

ESA's Human Research Office activities

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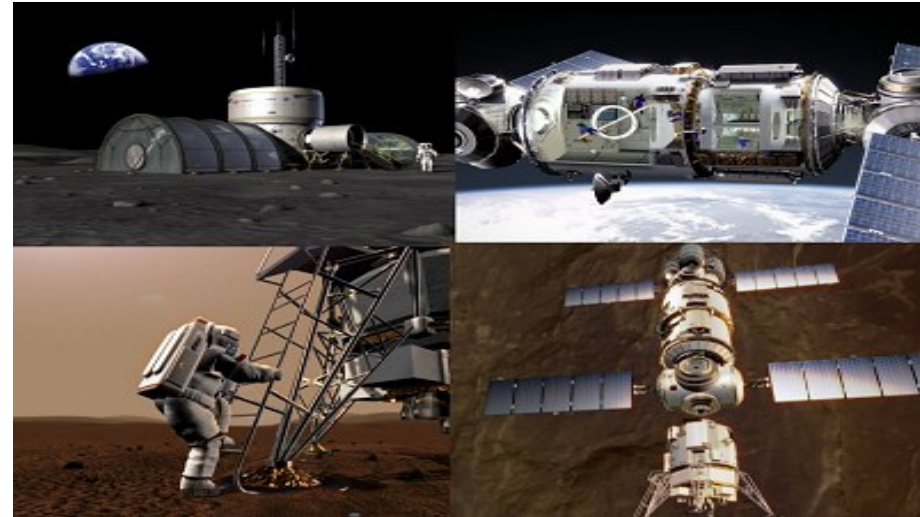


HUMAN RESEARCH AND EXPLORATION



Scientific support to the preparation of human space exploration is to a large extent be related to maintain crew health and performance and includes areas such as:

- understand how μG affects the human body
- physiological countermeasures
- biological effects of radiation
- psychological function
- life support systems
- nutrition
- autonomous medical care



INTERNATIONAL SPACE STATION



- First exploration and permanently **manned outpost** in space
- A successful **international** partnership and **close cooperation** between the United States, Russia, Canada, Japan and ESA, which represents 10 participating States



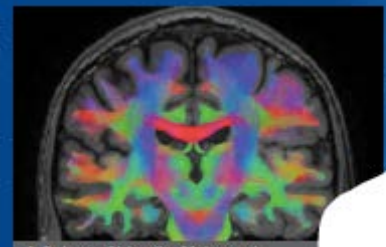
- A laboratory for unique research: more than **196** people have visited the complex, and more than **600** different research and technology development experiments have been conducted on-board the Station
- A platform to carry out **Exploration preparatory activities**, assess impact on astronauts of extended exploration missions, validate enabling technologies (habitat, radiation protection, life support, waste management and recycling, energy management)

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Human Research activities on-board the ISS

Ageing
Cardiovascular
Immunology
Muscle and bone
Neurophysiology
Nutrition
Respiratory system
Thermoregulation



↑ Brain scan (University of Antwerpen)



↑ Testing GRIP prototype on weightless parabolic flight



↑ Space food for the Energy experiment



↑ ESA astronaut Alexander Gerst with a thermometer on his forehead to measure his temperature continuously (ESA/NASA)

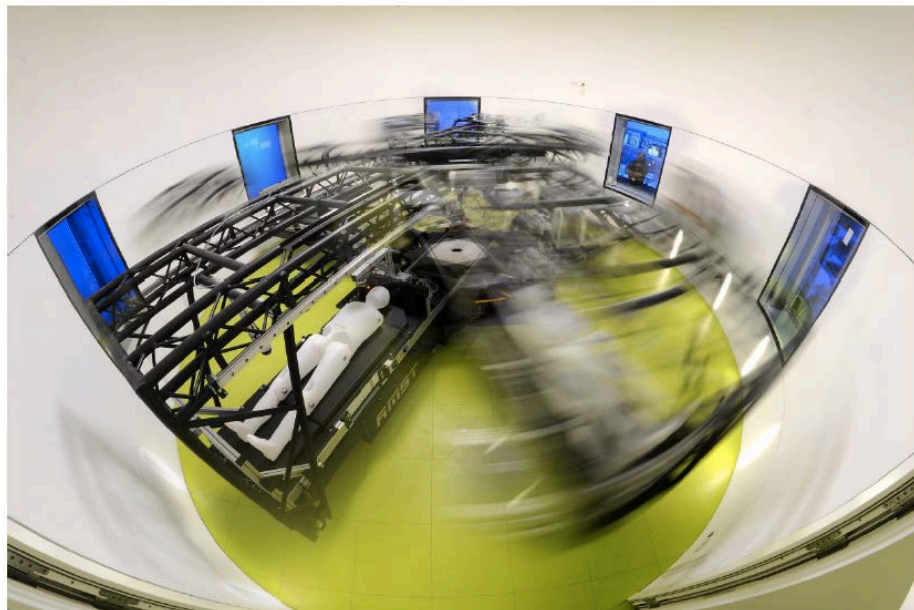
BEDREST STUDIES

What are bedrest studies?

Bedrest studies involve putting normal subjects in bed with their heads down at six degrees below horizontal for five to 60 days. During this time the participants are asked to perform all normal daily activities while staying in that position 24 hours a day. Scientific experiments are conducted on the volunteers almost every day so investigators can study the physiological adaptation of the body to this new postural condition. Bedrest studies allow scientists to evaluate countermeasure effectiveness.



BEDREST STUDIES

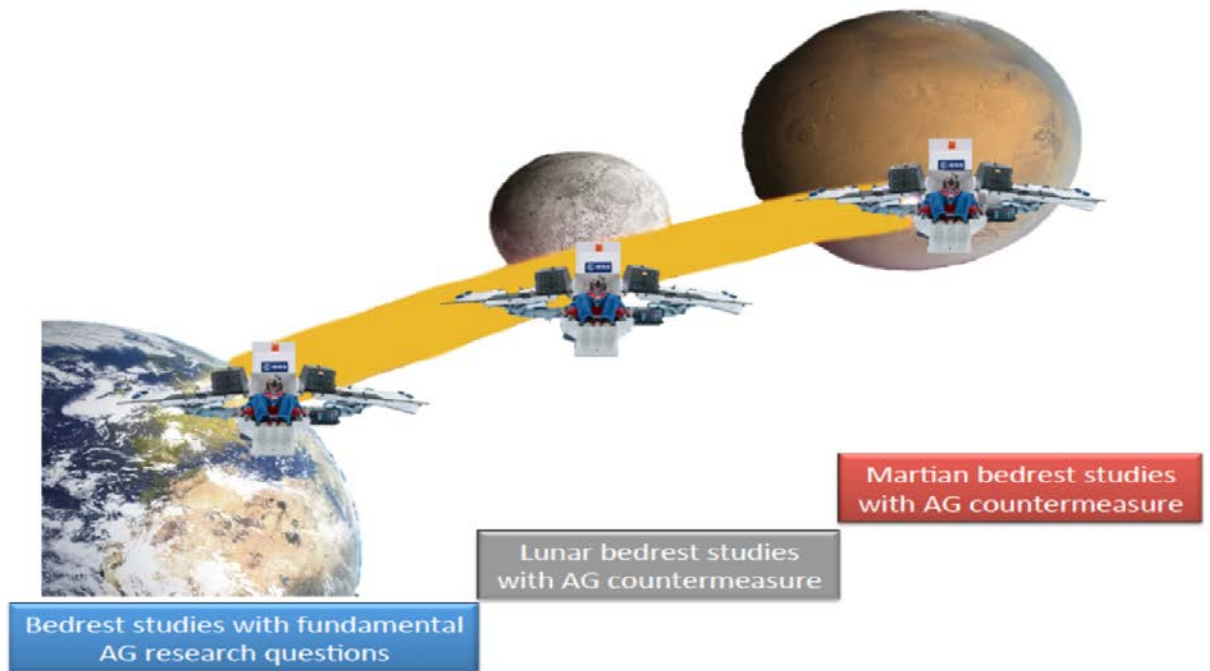


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BEDREST RESEARCH

ESA'S MULTI-YEAR BEDREST PROGRAMME PLAN



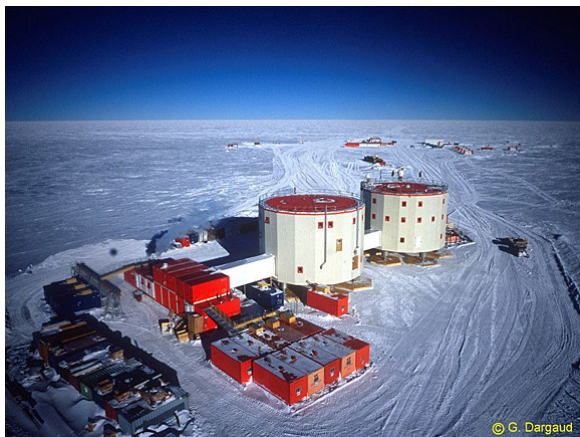
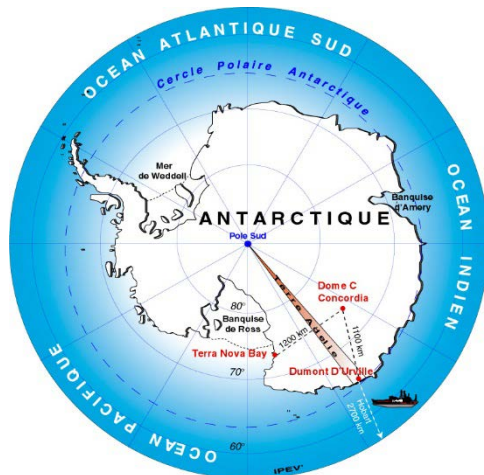
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ISOLATION AND CONFINEMENT RESEARCH

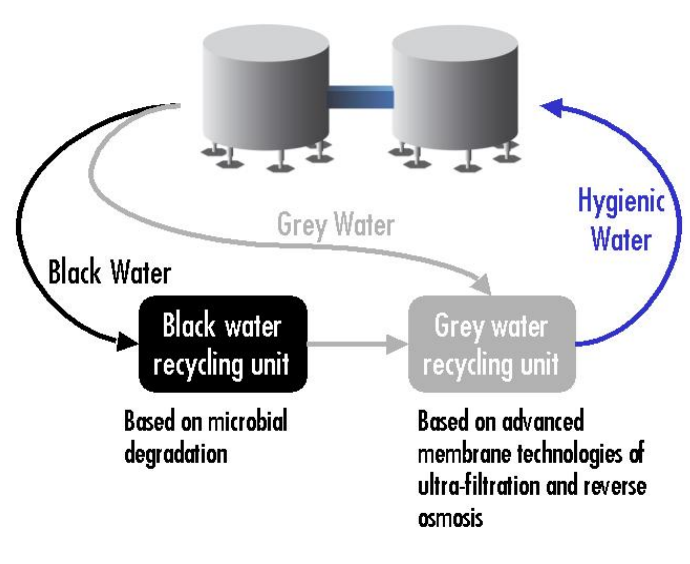
CONCORDIA STATION

- naturally hostile environment
- altitude 3200 m (equiv. to 3800 m at eq)
→ hypobaric, hypoxic conditions
- temperatures: summer average -30° , winter average -60°
- maximum 16 crewmembers
- access period: November- February



Water recycling

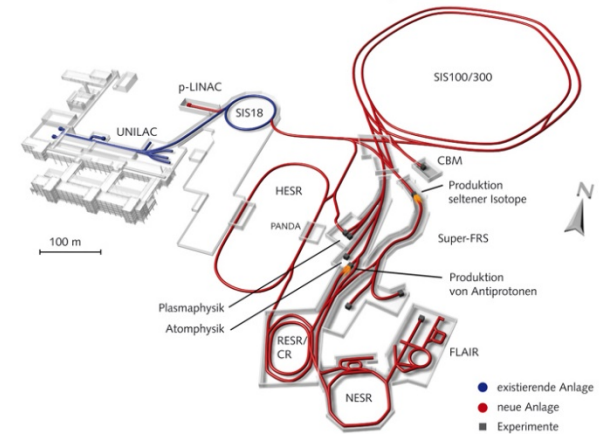
- Grey water recycling concept developed for spacecraft life support systems
- Breadboard achieved >95% recycling at hygiene water quality, with minor modifications drinking water quality possible
- Semi-manual unit adapted for Concordia and in operation since March 2005
- 75-80% recycling achieved, which is in line with IPEV/PNRA expectations
- Based on 4 stage process, Ultra-, Nano- Filtration and 2x Reverse Osmosis
- Will be complemented by a black water treatment unit, based on biological processes



RADIATION RESEARCH



IBER: Investigations into Biological Effects of Radiation



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RADIATION RESEARCH



CORA IBER:

Continuously Open Research Announcement for Investigations into Biological Effects of Radiation

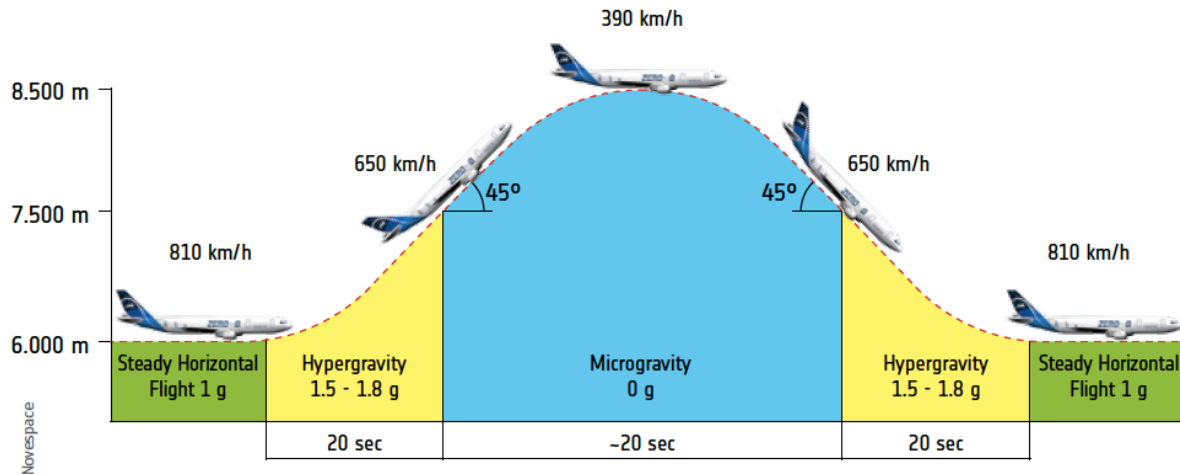
Facility	Energies
GANIL Caen / France	All ions from C to U are available
AGOR KVI-CART Groningen / Netherlands	Protons (190 MeV) ³ He (120 MeV/u) ⁴ He, ¹² C, ¹⁶ O (90 MeV/u) ²⁰ Ne (75 MeV/u)
HIT Heidelberg / Germany	¹² C: 80-430 MeV/u ¹⁶ O: 103-430 MeV/u ⁴ He: 50-220 MeV/u Prot.: 50-220 MeV/u
UPTD Dresden / Germany	70 - 230 MeV
Trento Proton Therapy Center - TIFPA Trento / Italy	70 - 228 MeV

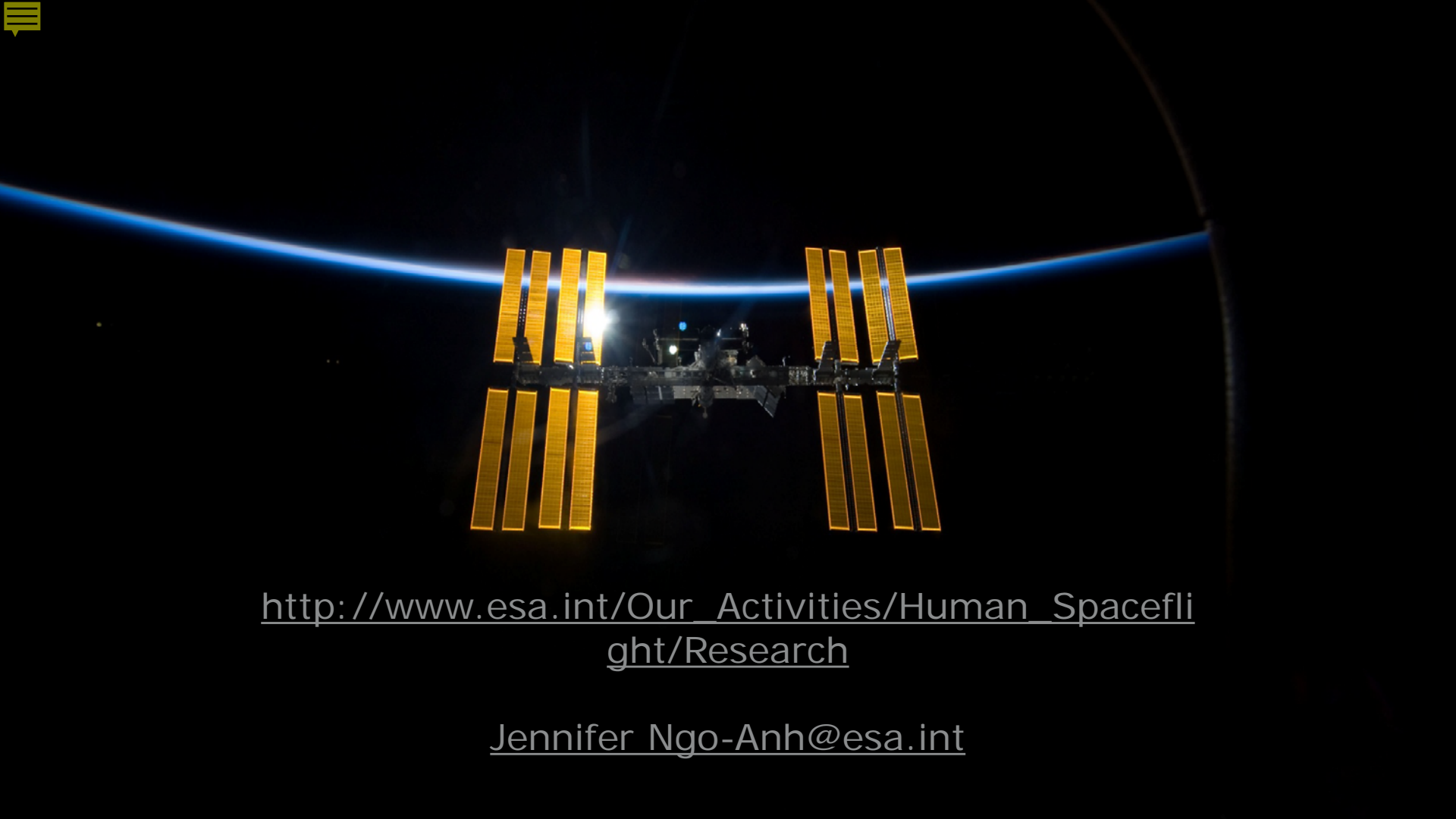
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PARABOLIC FLIGHT CAMPAIGNS

- Airbus A300
- 2-3 ESA campaigns per year
- Typically three flights during a campaign with around 31 parabolas being executed per flight.
- flexible research approach, i.e. use of typical laboratory-type instrumentation with possibility of direct intervention / modification by the research team during flight





http://www.esa.int/Our_Activities/Human_Spaceflight/Research

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