The :envihab -

Linking Biomedical Research and Technological Innovation for Astronauts Health

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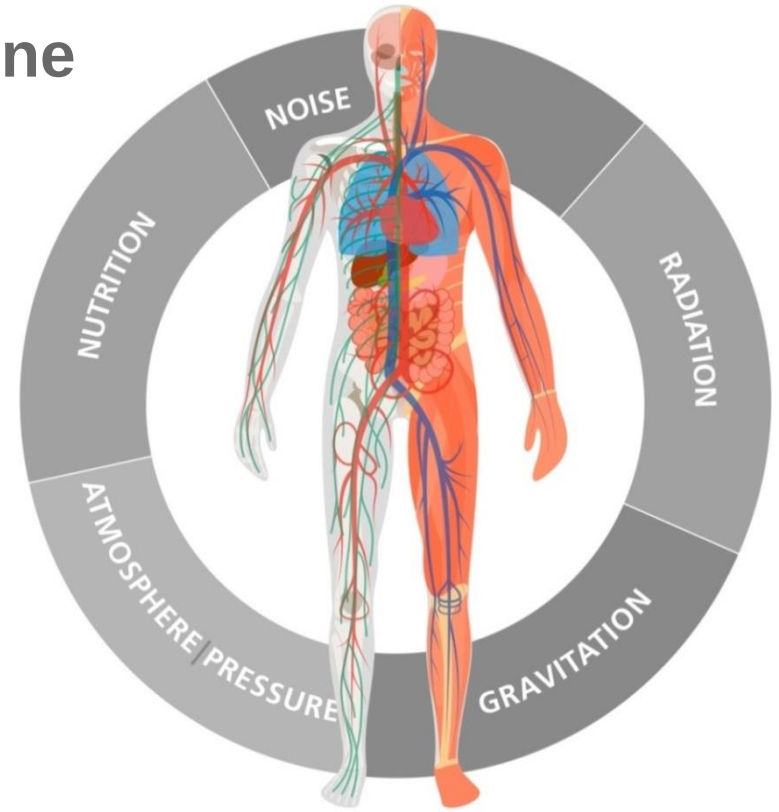
:envihab – Part of DLR´s Institute of Aerospace Medicine



- Space Life Science - Improving Health Span in Space and on Earth
  - Investigating environmental Influences on Human Health
  - Focused on Nervous system and behavior, Musculoskeletal system, Metabolism, Cardiovascular system

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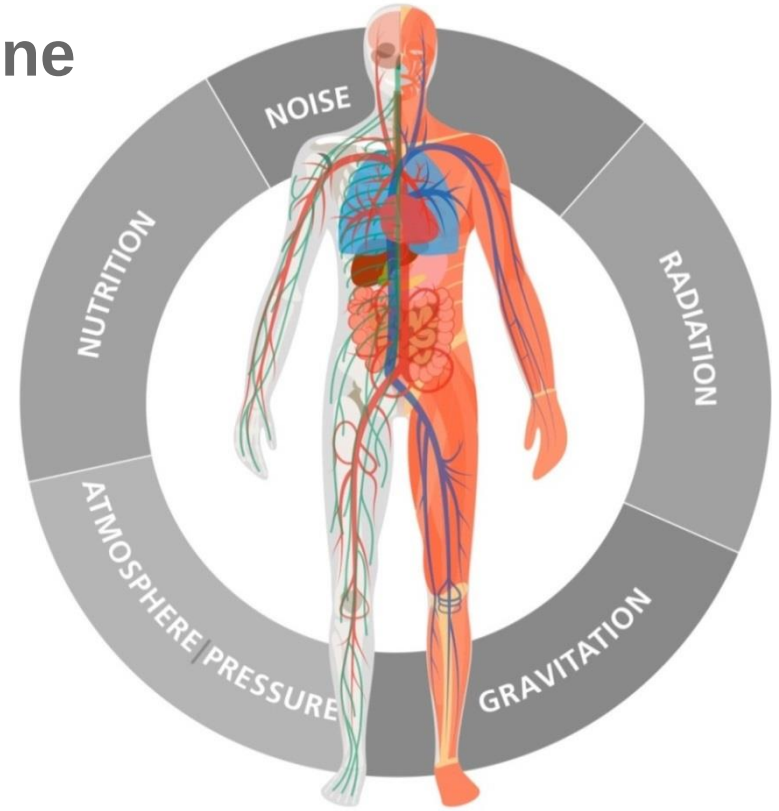
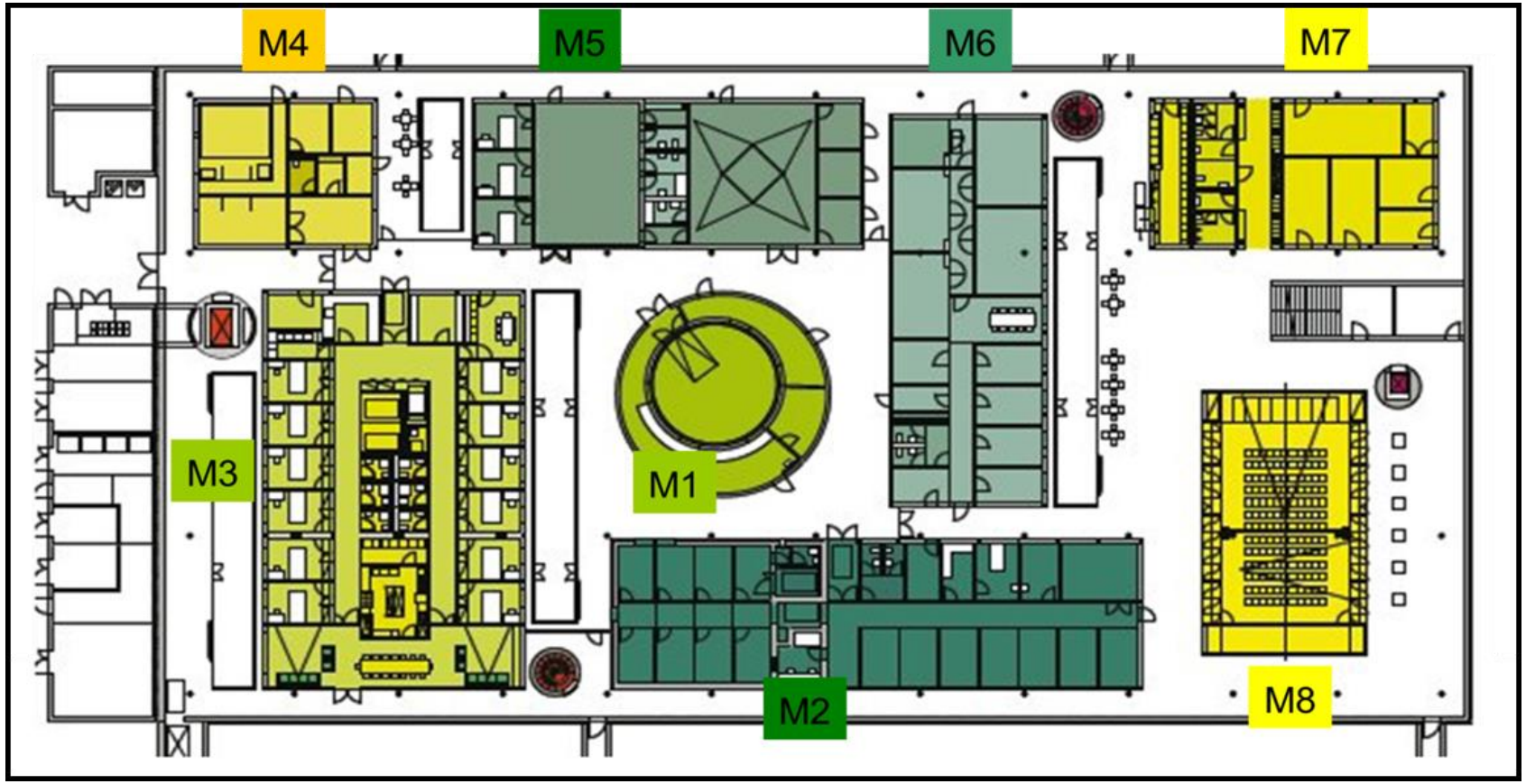


- Space Life Science - Improving Health Span in Space and on Earth
  - Investigating environmental Influences on Human Health
  - Focused on Nervous system and behavior, Musculoskeletal system, Metabolism, Cardiovascular system
- Strong partner in cooperative research projects:
  - Cutting-edge methods and technologies (Short Arm Human Centrifuge e.g.)
  - Unique scientific expertise (Bed Rest Studies; Sleep and Performance Studies; Astronauts health etc.)
- Integrated ground based program with simulation and experiments

:envihab – Unique Medical Research Facility

- :envihab (from the words ‘Environment’ and ‘Habitat’)
- operated by the Institute for Aerospace Medicine at the German Space Center since 2013
- State of the Art Space Analog (https://www.nasa.gov/analogs/):
  - play a significant role in problem solving for spaceflight research
  - Countermeasures can be tested in analogs before implementing them in space
  - Ground-based analog studies are completed more quickly and less expensively
- Modeling environmental health influences with different models (e.g. Deconditioning; Hypoxia; Noise)

:envihab – Modular Construction



M1 Short-Arm Human Centrifuge
M2 Physiology Lab and Baro Lab
M3 Living- and Simulation Area
M4 PET-MRI
M5 Psychology Lab
M6 Biology Lab
M7 Infrastructure
M8 Forum

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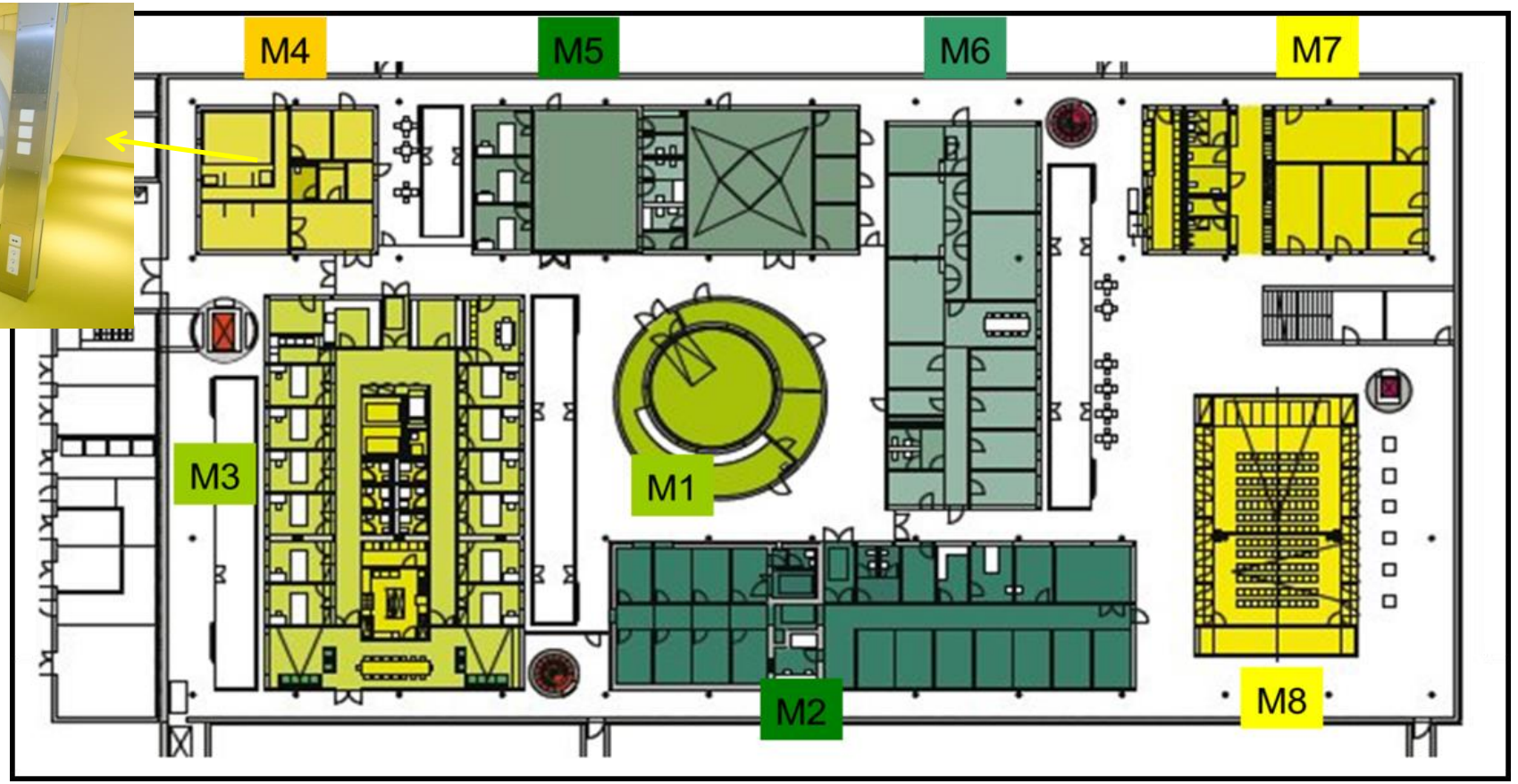

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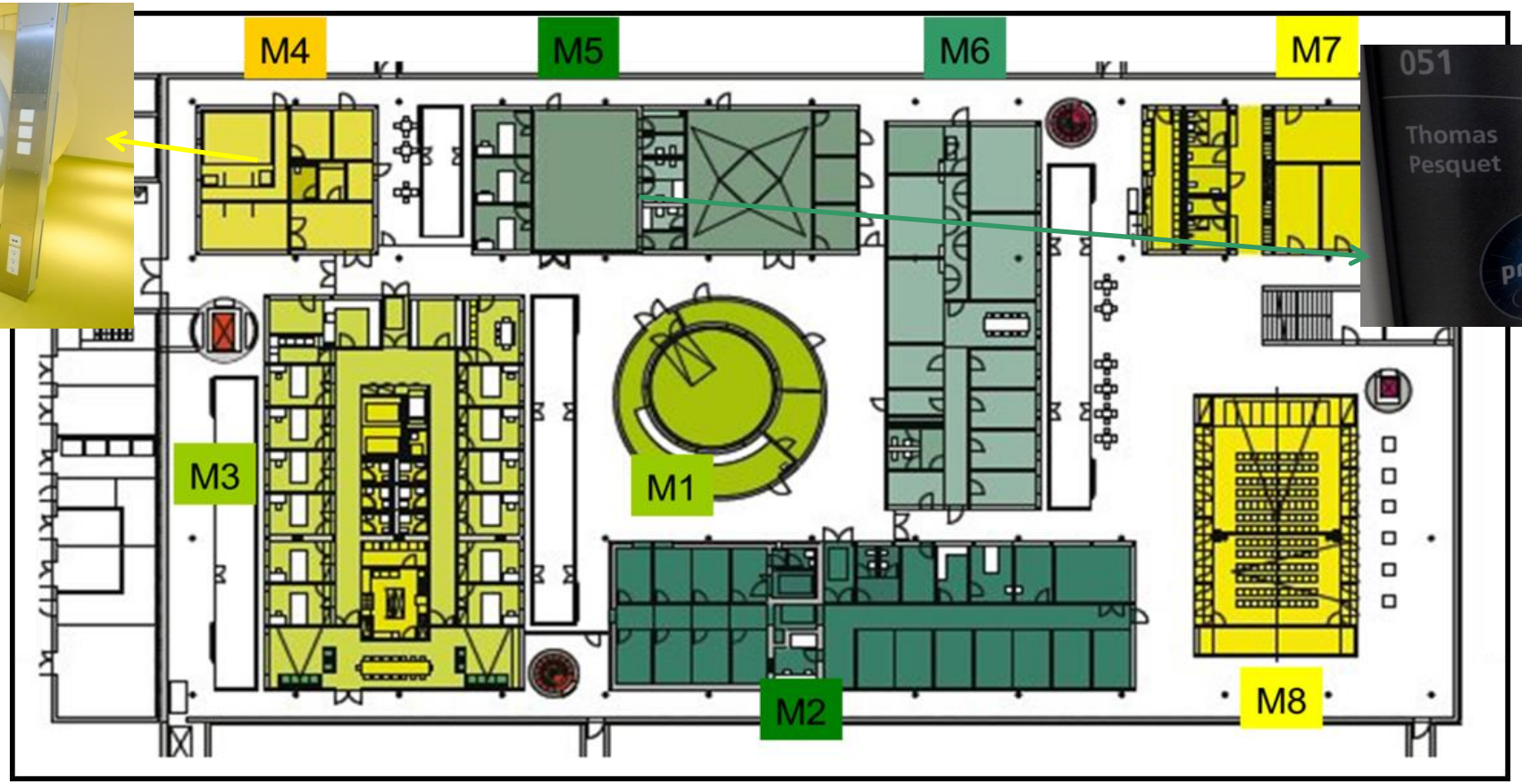
PET-MRI (M4)



Psychology Lab (M5)

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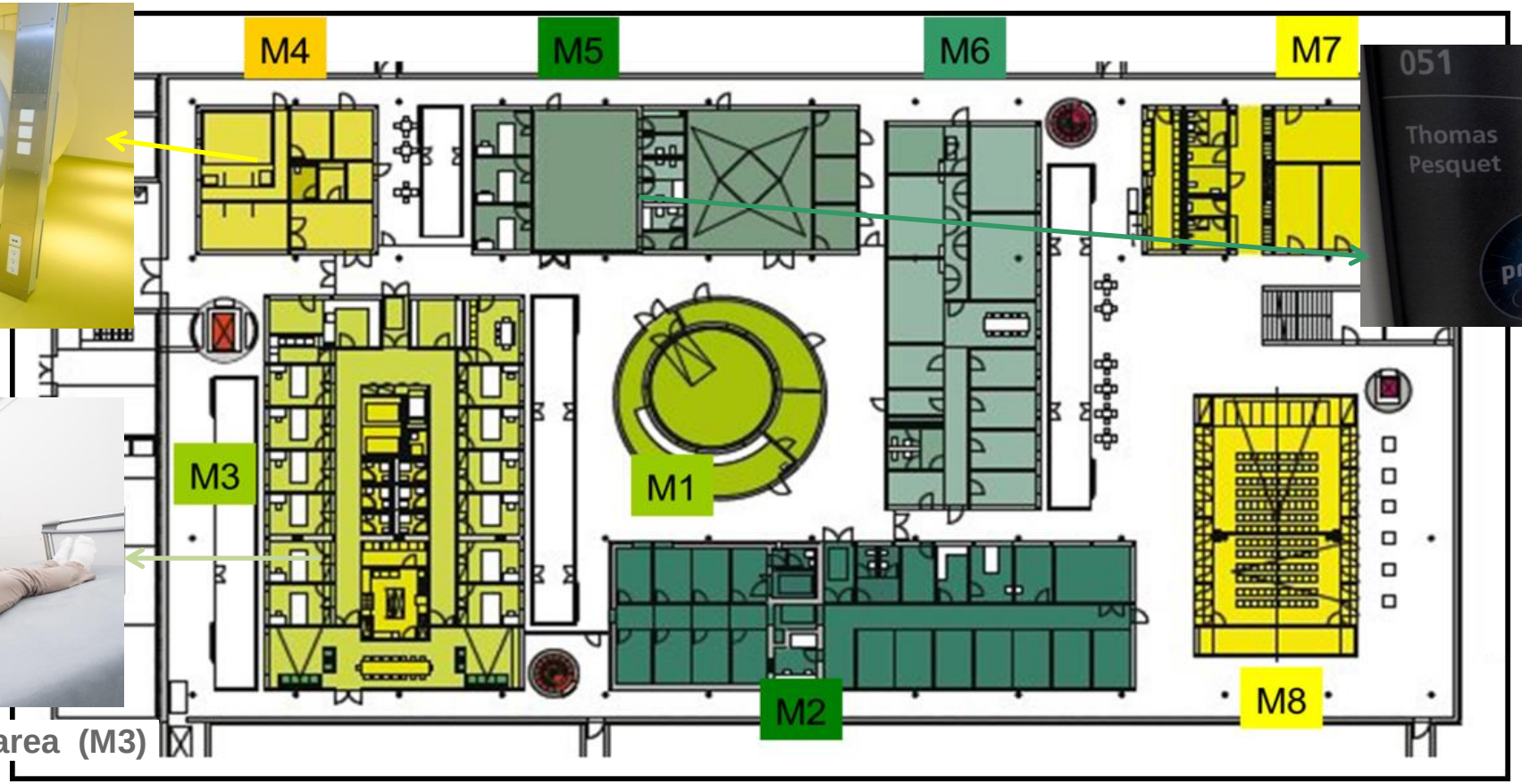

Psychology Lab (M5)


Living and simulation area (M3)

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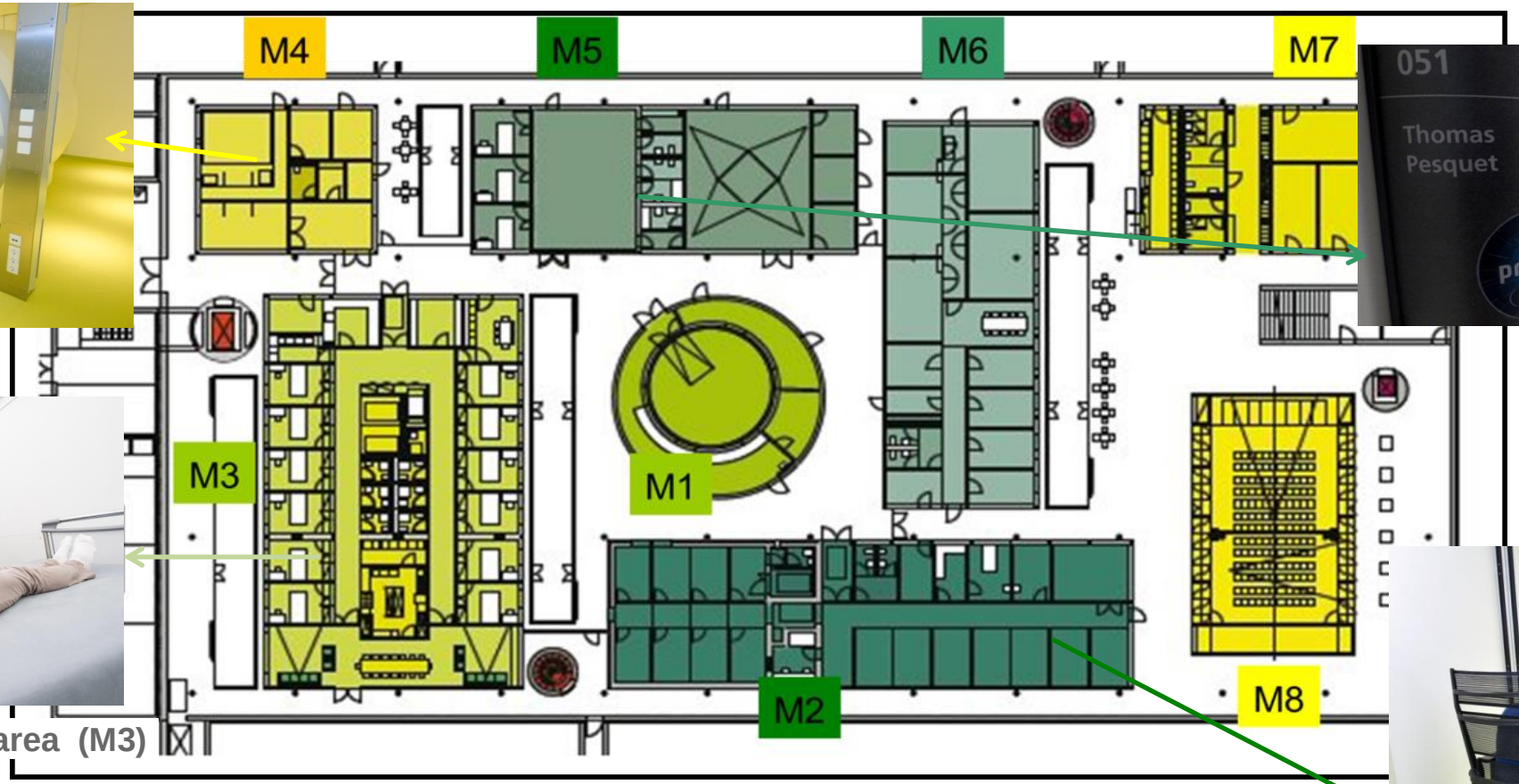

Psychology Lab (M5)


Living and simulation area (M3)


Physiology Lab (M2)

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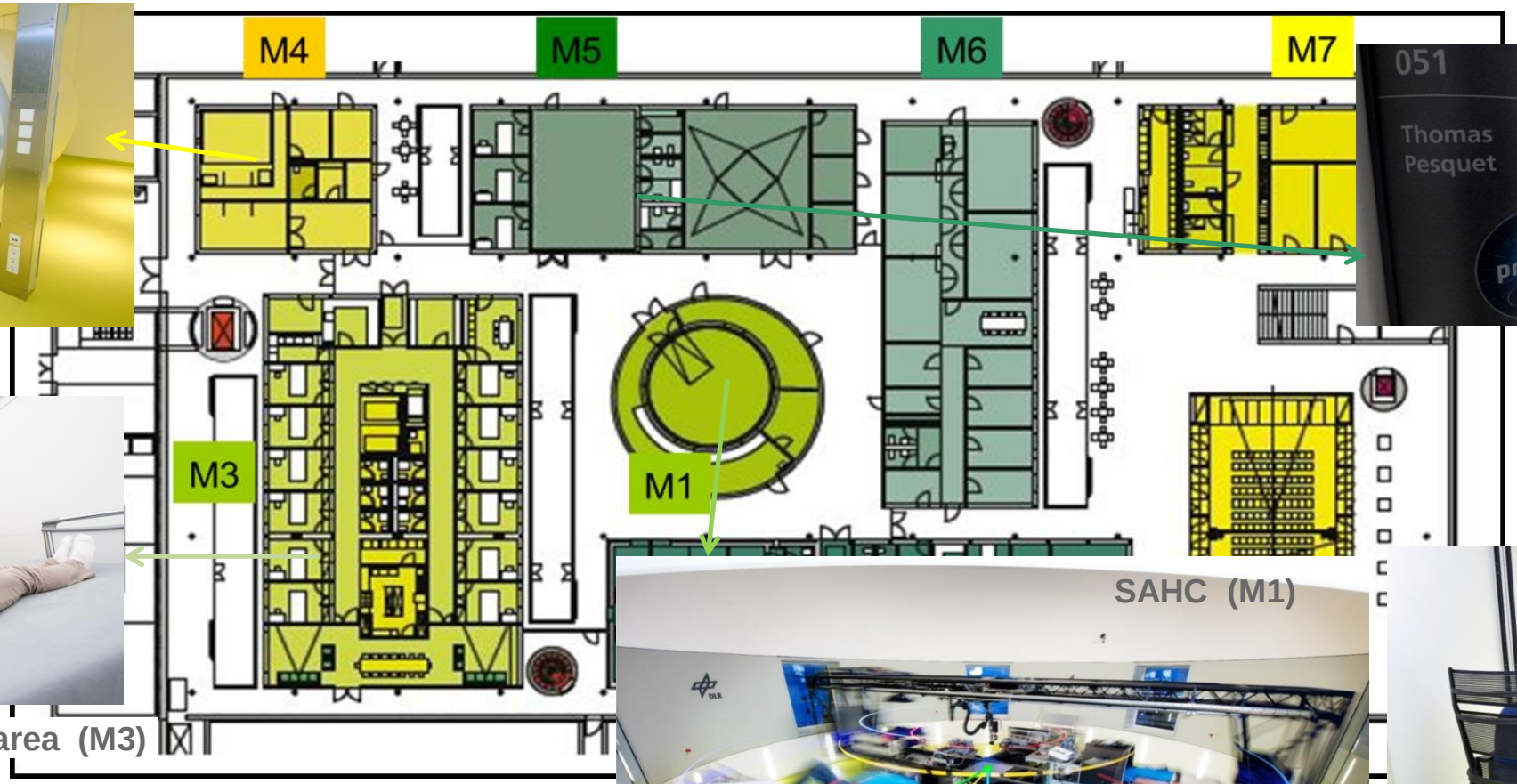

Psychology Lab (M5)


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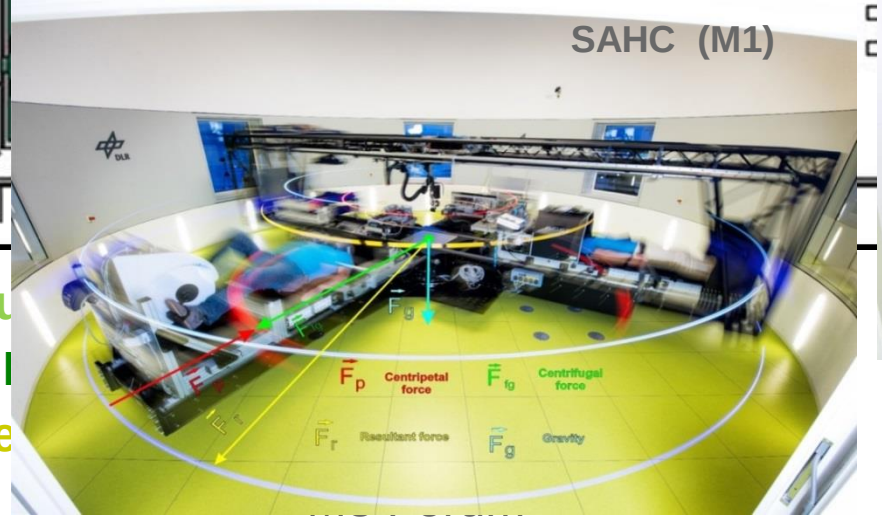


Physiology Lab (M2)

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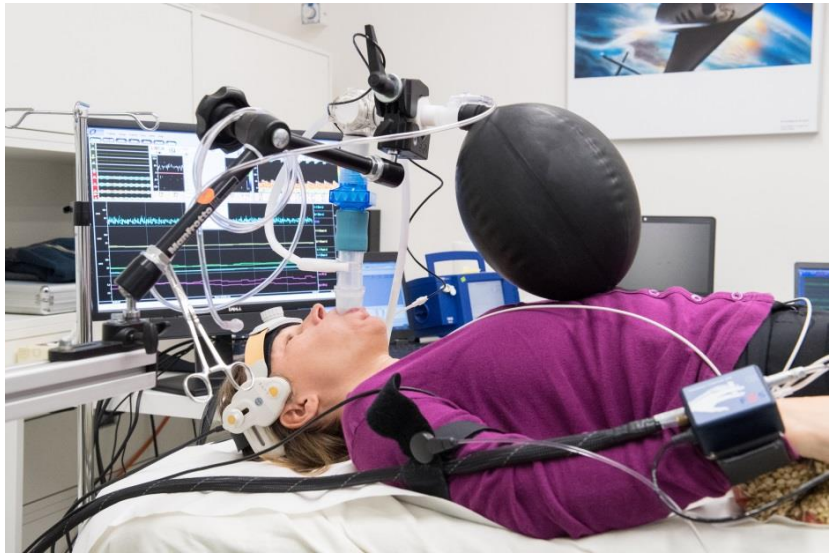
:envihab - Well-defined Experimental Conditions



- Various experiment settings possible
  - e.g. Atmospheric Conditioning (VaPER); Reduction of ambient pressure to 300 mbar
- Temperature and Humidity adjustable
- Confinement
- High standard research facility with innovative and state-of-the-art equipment
- Studies with up to twelve test subjects under highly controlled conditions and with variable duration
- Highly standardized -6° head down tilt (HDT) during 30/60 days bedrest studies at :envihab (NASA/ESA) – VaPER-BR-Study with 0.5% ambient CO_2

:envihab – Direct Return of ESA-Astronauts

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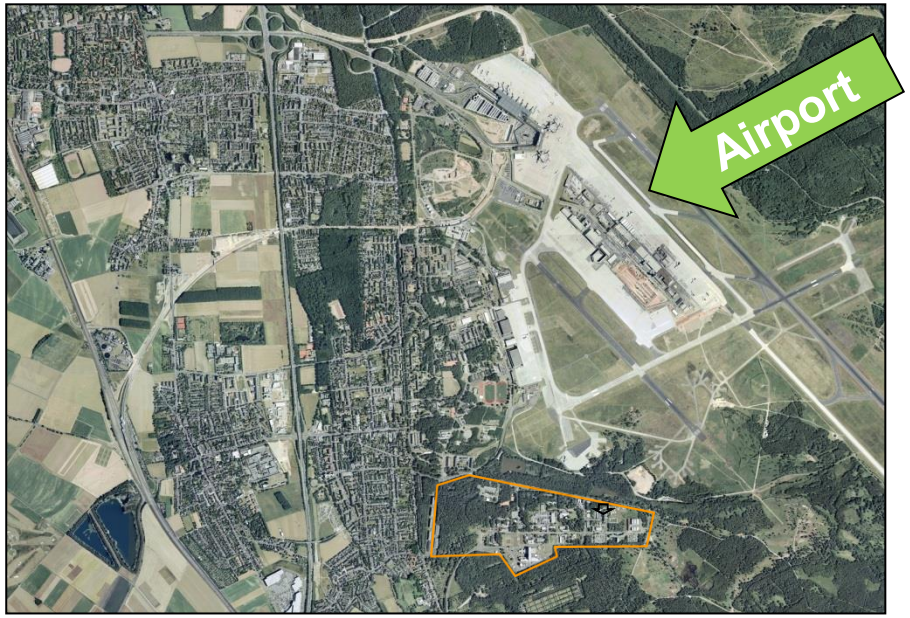

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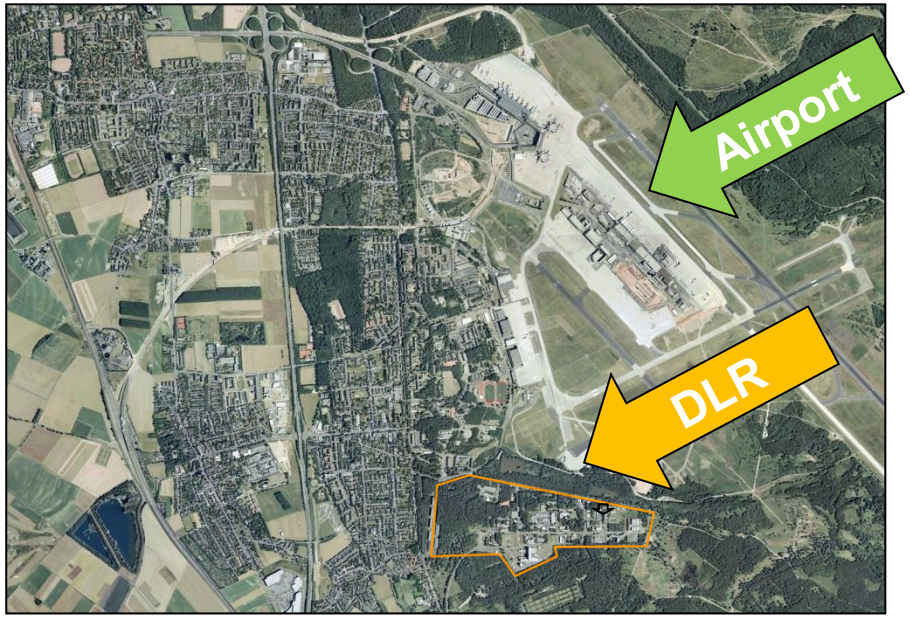

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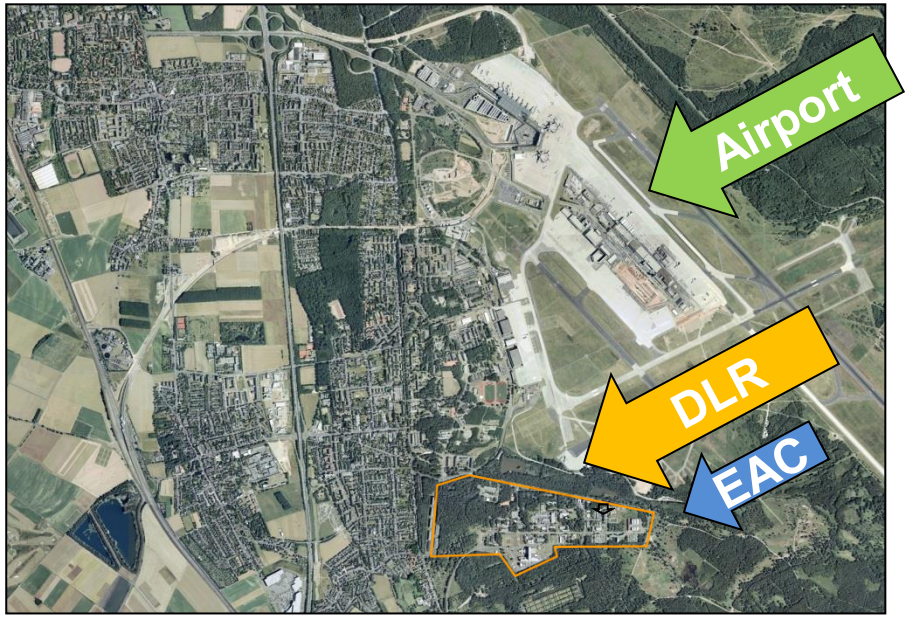

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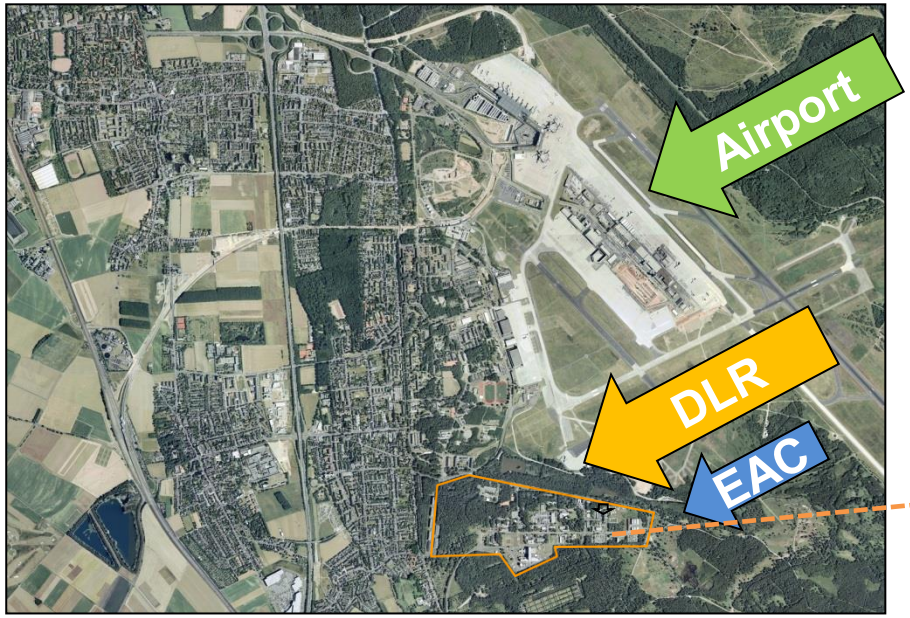

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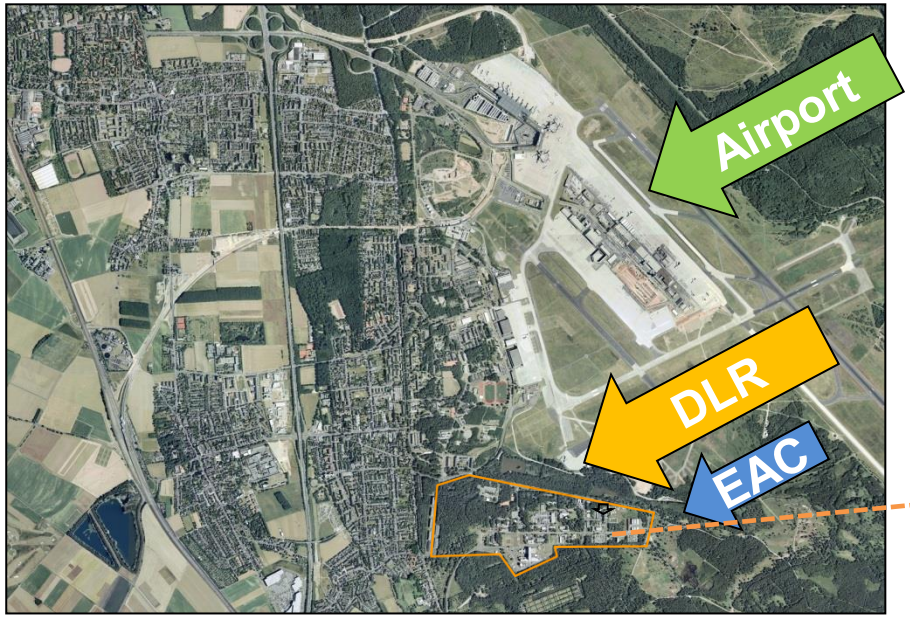

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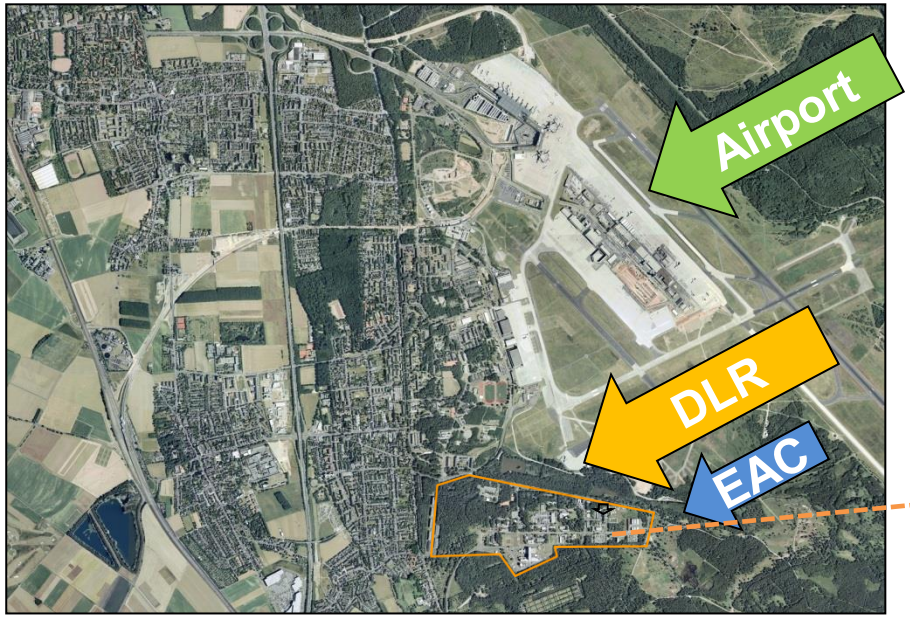

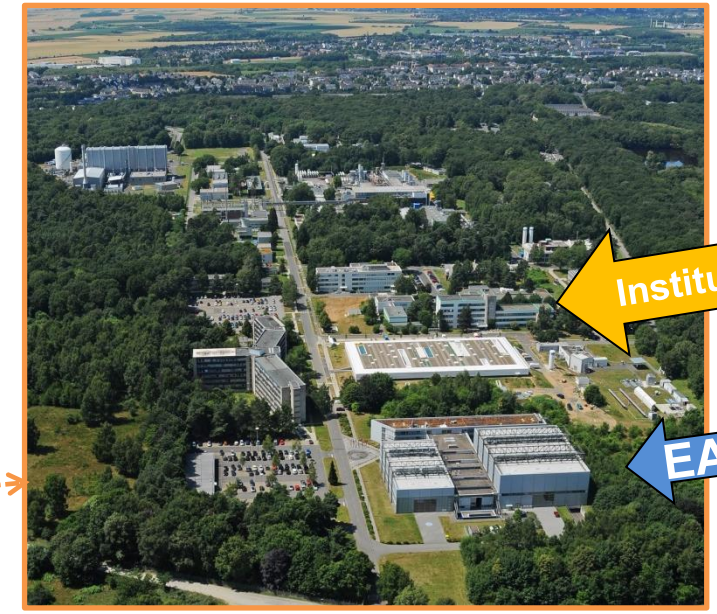

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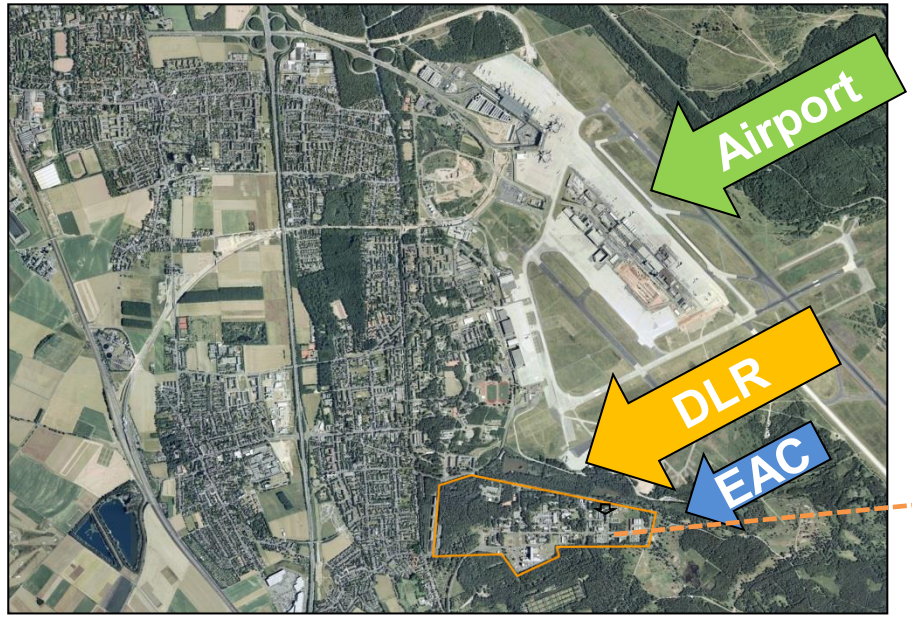

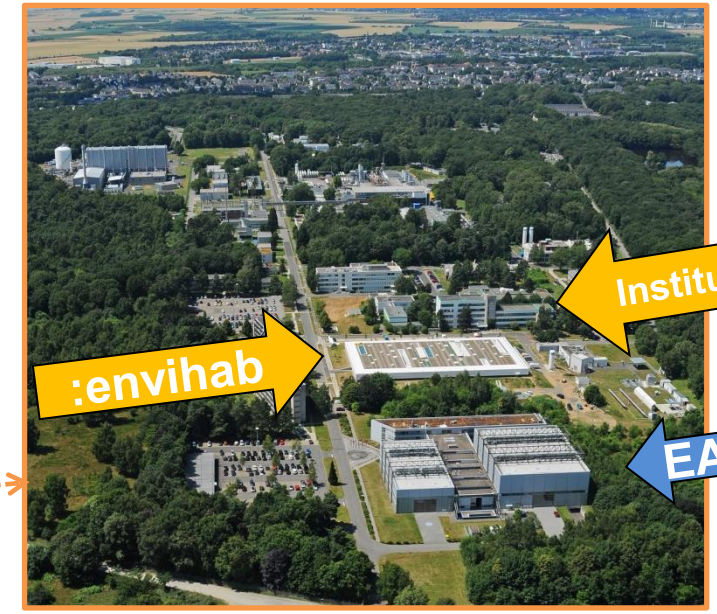

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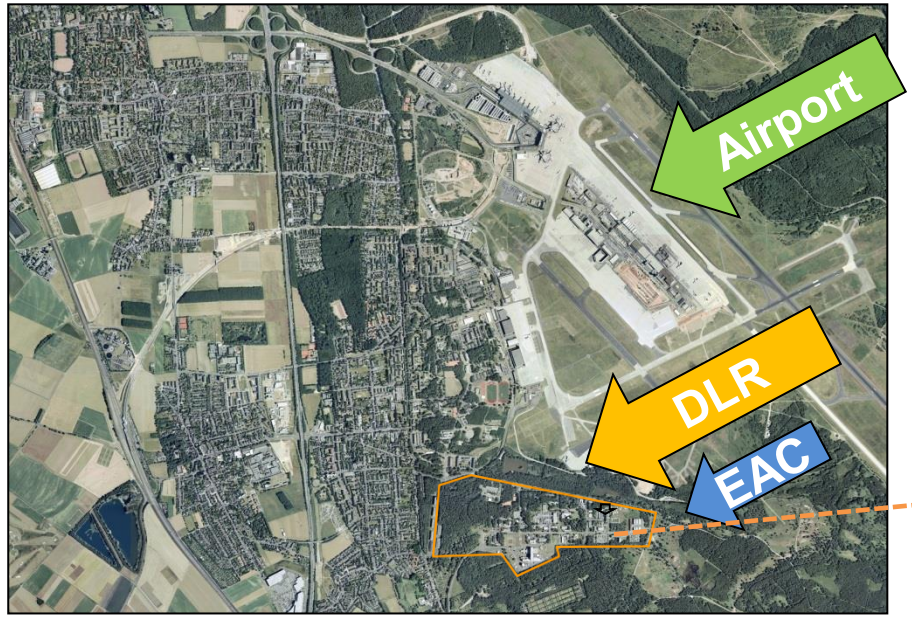
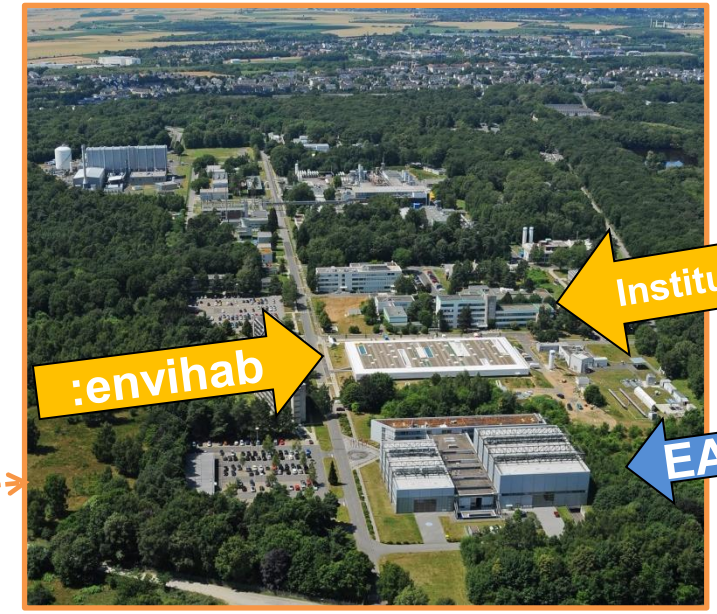




- Since 2014 Institute of Aerospace Medicine supports postflight activities of ESA Astronauts - Direct Return
- Supporting ESA/EAC with all important facilities in a few meters distance
  - European Astronaut Center,
  - Institute of Aerospace Medicine including Flight Medicine Clinic,
  - :envihab
- Pre- and postflight examinations can be performed at the same site with identical equipment and staff

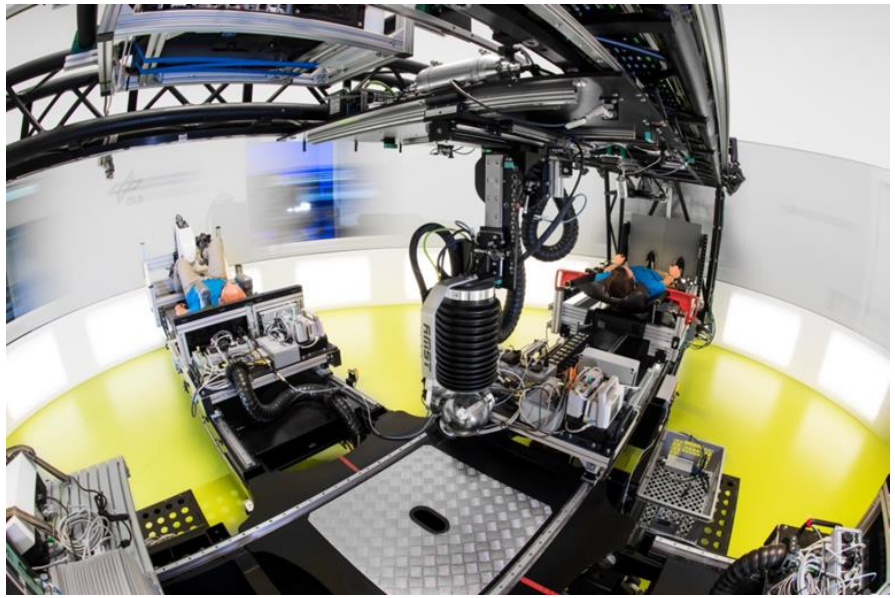
Direct Return – Hosting of ESA-Astronauts in :envihab

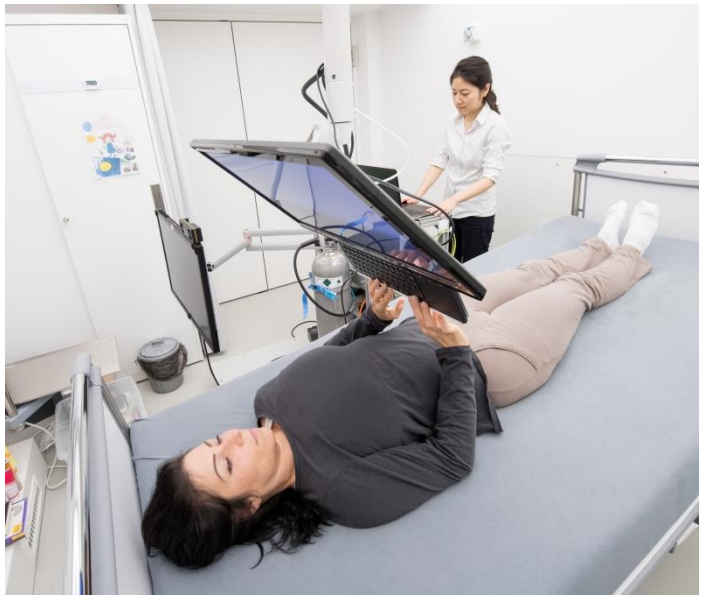
- Astronauts, crew surgeon and operational staff can be accommodated
- Crew quarters are fully access-controlled
  - Infection control
  - Astronaut privacy
- Advantage of noise-reduced Modul as crew quarter
- In door-to-door distance to ESA-Control Team
- Fully supported by DLR Staff

MED B: Clinical Data Collection (CDC) for ESA-Astronauts

- Direct after the arrival in the :envihab electrocardiogram and blood draw are performed
- Because of Space Associated Neuro-ocular Syndrome (SANS) many eye examinations are performed, in some cases the same as on the ISS
- Also stress electrocardiogram and dermatological examinations are conducted

Outlook





- Expecting ESA-Astronaut Alexander Gerst for his second Direct Return in :envihab in December 2018
- NASA-/ESA collaboration with DLR: Long term Bed Rest Study with Artificial Gravity as countermeasure in 2019 (AGBRESA-Study)

Acknowledgement

EAC: Frank de Winne; Stephane Ghiste; Beate Fischer for Direct Return

Special thanks to everyone, who enabled Direct Return at DLR and Bed-Rest-Studies (VaPER and AGBRESA)
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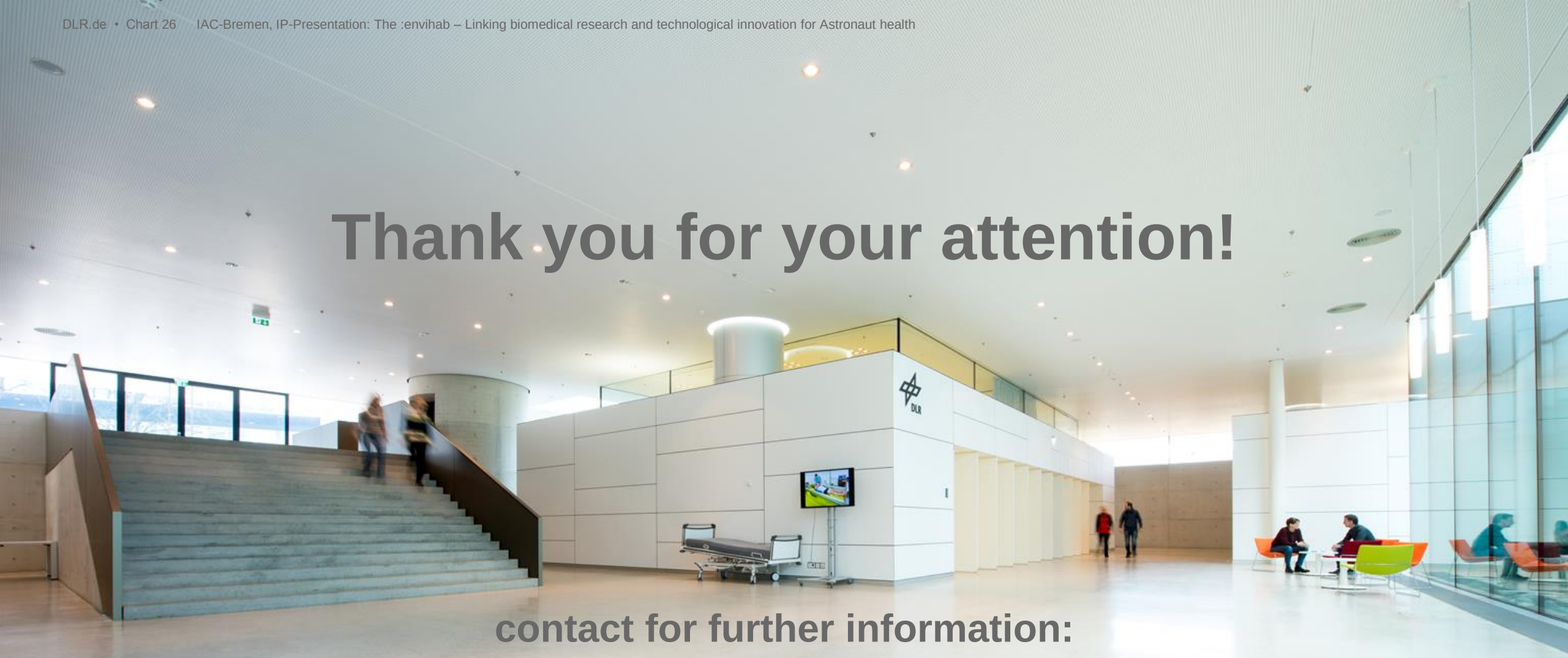

Thank you for your attention!

contact for further information:
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