

Emulating Active Space Debris Removal Scenarios in Zero-G Lab

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On-ground V&V facility for system testing

Verifying and validating ASDR technologies on Earth conditions require the following capabilities:

- Photorealistic simulations (real-time during HIL testing)
- Software-in-the-loop testing
- Zero-G robotic facility (Figure 1):
 - 5 x 3m area covered by a special epoxy material
 - Floating platforms and/or robotic arms for hardware-in-the-loop (HIL) testing to simulate the microgravity environment
 - A sun emulator to recreate the challenging space lighting conditions and 240 Hz advanced Motion Capture System

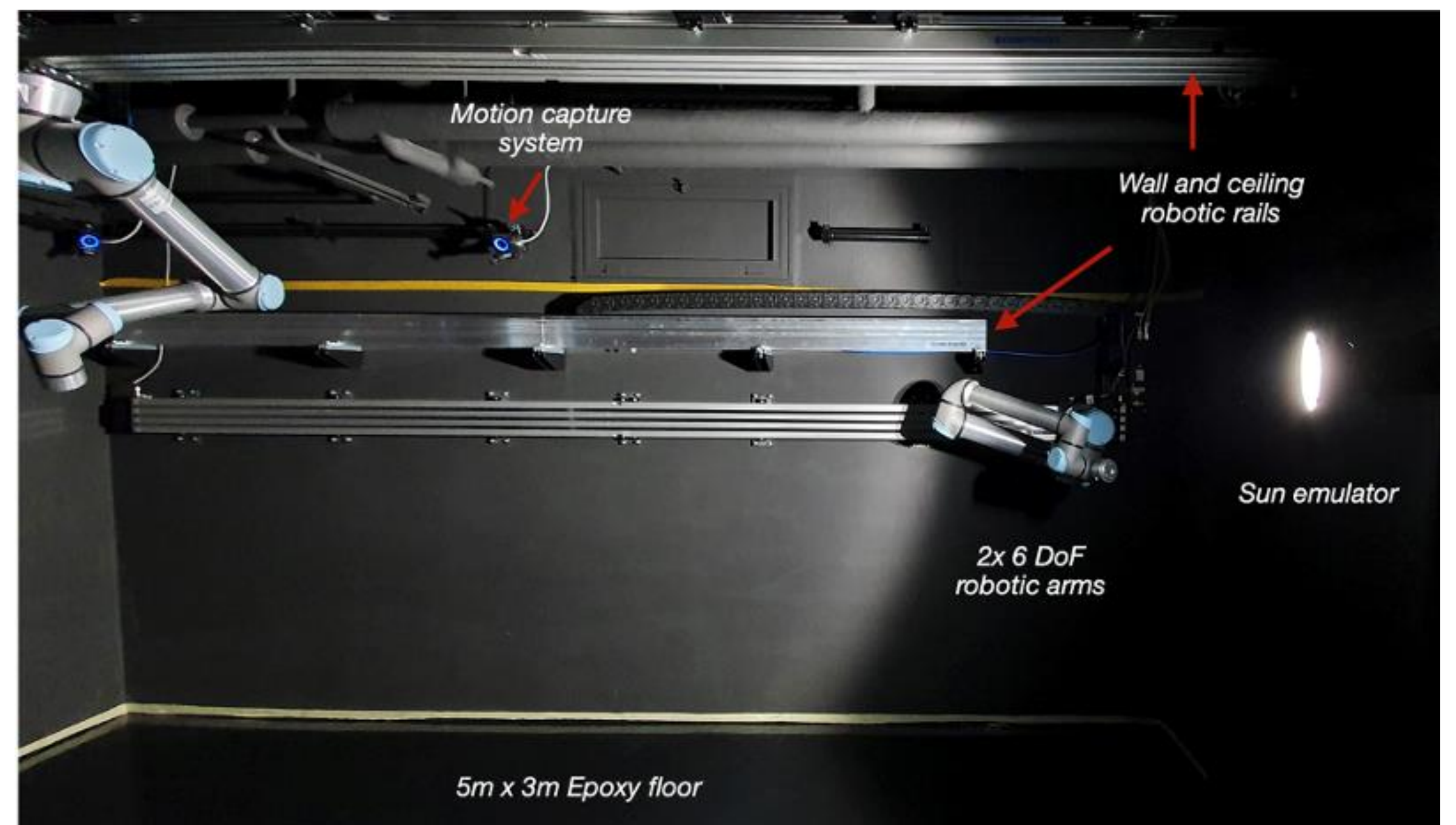


Figure 1: Zero-G laboratory at the University of Luxembourg

SnT-partnership: Active Space Debris Removal capturing system by SpaceR & Spacety

Autonomous capturing is challenging



Figure 2: CleanSpace One of EPFL

Catching harmlessly an uncooperative debris tumbling at high-velocity needs:

- compliance
- reliability
- robustness

Not harming the target = Maximizing resource reusability

Rigid capture interfaces

→ Generate more smaller debris tumbling in orbit

Soft capture interfaces

→ No harm of debris & Exploitable resource

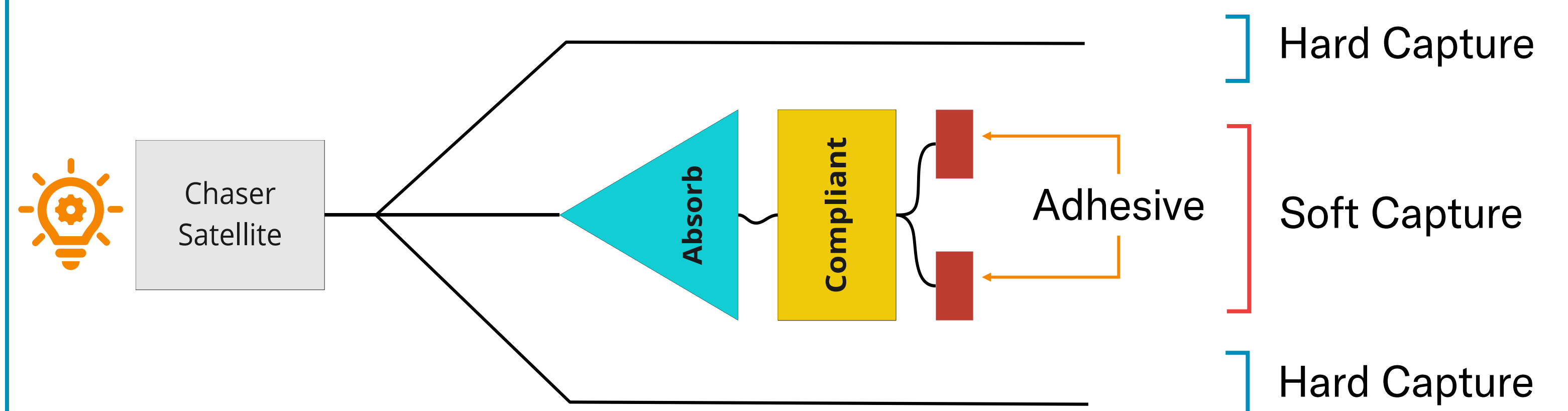


Figure 3: Concept of ASDR capturing system by SpaceR & Spacety

Two-step capturing mechanism

- 'Soft Capture' absorb and dampen vibrations generated during the contact
- 'Hard Capture' secures the debris

FNR-Bridge project: High-fidelity testing environment

Within the joint project between SpaceR and Spacety (the HELEN project) for recreating reliable testing conditions for space debris removal technology:

- Nvidia Omniverse will be used to integrate virtual and physical components
- High-fidelity photorealistic on-orbit simulations and the Zero-G robotic facility will be integrated

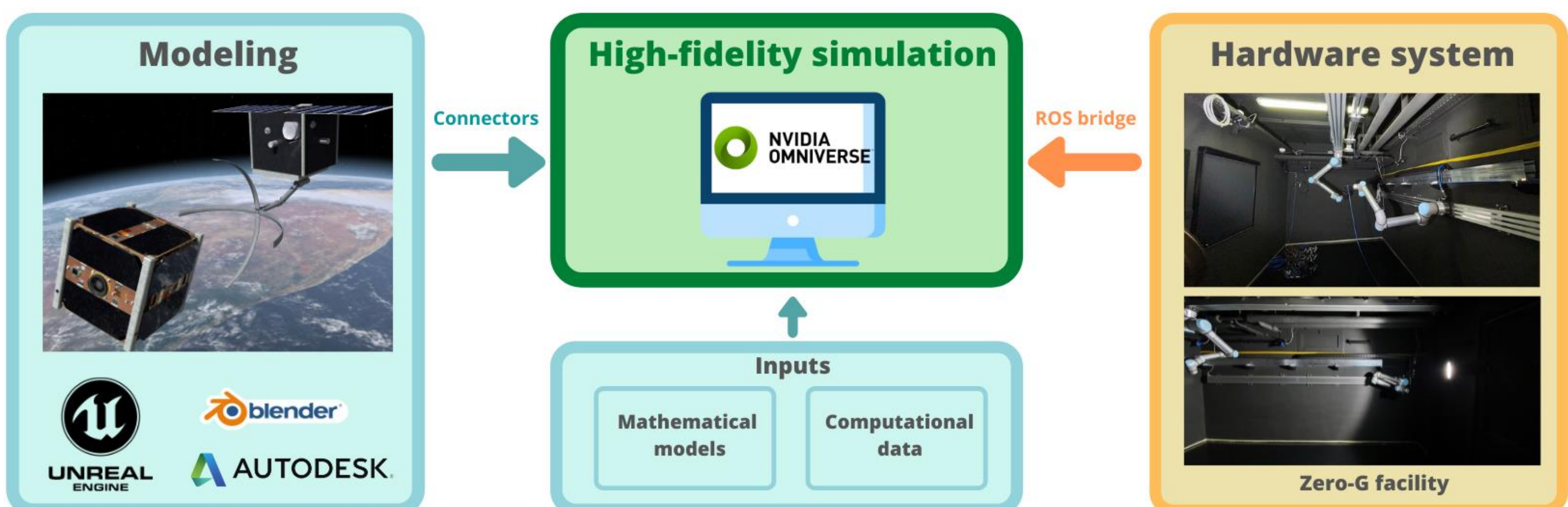


Figure 4: Digital twin concept for on-orbit operations