

MEDES

Institute for space physiology and medicine

Explore and innovate for health

MELISSA conference

November 2022



MEDES – Institute for space physiology and medicine



- A hybrid organization for **SPACE** and **HEALTH**
- A multidisciplinary team with various health professionals & IT and biomedical engineers
- Economic Group of Interest
Main members: CNES et Toulouse Univ. Hospital

Missions :

- ▶ Provide **expertise & operational support** in the field of **space physiology and medicine** for human spaceflight & for R&D in space
- ▶ Support **clinical research**
- ▶ Promote **innovations** for space and health

3 TYPES OF ACTIVITIES



Space exploration



Clinical research



Innovations / applications





1. Space exploration

*Maintain crew health
And innovate for health thanks to space environment*



Medical and biomedical expertise for spaceflights and research in microgravity

- For operational space medicine – Crew health management

Support for CNES / ESA-EAC

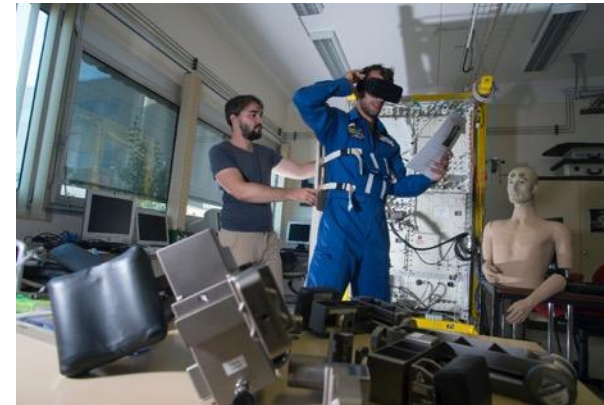
- Support for astronaut medical selections
- Medical follow-up of astronauts
- Contribution to ESA medical board
- Astronaut training



- For scientific or industrial research in microgravity – for innovative space biomedical programs

Support for CNES / CADMOS – Support for space agencies or companies

- Support the design phase of new experiments
- Operational support for scientific experiments and technological evaluations under microgravity in the field of life sciences (ISS, parabolic flights...)

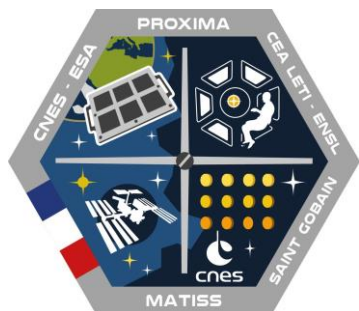


Examples: AQUAPAD & MATISS projects

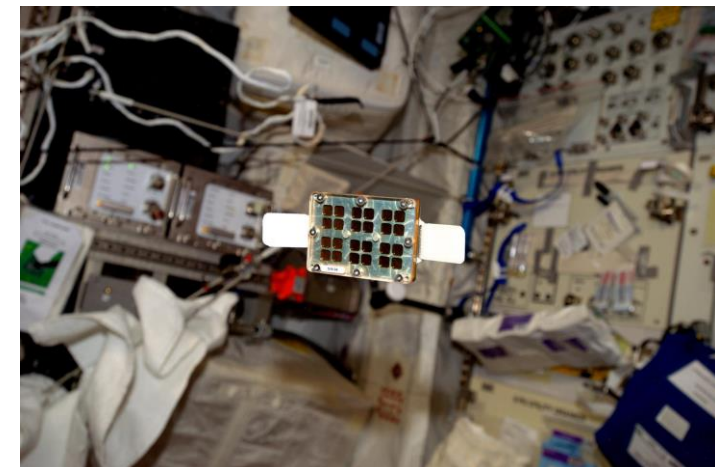
French projects (CNES) developed during Proxima space mission (2017) for ESA with MEDES support



- The Aquapad device aims to test a new way of analyzing water with an innovative diagnostic tool. Just as effective as the current system, it brings more speed and simplicity of use.
Partners: CNES, MEDES, Biomérieux



- Matiss device aims to test new intelligent surfaces in microgravity. These surfaces react to the approach of bacteria by preventing them from settling, proliferating and creating the biofilms that protect them in a hostile environment
Partners: CNES, ENS Lyon, CEA



A photograph of a man lying in a hyperbaric oxygen chamber. The chamber is a clear, dome-shaped enclosure. The man is lying down, looking upwards. A large, clear, flexible tube is connected to the chamber. A white medical device is also visible inside the chamber. The background is dark and out of focus.

2. Medical and clinical research

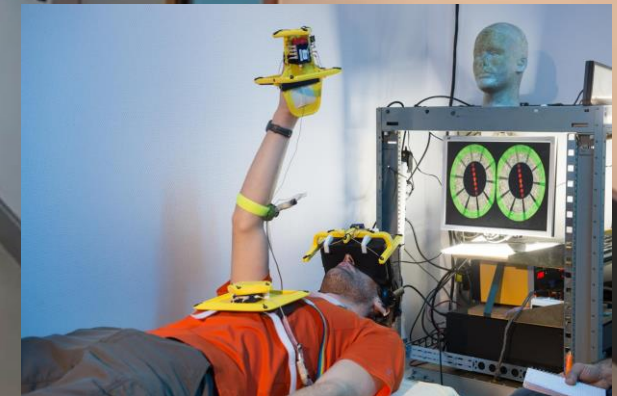
Clinical research for space and for medical applications

THE SPACE CLINIC

- Clinical research center with 30 years of expertise and advanced technologies at the crossroads between health and space
- Direct access to Toulouse University Hospital
- For space or for medical / industrial research
 - **For space:**
 - Clinical simulation studies – bed rest / Dry immersion
 - Evaluation of equipment / Countermeasures
 - **For medical / Industrial research**
 - Medical research / Evaluation of equipment / Pharma / Nutrition

• Specific equipment

- Lab for biological sampling
- Dexa
- XTremeCT scanner
- Dry immersion baths
- Tilt Table
- New Short Arm Centrifuge
- LBNP (Lower body negative pressure)
- VO2Max



2 models of weightlessness simulation



Bed Rest Model

Dry Immersion Model



Dry immersion model: VIVALDI study

Dry immersion studies for ESA (CNES promoter) with 5 days of immersion (4 days of baseline data collection and 3 days of recovery)

VIVALDI I



- In autumn 2021 on an exclusively female panel: a first in Europe
- 18 female volunteers
- Objective:
 - To support the feminization of crews
 - To fill in the lack of scientific data on women
 - To compare with data on men
 - To validate the dry immersion model for women

VIVALDI II



- In autumn 2022 on a male panel
- 20 male volunteers
- Objective:
 - To add new data on dry immersion model on men
 - To compare with data on women



Bed rest model

- MEDES carried out more than 25 bed rest studies (short, mid et long term)
- Evaluation of the effectiveness of physiological, nutritional, drug and artificial gravity countermeasures
- 3 last long term bed rest studies :
 - LTBR Study
 - Wise Study
 - Cocktail Study
- Next study: For ESA / CNES
 - Spring 2022
 - 24 men
 - Countermeasure: centrifugation with ergometer bike



Example: Bed rest Cocktail

- Funding: CNES and ESA
- 16 teams of researchers involved (cardiovascular system, metabolism, muscle, bone, immunology...)
- 20 volunteers
- A multidisciplinary team: 40 MEDES staff involved (nurses, doctors, nutritionists...)
- Main objectives:
 - Study the effects of microgravity (simulated by 60 days of bed rest) for the body
 - Study the effects of a cocktail of natural antioxidants comprising vitamin E and coupled with omega-3 in order to help to prevent and / or reduce the deleterious effects of microgravity
- Duration:
 - 15 days before (pre test)
 - 60 days of bed rest
 - 15 days after (post tests and re-adaptation)



The background image features a hand holding a glowing, translucent DNA double helix structure. The scene is set in a laboratory with various glassware, including test tubes and beakers, some containing liquids. Overlaid on the image are futuristic digital elements: a circular interface with a grid of points and lines, a glowing DNA helix, a brain icon, and a pulse line icon. The overall color palette is dominated by light blues and oranges, creating a high-tech, scientific atmosphere.

3. Innovation & applications for health

Space to innovate for health



Innovate for health
While answering to the challenges
of space exploration
Thanks to the unique features of
space environment



By developing / integrating
new uses of data, services, expertise or
technologies from the space field

Space and health

Common fields of innovation

*eHealth
Connected Health*



*5P Medicine,
Medical devices, AI*



*Environment & health
Health early warning systems*



*Biotechnology
Biomanufacturing*



Bridge the gap between space providers and the health market - Connect by Cnes

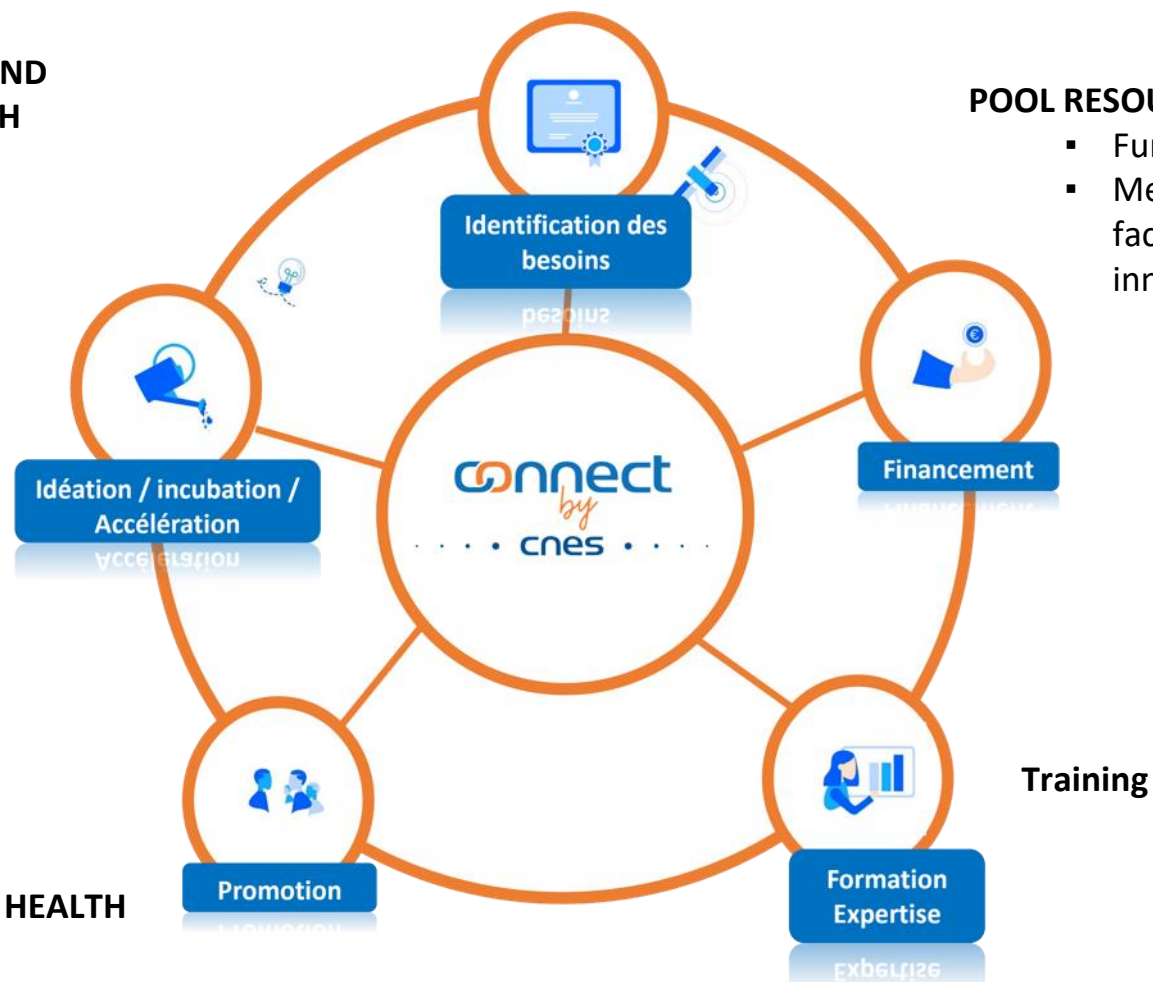
IDENTIFY THE NEEDS AND TRENDS OF THE HEALTH ECOSYSTEM

SUPPORT THE EMERGENCE OF NEW PRODUCTS

PROMOTE SYNERGIES BETWEEN SPACE AND HEALTH

POOL RESOURCES TO SUPPORT INNOVATIONS

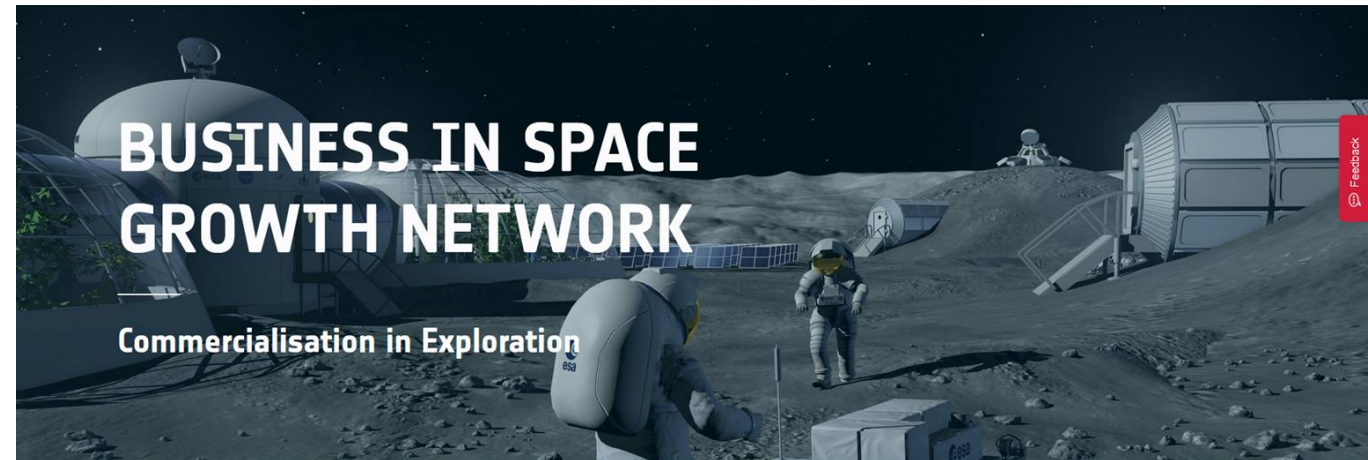
- Funding sources
- Means / resources / expertise / facilities from the space or health innovation ecosystem



BSGN ESA Program



- The Business in Space Growth Network (BSGN) creates an ecosystem for commercial services and products to thrive across Space and Earth.
- Microgravity can help combat disease and improve global health.
- Life Sciences Biotech & Pharma accelerator can give you the opportunity to use of the world's most unique laboratory to improve drug discovery, design, development and manufacturing.
- To have the opportunity to use microgravity for R&D, a dedicated **call for proposals** is open: <https://opencall.bsgn-lifescience.space/>
Until 10th November !





Institute for Space Medicine and Physiology
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