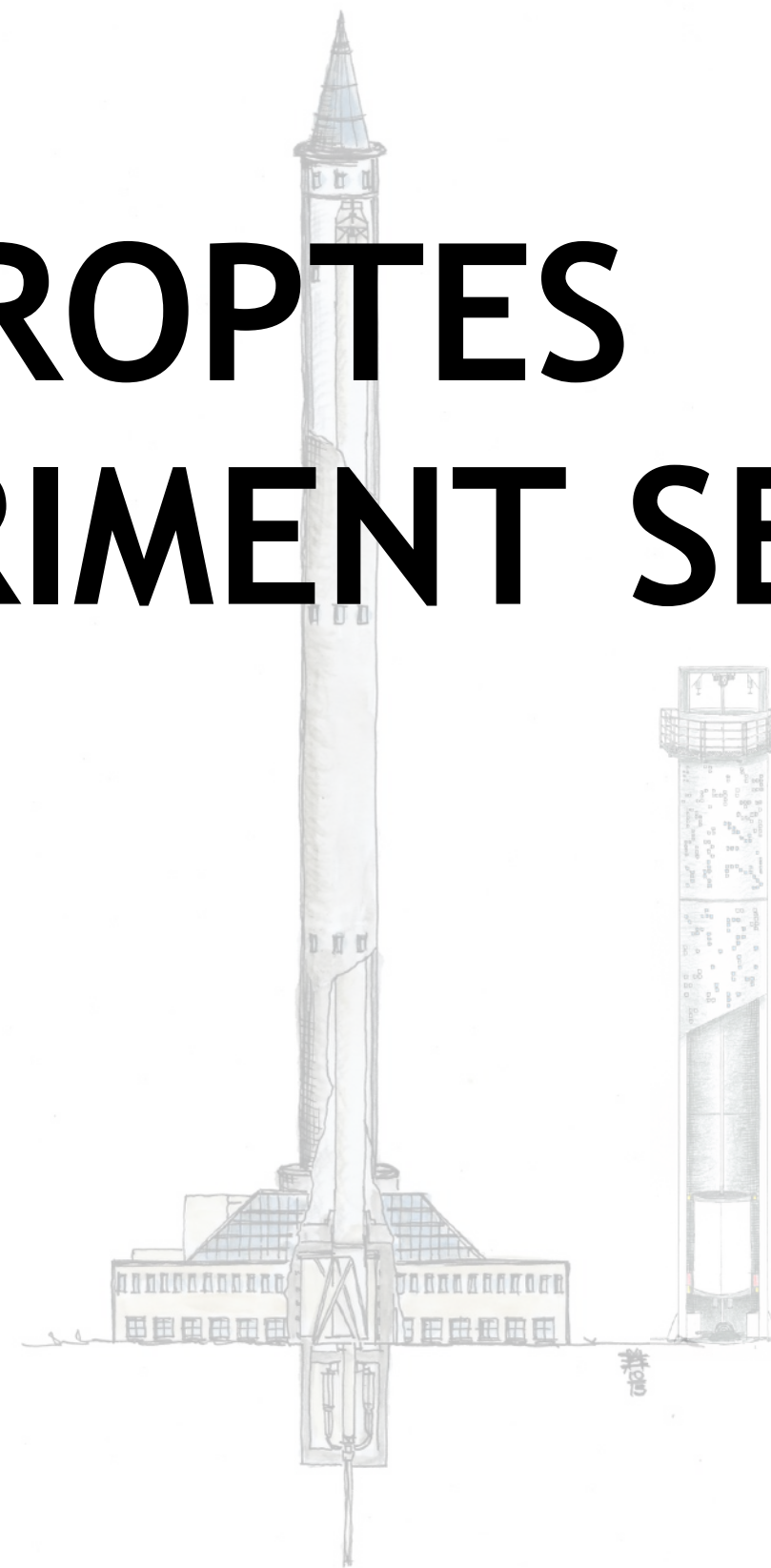


INTRODUCTION OF DROPTES „DROP TOWER EXPERIMENT SERIES“

BREMEN DROP TOWER /
GRAVITOWER BREMEN PRO



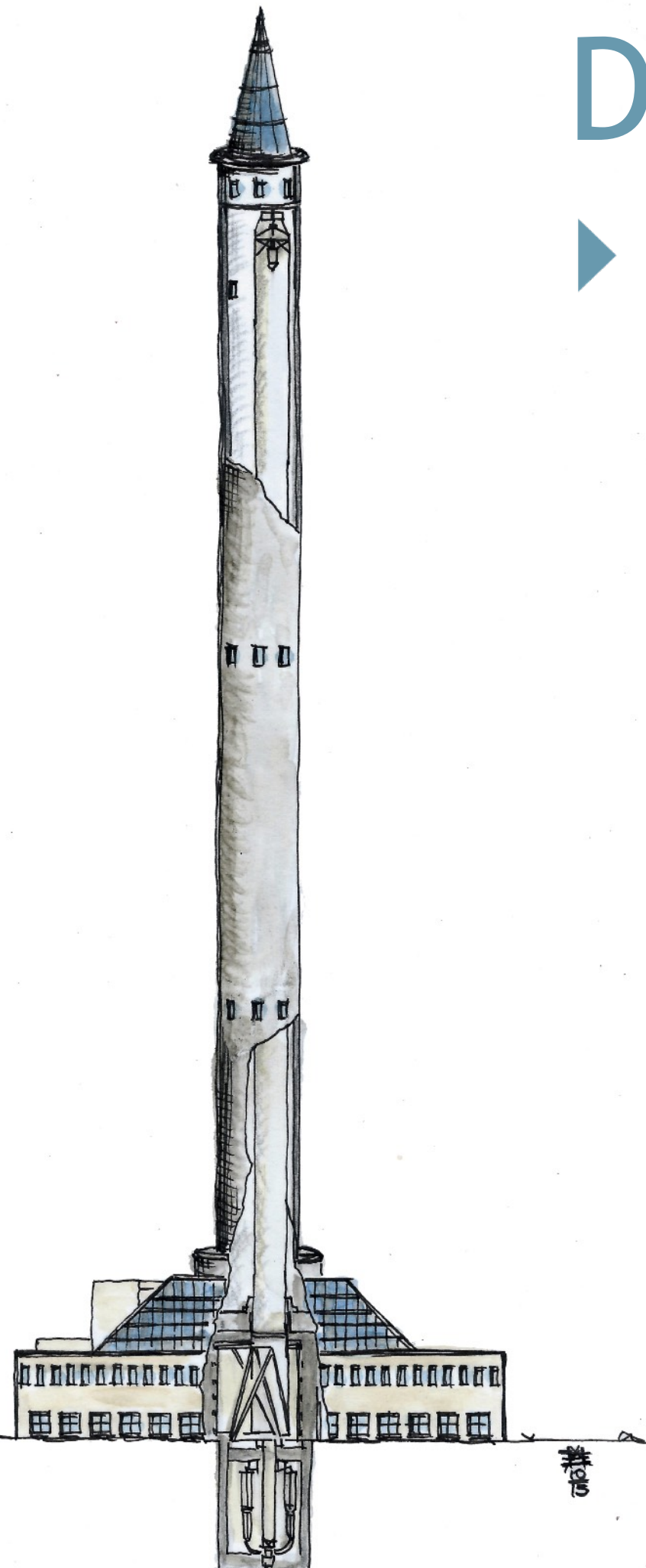
Dr. Thorben Könemann - Head of Science and Operation,
ZARM Drop Tower Operation and Service Company

"Access to Space For All - Path for Space Technology Capacity-Building", Side Event - COPUOS, May 31, 2023

Drop Tower Experiment Series (DropTES)

► General Program Information

- UN Fellowship Program:
Access to Space for All Initiative - Hypergravity/**Microgravity Track**
- Annual **space-related activity at the Bremen Drop Tower** in Germany
- First Cycle was initiated by UNOOSA, DLR, and ZARM in 2014
- Executing Agency:
United Nations Office for Outer Space Affairs (UNOOSA)
- Supporting Agency:
German Aerospace Center (DLR) Space Agency
- Hosting Institution:
Center of Applied Space Technology and Microgravity (ZARM)



Drop Tower Experiment Series (DropTES)

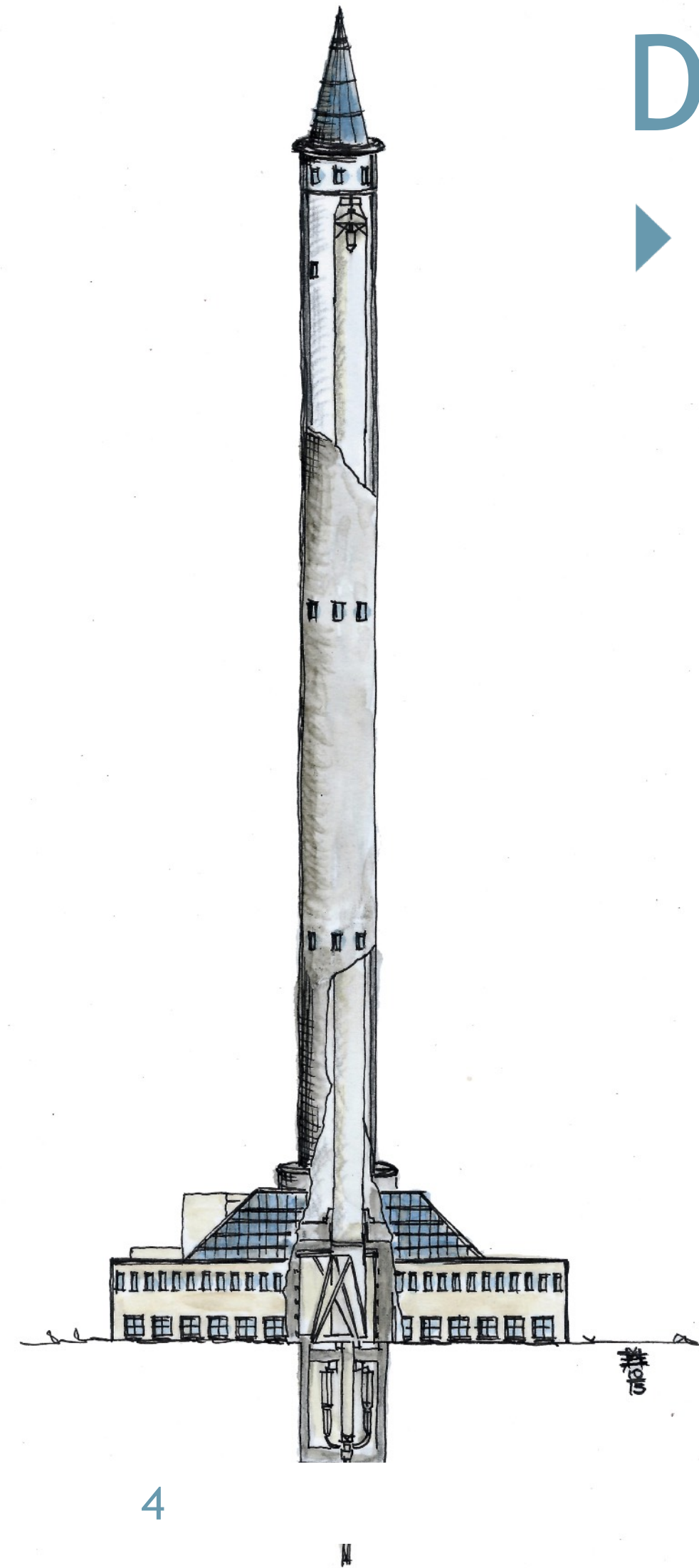
► General Program Information

- Realization of a **scientific and/or technological experiment under short-term conditions of weightlessness** at the Bremen Drop Tower and/or GraviTower Bremen Pro in Germany
- Expected Profile of Applicants: **Government organizations, research institutes, universities, and other public and non-for-profit organizations**
- Number of Selected Applicants: **One team leader with up to four team members** who are from Member States of the United Nations (support)
- Following space project guidelines (**proposal, reports, reviews**)
- **Two weeks at ZARM** to conduct microgravity experiments consisting of five **drops or catapult launches** in the **Bremen Drop Tower** or five **half-days** in the **GraviTower Bremen Pro** in Germany
- Travel, accommodation, and drop tower utilization are **sponsored**
- Program language: **English** / Program duration: **about 1 year**

Drop Tower Experiment Series (DropTES)

► Schedule

- Application Phase: May 2023 - November 2023
 - **Announcement of Opportunity (Deadline: 26 Nov. 2023 at 23:59 CET), Expression of Interest -> technical consultation sessions**
- Selection Phase: November 2023 - January 2024
 - **Proposal evaluation by selection board (UNOOSA, DLR, and ZARM)**
 - **One team will be selected per DropTES cycle**
- Preparation Phase: February 2024 - 4th Quarter 2024
 - **Experiment preparation in close cooperation with ZARM**
- Experiment Phase: 4th Quarter 2024
 - **Two weeks at ZARM in Germany (experiment integration + series)**
- Reporting Phase: Submission of Final Report until 31 January 2025
- Outreach and Publication Phase



Drop Tower Experiment Series (DropTES)



► „Stepping Stone into Space“



Drop Tower Experiment Series (DropTES)



► „Stepping Stone into Space“



- Promotion of space education and research
- Enhancement of capacity-building activities
- Fostering skills, knowledge, and cooperations
- Boosting the Technology Readiness Level (TRL)
- Link to further Access to Space for All Tracks



Drop Tower Experiment Series

► „Stepping Stone into Space“



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GJU

الجامعة الألمانية الأردنية
German Jordanian University

Round 8: Universidad de Antioquia team

In 2022, the award went to Universidad de Antioquia team. The objective is to explore the possibility of autonomous soldering in microgravity environment and study the microstructure of the tin drops obtained during the solidification process in microgravity and compare them to the ones solidified in normal gravity.

Round 7: Universidad Católica Boliviana "San Pablo" team

In 2020, the award went to Universidad Católica Boliviana "San Pablo" team. The objective is to determine the 3D printing feasibility, measure intra-structure remaining liquid resin after light exposure, and compare manufacturing time, amount of used material while processing in 2 different approaches.

read more ►

Round 6: Politecnico de Milano "Polimi" team

In 2019, the award went to Politecnico de Milano "Polimi" team. The objective of their experiment is to analyze the lateral sloshing of a ferrofluid solution in low gravity with the aim of measuring its oscillation frequency while subjected to different magnetic field intensities.

read more ►

Round 5: University of Bucharest and Politehnica University of Bucharest

In 2018, the award went to the University of Bucharest and Politehnica University of Bucharest. The objective of their experiment is to expose medicine droplets containing aqueous chlorpromazine (CPZ) solution to both laser radiation and microgravity conditions.

read more ►

Round 4: Warsaw University of Technology

In 2017, the award went to the Warsaw University of Technology. The objective of their experiment is to verify, in vacuum and microgravity conditions, the deployment of the deorbit sail system on their two-unit CubeSat called "PW-Sat2".

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Round 3: Instituto Tecnológico de Costa Rica and Universidad de Costa Rica

In 2016, the award went to Instituto Tecnológico de Costa Rica and Universidad de Costa Rica. The objective is to expand the technical knowledge and information on the behaviour of a reduced-scale robotic arm manipulator such as dynamics, motion, and control under microgravity conditions.

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Round 2: Universidad Católica Boliviana "San Pablo" team

In 2015, the award went to Universidad Católica Boliviana. The objective of their experiment is to examine and evaluate the property of an alloy of Nickel and Titanium "Nitinol" under the microgravity environment

read more ►

Round 1: German Jordanian University

In 2014, the award went to German Jordanian University, Jordan. The objective of their experiment is to investigate the stability of tether dynamics for satellites with electromagnetic tether systems using a Tilger, a mass damper.

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Drop Tower Experiment Series

► „Stepping Stone into Space“



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DropTES 2023

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in after light exposure,
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their experiment is to
measuring its oscillation



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POLITEHNICA

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[read more ►](#)



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الجامعة الألمانية الأردنية
German Jordanian University

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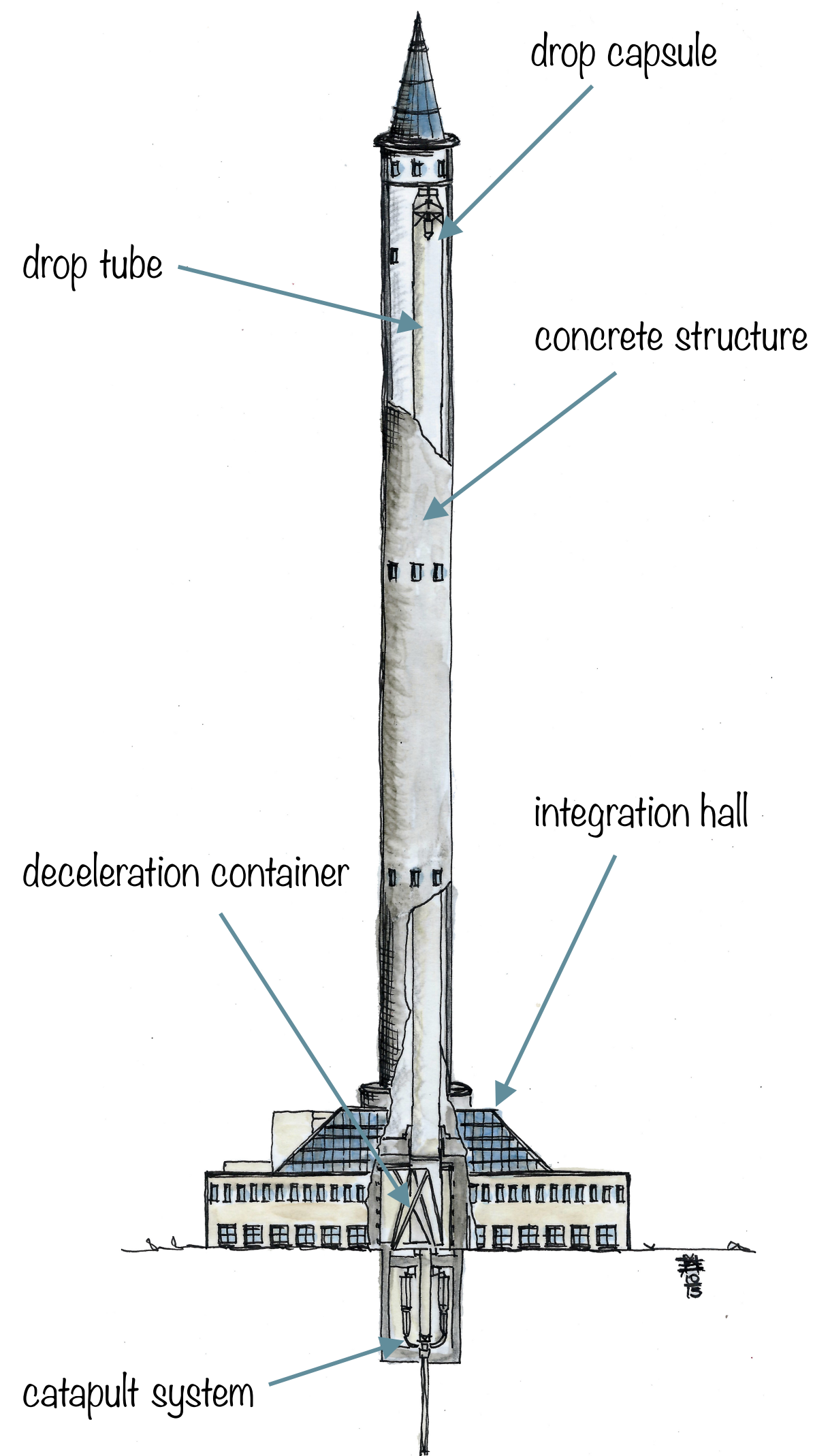
tions

(TRL)

acks



Bremen Drop Tower



FACTS ABOUT THE DROP TOWER BUILDING

- **height of the Bremen Drop Tower: 146 m**
- diameter of the concrete structure: 8 m
- stairs: about 600 steps until the top

FACTS ABOUT THE DROP TUBE

- height of the drop tube: 120 m
- distance of free fall: 110 m
- diameter of the drop tube: 3.5 m
- deceleration container: filled with 15 m³ of polystyrene pellets up to a height of 8.20 m
- **experiment duration in microgravity:**
drop experiment - 4.7 s
catapult experiment - 9.3 s (worldwide unique)
- maximum capsule speed: 168 km/h
- **gross weight of standard capsule: 500 kg**
- vacuum: 18 pumps draw out 1,700 m³ of air in 1.5 to 2 h
- pressure after evacuation: 10 Pa (0.1 mbar)
- **achievable microgravity quality: 10⁻⁶ g**
- **number of drops or catapult launches:**
up to 3 times a day

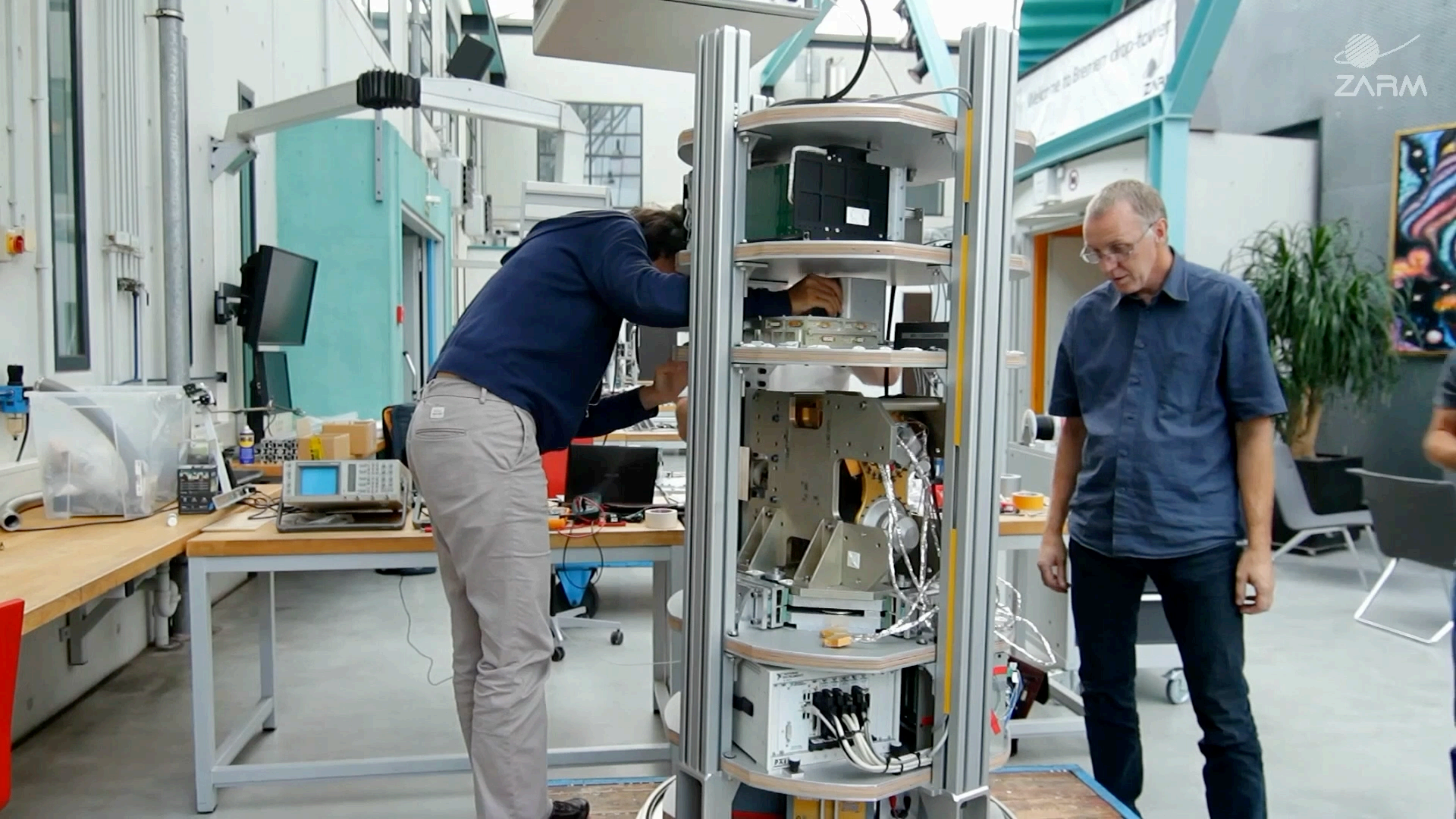


BREMEN DROP TOWER

Bremen Drop Tower



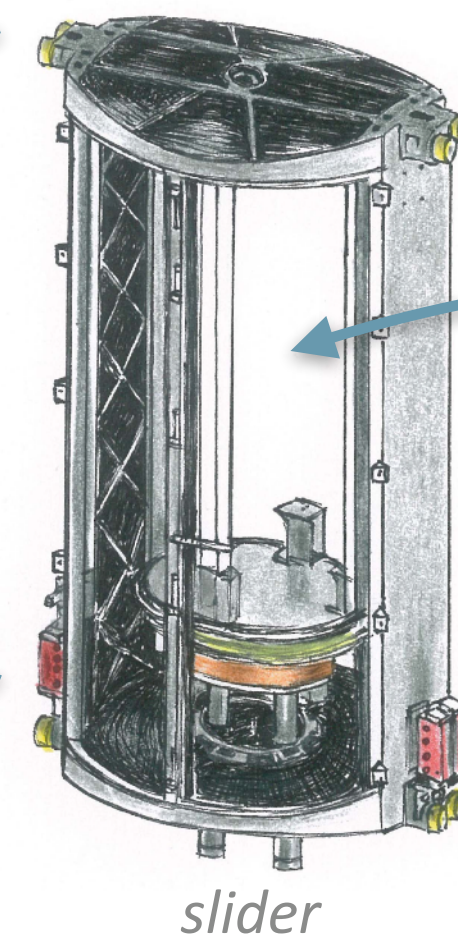
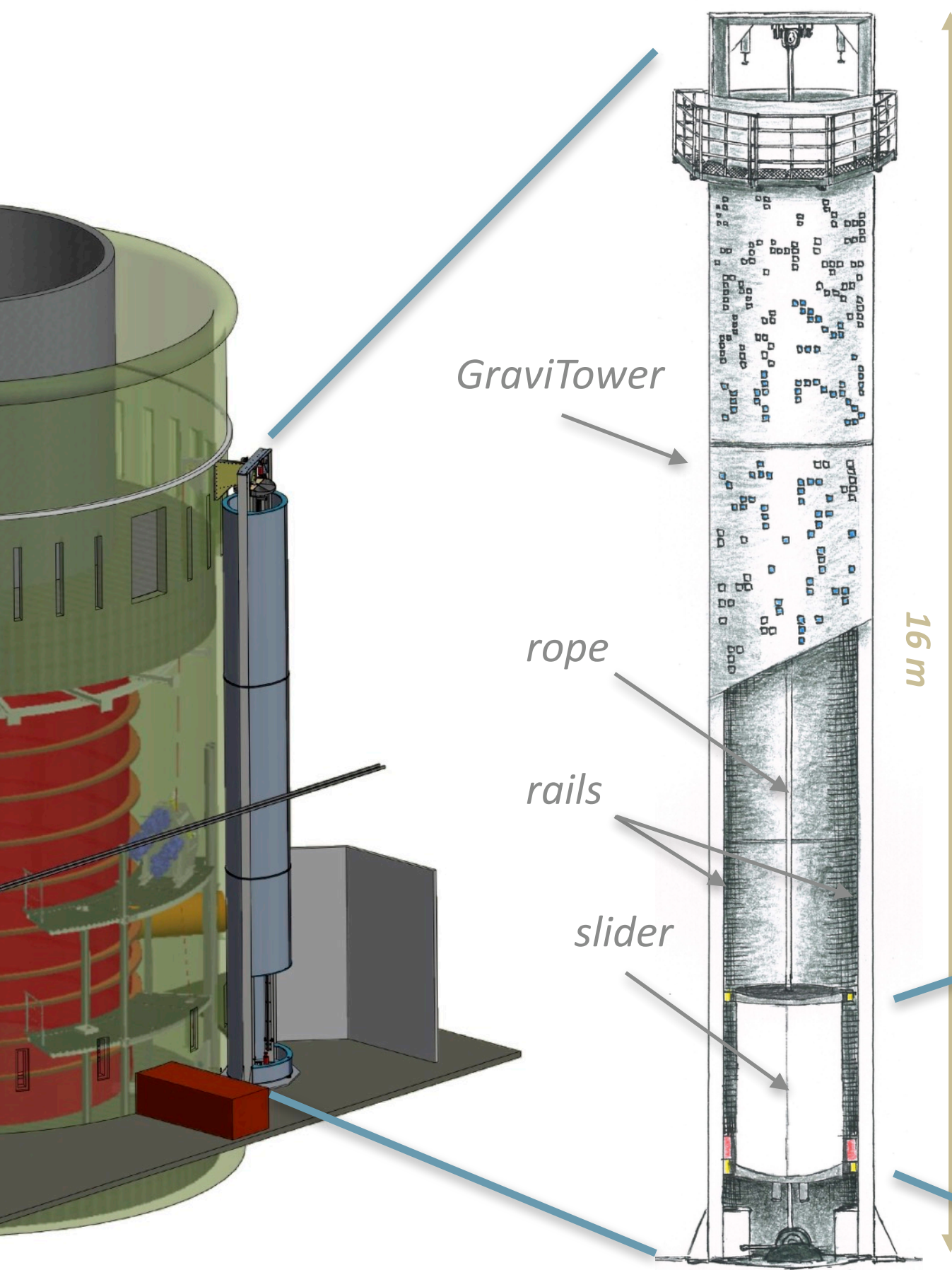
BREMEN DROP TOWER



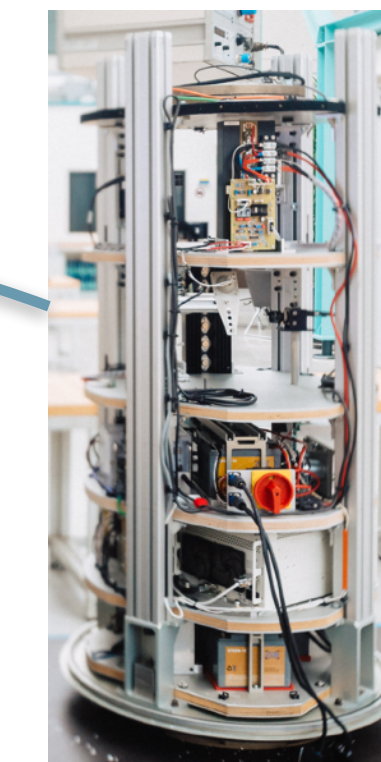
GraviTower Bremen Pro

Next-Generation Drop Tower System

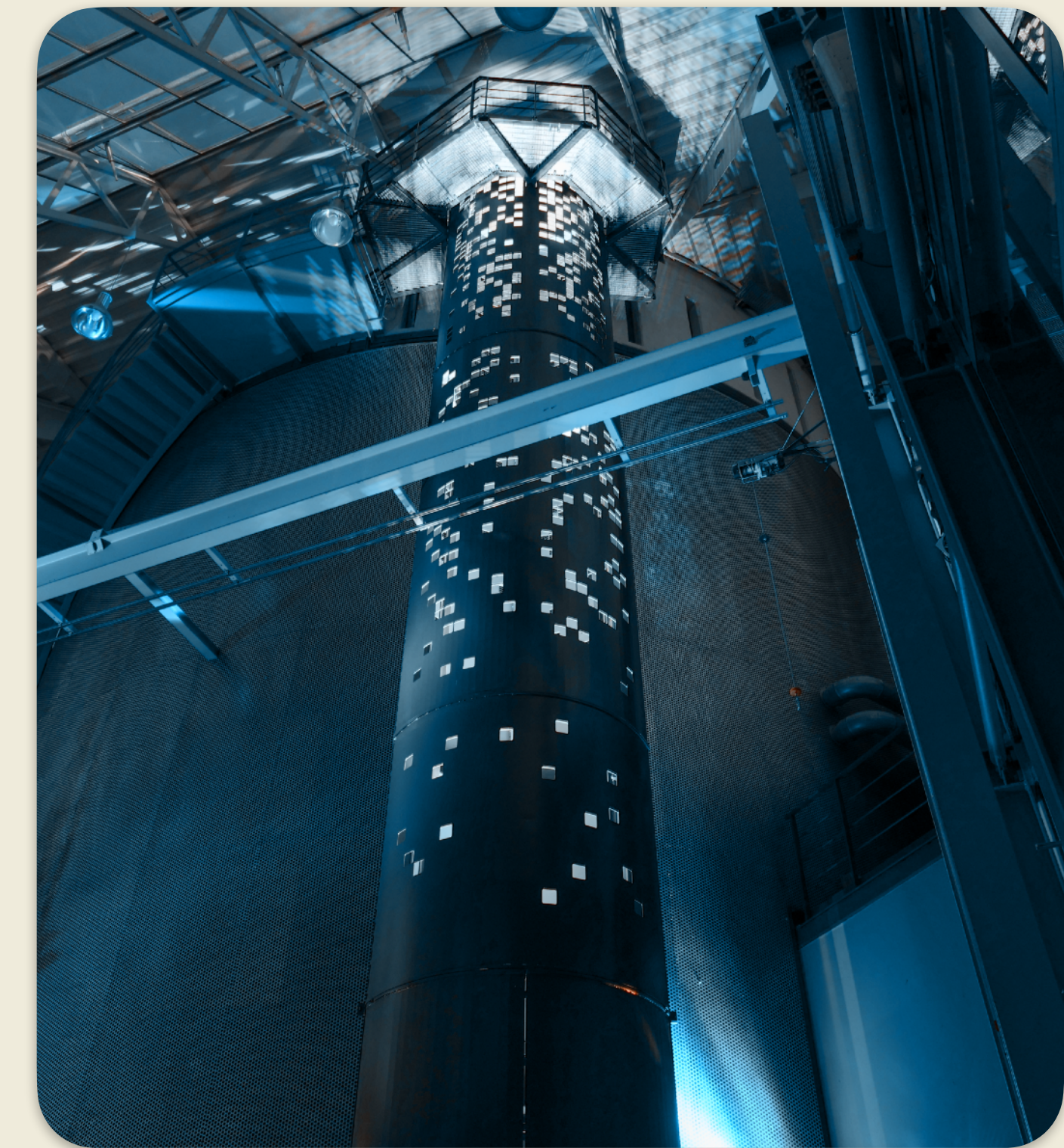
- ▶ rail-guided system (rope drive + hydraulic winches)
- ▶ over 80 experiments per hour
 - almost 1000 experiments a day
- ▶ 2.5 s in microgravity ($< 10^{-4} \text{ g}$)
 - **partial-g: e.g. Moon / Mars**
- ▶ standard capsule
 - synergy with Bremen Drop Tower



▶ no vacuum



standard capsule

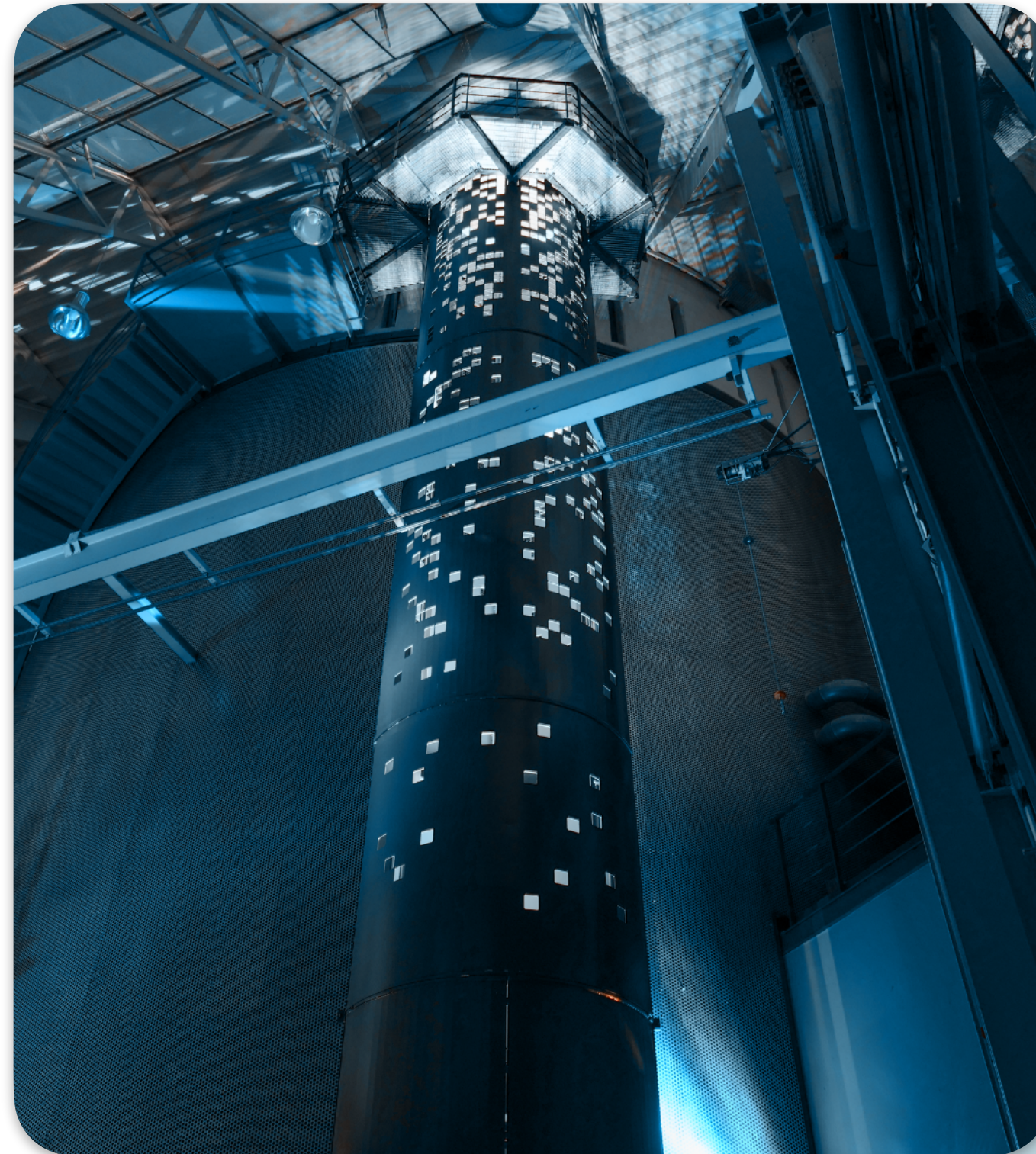


GRAVITOWER BREMEN PRO



BREMEN DROP TOWER / GRAVITOWER BREMEN PRO

► „Stepping Stones into Space“ - Microgravity / Partial-gravity for Research, Technology Tests, and Mission Preparations

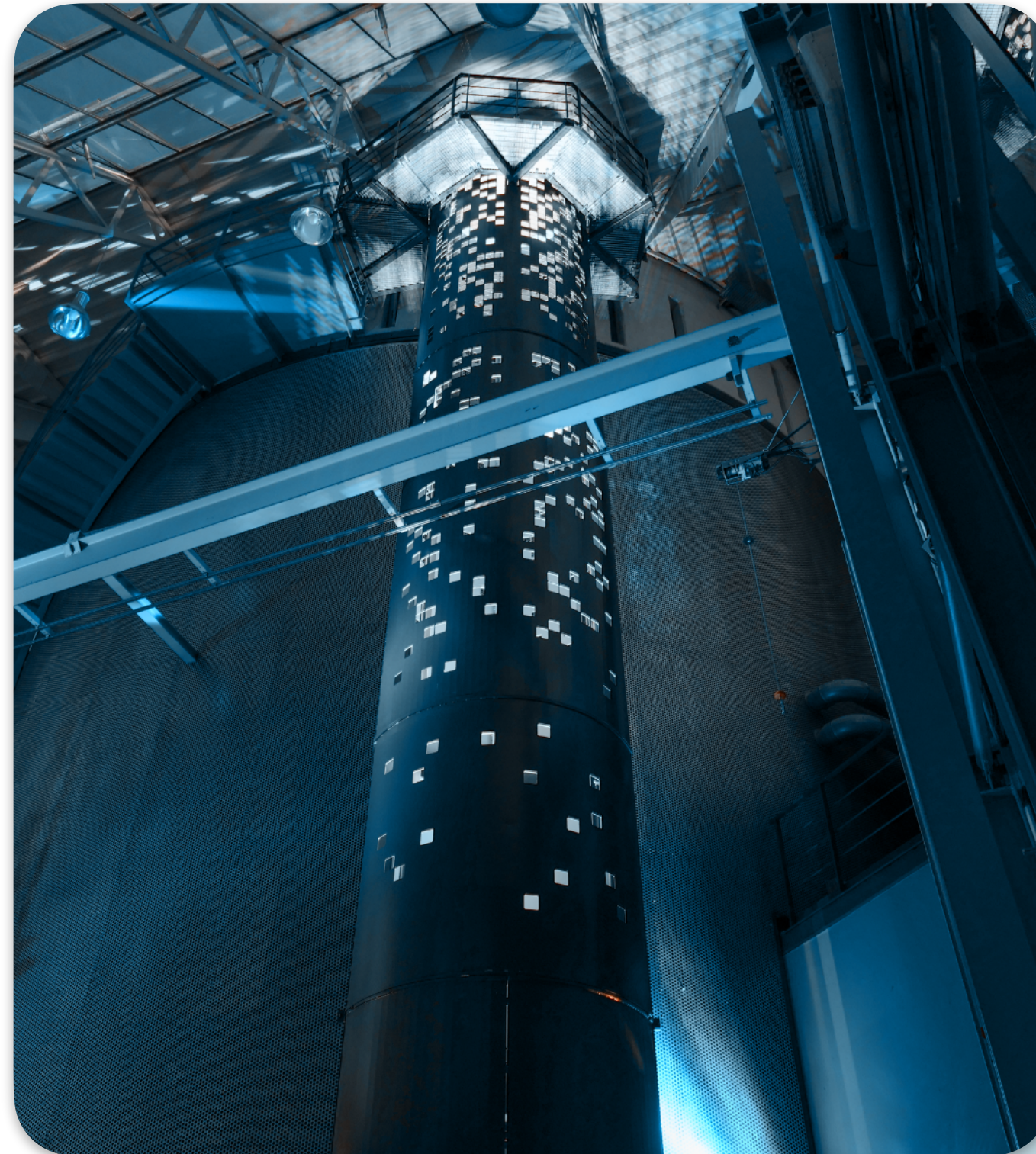


Summary

- *up to 9.3 seconds in weightlessness*
- *high-quality microgravity*
- *up to 1000 experiments per day*
- *partial-gravity option*
- *identical payload capsules*
- *high payload capacities*

BREMEN DROP TOWER / GRAVITOWER BREMEN PRO

► „Stepping Stones into Space“ - Microgravity / Partial-gravity for Research, Technology Tests, and Mission Preparations



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Acknowledgements



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