

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Microgravity Experiments from Sub-Orbital to Orbital Platforms (3)

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THE PATHWAY TO LAUNCH THE MAIUS-2/3 PAYLOAD ON A SOUNDING ROCKET

Abstract

After a successful launch of the first sounding rocket mission housing experiments on matter-wave interferometry, MAIUS-1 (Materiewellen-Interferometrie unter Schwerelosigkeit – Matter-Wave Interferometry under Microgravity) two sounding rocket missions, MAIUS-2 and MAIUS-3, are planned to perform sequential and simultaneous dual-species atom interferometry with Bose-Einstein condensates (BEC) of Potassium-41 and Rubidium-87. The scientific payload of the MAIUS missions will be launched on-board a VSB-30 sounding rocket from Esrange in Sweden. This allows for approximately 360 s of microgravity conditions and therefore offers a microgravity environment for experiments on timescales not accessible in ground based experiments.

During ascent of the rocket, vibrational loads of up to 1.8 g RMS in the frequency range of 20-2000 Hz and accelerations of up to 13 g can occur. Furthermore, static loads, caused by the re-entry and the landing, can be as high as 50 g. Both missions MAIUS-2 and MAIUS-3 fly the same payload. The five main subsystems - physics package, laser system, electronics, laser electronics, and the batteries need to withstand this challenging environment.

This paper will present the final design of each subsystem and the overall payload after the successful payload Critical Design Review (CDR) at the end of 2018. Additionally, it shows the results of the vibration tests of the subsystems of MAIUS-B already performed at the shaker test facility at the center of Applied Space Technology and Microgravity (ZARM) in Bremen.

Furthermore, the finalized thermal concept as well as the concept for the water and the electronic umbilicals will be discussed in detail. In addition, the ground support equipment for the launch campaign as well as the next steps towards the launch of MAIUS-2 (2020) and MAIUS-3 (2021) will be introduced.