UN FELLOWSHIP PROGRAM - DROPTES
@THE BREMEN DROP TOWER

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ZARM Drop Tower Operation and Service Company
UNOOSA Webinar, June 09, 2021
Content

- Bremen Drop Tower
- Drop Tower Experiment Series (DropTES)
- GraviTower Bremen Pro
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

- Experimenter’s Integration Area / Payload Services
Bremen Drop Tower

- Experimenter’s Integration Area / Payload Services

Standard Capsule Versions:

- payload masses -

- catapult
- 165 kg

- short
- 265 kg

- long
- 225 kg
Bremen Drop Tower

**RESEARCH AREAS**

- Combustion
- Fundamental Physics
- Fluid Dynamics
- Astrophysics (Planet Formation)
- Materials Sciences
- Biology
- Hardware Tests
- Student Programs
- Chemistry

- *fundamental research*
- *technology development (mission preparations)*

**FACTS AND FIGURES**

- **start of operation:** September 1990
- **number of drops / catapult launches:** over 9000 performed
- **number of drop tower projects:** over 230 assisted
- **framework contractor of**
Bremen Drop Tower

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fundamental research

technology development

(mission preparations)

DROP YOUR THESIS!

REXUS / BEXUS
Content

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Drop Tower Experiment Series (DropTES)

- **General Program Information**
  - UNOOSA - Access to Space for All Initiative
  - Annual Science Activity at the Bremen Drop Tower, 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
  - open to student research teams from entities that are Member States of the United Nations
  - allows to realize a real microgravity research project
  - shall be an integral part of the student’s syllabus, e.g. as Bachelor, Master and/or PhD theses
  - follows space project guidelines (proposal, reports, reviews)
  - each drop tower experiment series consists of five drops or catapult launches
  - travel, accommodation, and drop tower utilization are sponsored
  - program language: English / program duration: usually 1 year
  - technical support by ZARM

- Fiber-Coupled Passively Cooled cw Diode Lasers
  - Features:
    - High optical output power of 45 W cw
    - Fiber core diameter: 400 \( \text{m} \) / 600 \( \text{m} \) (NA 0.22)
    - Long lifetime > 20,000 h, high reliability
    - Passively cooling with integrated TECs
  - Applications:
    - Pumping of solid-state lasers and fiber lasers
    - Material processing in industry
    - Medical applications
Drop Tower Experiment Series (DropTES)

- **Selection Process:**
  - proposal evaluation by selection board (UNOOSA, DLR, and ZARM)
  - one research team per DropTES cycle will be selected each year

- **Experiment Preparation (Home Laboratory):**
  - assisted by ZARM (consulting, drawings, manufacturing of hardware)

- **Experiment Series (Bremen Drop Tower):**
  - experiment integration (drop tower capsule) - first week
  - experiment drops or catapult launches - second week

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| Feb | -> | June | July | Aug | -> | Nov | -> | Feb +1 | May +1 | June +1 | Sep +1 |
|-----|----|------|------|-----|    |     |     |     |       |        |        |       |
|     |    |      |      |     |     |     |     |     |       |        |        |       |

- Announcement of Opportunity
- Selection
- Experiment Preparation
- PDR
- 1. Report
- CDR
- 2. Report
Drop Tower Experiment Series (DropTES)

Bremen Drop Tower

Drop Tower Experiment Series (DropTES)

GraviTower Bremen Pro
GraviTower Bremen Pro (GTB Pro)

- over 12 experiments per hour
- 2.5 s in microgravity
  - partial-g: Moon / Mars
- „rail-guided system“
  - rope drive
    (hydr. winches)
- standard capsule
  - synergy with Bremen Drop Tower
GraviTower Bremen Pro (GTB Pro)

- over 12 experiments per hour
- 2.5 s in microgravity
- standard capsule
  - synergy with Bremen Drop Tower
GraviTower Bremen Pro (GTB Pro)

- over 12 experiments per hour
- 2.5 s in microgravity
- standard capsule
  - synergy with Bremen Drop Tower
GraviTower Bremen Pro (GTB Pro)

- over 12 experiments per hour in low gravity
- standard capsule
- synergy with Bremen Drop Tower

2.5 s in microgravity - partial-g: Moon / Mars

rail-guided system - rope drive (hydr. winches)

standard capsule - synergy with Bremen Drop Tower
GraviTower Bremen Pro (GTB Pro)

Next Steps

- finalizing software, May - June, 2021
- assembling slider and subsystems, integration of slider and subsystems, June - August, 2021
- testing completed GTB Pro, September, 2021
- expected availability, end of Q3 / beginning of Q4, 2021

⇒ available for DropTES 2022
⇒ apply until June 30, 2021
⇒ drive dynamics better as simulated
Thank you very much for your Attention