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CARIOQA industrial partnerships:
Recap of two-day workshop in Bremen on the Physics Package

Some of the technologies being developed as part of CARIOQA are still at a low Technology Readiness Level (TRL). A key challenge of the project is therefore to raise several new technologies to at least TRL 6 by the end of Phase B. The Physics Package is one of the critical elements to be developed, requiring strong and coordinated efforts from all partners. The Physics Package is the core of the instrument: it contains the ultra-cold atoms and hosts the measurement process.

Picture of the Thales Alenia Space (TAS), ZARM and CNES teams in front of the Bremen Drop Tower, which offers the possibility to conduct advanced research in microgravity and serves as an essential test facility for validating certain concepts before exposing them to their operational environment.

The preparation of the ultra-cold atomic ensemble is performed through several steps involving interactions with magnetic, optical, and high-frequency fields. In addition, the ensemble must be isolated from external disturbances such as magnetic fields and atomic collisions. This requires operation in an ultra-high-vacuum environment surrounded by a magnetic shielding system. That's why face-to-face co-engineering sessions at the ZARM facilities was identified as a priority at the beginning of Phase B.

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"From the perspective of CNES, this visit to ZARM was highly productive, focusing on the Physics Package development and the challenges it presents. This meeting was instrumental in fostering stronger interactions between our teams and aligning our technical approaches. We took part in detailed discussions that allowed us to better understand each other's perspectives on key technical aspects. The face-to-face interaction was crucial in bridging any gaps and ensuring a smoother collaboration. The insights gained will significantly enhance our joint efforts and drive the project forward. Overall, the meeting was a valuable step in strengthening our partnership and move the project forward."

Thomas Leveque - CNES: CARIOQA Instrument Coordinator

"The Center of Applied Space Technology and Microgravity (ZARM) at the University of Bremen has gathered the expertise in building cold atom instruments for space missions. With the face-to-face meeting in Bremen, and the intense technical discussions that took place, an important cornerstone was set. One of the project's work modules defines the development and qualification of components for the Physics Package and maturing key subsystems. Nevertheless the trade-offs to be made for the instrument interfaces and the performance of the atom interferometer are crucial next steps. ZARM had the chance to meet the team from CNES, DLR and TAS for the first time and can now proceed with the technical specification of the Physics Package. It was a real pleasure to host the team and organise the meeting."

Marvin Warner - ZARM: Physics Package Engineer

"For TAS, it is clear that such major developments progress more efficiently when all parties can interact directly and with full transparency. This was fully the case during these two days, with efficient exchanges on all identified topics. It is important to keep in mind that the Physics Package core (where the atomic trajectories are located) must be accommodated at the centre of mass of the platform in order to limit the bias induced by the satellite nadir rotation on the acceleration measurement. Therefore, strong engineering interactions will be required to optimise the instrument accommodation within the satellite platform and ensure the best performance. It was also the opportunity to meet partners' direct suppliers for the Physics Package and software, and to visit the ZARM laboratories where the future CARIOQA Physics Package will be developed."

Thierry JEANNET - TAS : CARIOQA Project Manager

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