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TOWARDS A GROUND-BASED PARTIAL-GRAVITY PLATFORM AND BIG SCIENTIFIC DATA  
WITH THE GRAVITOWER BREMEN PRO**Abstract**

Since the beginning of the year 2022, the GraviTower Bremen Pro (GTB Pro) represents ZARM's new next-generation drop tower system, which makes use of a rail-guided rope drive being able to perform over 80 short-term microgravity experiments per hour. Its technology is based on a commercial hydraulic winch system with more than 4000 hp of engine power that moves a rail-guided drag shield in a 16 m high tower, upwards and downwards.

With its novel and sophisticated Release-Caging-Mechanism (RCM), the actively driven GraviTower located in the integration hall of the Bremen Drop Tower is capable to control heavy payloads in a very smooth and precise manner. The RCM developed and patented by ZARM also enables a fast and reliable decoupling as well as re-coupling of the experiment capsule inside the drag shield. Due to the fact that the standard capsule (the short and respectively catapult capsule structure) of the Bremen Drop Tower is utilized, high synergy effects are given between both, the Bremen Drop Tower and GraviTower Bremen Pro. It means a simple switching between all operation modes (drop, catapult, or GraviTower) with the same experiment capsule.

In this paper, we will give an overview about ongoing development projects on the GTB Pro. The first project is dedicated to the next version of the RCM offering precise partial-gravity capabilities, like gravity levels on Moon and Mars. With such an additional GTB Pro operation mode, exploration research and technology developments (e.g. ISRU technologies) can be pursued targeting on early preparations of space missions, e.g. to our next destination - the Moon. The second project is concentrated on the implementation of artificial intelligence (AI) and machine learning (ML). It means a novel way to generate and handle big scientific data with a microgravity / partial-gravity platform, the GTB Pro, which is capable of providing very high experiment repetitions.