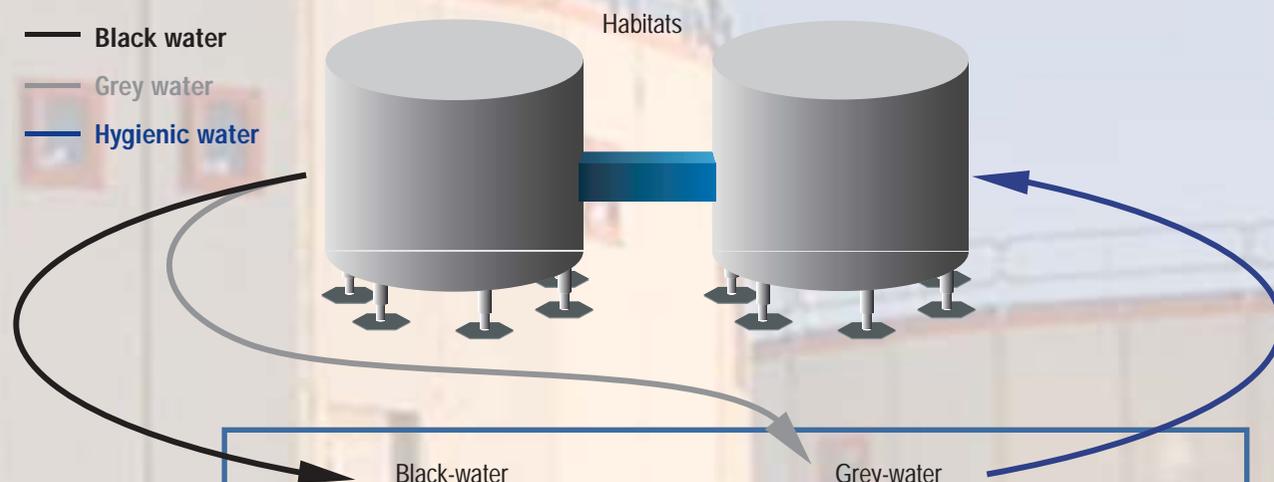
As one of the most isolated places on Earth, the Concordia Station constitutes an excellent environment in which to replicate many aspects of a space mission to Mars. In particular, studies can be conducted on the physiological and psychological problems that may arise under the extreme conditions of isolation and confinement encountered during a space journey that may last six months or more. The outcomes of such studies will contribute to the definition of a future crewed mission to Mars within ESA's 'Aurora' space exploration programme.



ESA is therefore cooperating with IPEV and PNRA on several of the scientific and technological aspects of Concordia. More information can be found at: [www.esa.int/aurora](http://www.esa.int/aurora)



# The ESA Solution at a Glance



## The Goal

The Antarctic environment is protected by International Treaties and all waste materials must be removed from the Continent. Whilst highly commendable as an overall goal, this can lead to considerable logistical efforts. For the Concordia Station, it means that the waste materials produced have to be appropriately treated, and waste waters in particular are a major concern.

## The Constraints

- Up to 70 people in residence at certain times.
- Water usage of 26 litres/person/day.
- Temperatures of -30 to -60°C.
- Total isolation in winter.

## WATER RECYCLING

## The Solution

In order to cope with the life-support needs and isolation constraints during long-duration space missions, ESA has developed advanced methods for recycling :

- 'Black' water: waste water with high organic-waste content (urine, faeces) and
- 'Grey' water: water from showers, washing, etc.

which will be re-used at Concordia.

### Biological Process



Based on microbial degradation.

Inlet : black water  
 Outlet : grey water  
 Recycling efficiency : > 60%

### Physical-Chemical Process



Based on advanced membrane technologies of ultra-filtration and reverse osmosis.

Inlet : grey water  
 Outlet : hygienic water  
 Recycling efficiency : > 95%

**This combination of space-related treatments yields water that meets the hygiene and safety standards for potable water. For more information, visit: [www.estec.esa.nl/ecls/](http://www.estec.esa.nl/ecls/)**



### **ESA Partners**

- Epas (Belgium)
- Polymem (France)
- Technomembranes (France)
- University of Clermont Ferrand (France)
- Vito (Belgium).

## **Benefits for our daily lives: the ESA Technology Transfer Programme**

Over the past 35 years, the European space industry has gained considerable expertise in building, launching, controlling and communicating with satellites. From this long experience of how to overcome the hazards and problems created by such a hostile environment, many valuable new technologies, products and procedures have been developed. Today, this expertise is improving our daily lives by providing many innovative solutions for products and services on Earth.

Groundbreaking European space technologies are becoming increasingly more available for development and licensing to the non-space industry through the process of technology transfer. The ESA Technology Transfer Programme has already achieved over 120 successful transfers or spin-offs from space to non-space sectors.

## **WATER RECYCLING**

### **Other Potential Applications**

- Aircraft
- Boats
- Isolated habitats (mountains, islands, ...)
- Sustainable development of certain countries
- Other isolated and harsh environments

This success is reflected by the fact that since 1991 technology transfer has generated more than 20 million Euros in turnover for European space companies and 120 million Euros for the non-space industries involved. Already 2,500 jobs and 12 new companies have been created.

The ESA Technology Transfer Programme is carried out by a network of technology brokers across Europe and Canada. Their job is to identify technologies with potential for non-space applications on one side, and on the other side to detect the non-space technology needs. Subsequently, they market the technology and provide assistance in the transfer process.



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**Concordia Station:**

<http://www.concordiastation.org>

**Aurora Programme:**

<http://www.esa.int/aurora>

**Technology Transfer Programme:**

<http://www.esa.int/ttp>

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