Ref. Number: GT17-187MM **Original Budget: 2,000 K€**
Proposed Budget: 4,000 K€

Original Activity: Quantum Technologies for Space (ESA/IPC(2019)61,add.3).

Original Objectives and Description:
The aim of this activity is to provide a framework in which economic operators can improve the reliability and time-to-market of quantum technology applications and products for space while benefiting from the expertise and know-how of a recognised applied research organisation, experienced in the complex nature of quantum experiments and space engineering.

Quantum technology is in the process of moving from laboratory testing to early applications. It makes use of some of the properties of quantum mechanics, especially quantum entanglement, quantum superposition and quantum tunnelling, for practical applications such as computing, sensors, cryptography, metrology and imaging. The different way of interacting with quantum systems promises entirely new applications as well as revolutionary advances in performance in existing ones.
In particular, Quantum technologies can be mapped as mission enablers against a number of space applications. Cold-atom based technologies are used to perform metrology of unprecedented accuracy and precision, enabling the next generation gravity-mapping missions, novel fundamental physics missions, and future navigation missions. Entangled photon states enable fundamental physics missions and quantum encryption applications.

As an example, the next envisaged quantum payload development relates to the use of cold-atom interferometry for a future Earth gravity mapping mission. Payload definition and technology development activities are already ongoing and the first subsystems have undergone testing campaigns at the beginning of 2019, while the first instrument integration and optimisation efforts could start as early as 2020.
Still, developing quantum technologies for space has proven extremely complex and, so far, has tended to be marred by major cost overruns and schedule slippages. Therefore, the overall approach of this framework is to utilise the expertise from a recognised applied research organisation in a number of support activities needed to further develop quantum technologies for space and ultimately bringing quantum payloads to space.
Depending on current TRL and available funding the main tasks of the support activities may include any of the following:

- materials, technology and process screening;
- design optimisation;
- subsystem testing;
- interface definition / optimisation;
- instrument / payload assembly,
- integration and verification (AIV) performed in the framework of a suitable model philosophy, culminating in the Flight Model.

In the context of this framework, up to 8 technology development activities will be implemented, with a maximum budget of 250 K€ and a maximum duration of 12 months per activity.

Original Deliverables: Analysis report, design report, breadboard.