SPACE SYSTEMS SYMPOSIUM (D1)
Enabling Technologies for Space Systems (2)

Author: Mr. David Binns
European Space Agency (ESA), The Netherlands

Mr. Matthew Bullock
European Space Agency (ESA), The Netherlands
Mr. Nicola Rando
European Space Agency (ESA), The Netherlands
Mr. Joerg Callies
European Space Agency (ESA), The Netherlands
Mr. Clifford Ashcroft
European Space Agency (ESA), The Netherlands
Mr. Lucio Scolamiero
European Space Agency (ESA), The Netherlands
Mr. Eike Kircher
European Space Agency (ESA), The Netherlands

TECHNICAL SUMMARY OF THE FUTURE TECHNOLOGY ADVISORY PANEL (FTAP) FIRST CYCLE: ULTRA-STABLE DEPLOYABLE STRUCTURES, COLD ATOM DEVICES AND OTHERS

Abstract

The Future Technology Advisory Panel (FTAP) is part of ESA's science advisory structure. It is composed of external technology experts, selected for their broad technical knowledge, and ESA scientific advisory structure representatives. FTAP was introduced by the European Space Agency to support it identifying technology which would enable advanced new science. The panel selected 6 topics (Ultra-Stable Deployable Structures (USDS), Cold Atom Devices, Formation Flying, Infrared Detectors, Lasers and Large Mirrors).

Cold Atom Devices (optical clocks and atom interferometers) and Large Ultrastable Structures (bringing together ultra-stable deployable structures, large monolithic mirrors, nanometer metrology) were recommended. An overview of the others is presented for completion.

USDS offer an alternative to formation flying providing long baseline interferometry and large focal lengths for synthetic aperture radar and telescopes respectively. USDS is defined as a technology which enables deployment of a large structure, bypassing launch fairing restrictions and providing sub-millimetre stability over tens of metres. In the Earth Observation domain the benefits of large structures could enable larger antennae for Ka-Band SAR, Ku-Band SAR applications and Optical Aperture Synthesis for very high resolution (visible to IR) observations from geostationary orbit. Astrophysical observatories could be able to utilise USDS to accommodate large focal lengths particularly for X-ray and Gamma Ray astronomy, Exo-planet Astrometry observations and perhaps further in the future Far-IR imagery using large baseline interferometry. Three technology approaches were considered: Truss like structures, articulated booms and telescopic booms. To support both space science and Earth observation activities of ESA, commonality was assessed, to determine if the development programme could be shared.

Cold Atom Devices encompasses atomic interferometry and optical clocks. Such devices depend on high finesse cavities, trapping atomic species and interrogating them with lasers. Breakthroughs are needed in magnetic trapping technology and very highly stable lasers. The long term stabilities required could

be in the order of 10e-18 and differential accelerations of 10e-15 between atomic species are of scientific interest for science return for missions testing general relativity and the Weak Equivalence Principle.

Formation flying and rendezvous can be separated into two main areas separated by whether the target object/spacecraft is cooperative or un-cooperative. The applications are mission such as Mars Sample Return and Next Generation geodesy missions.

The paper summarises the requirements and recommendations for the development approach of USDS and Cold Atom Interferometry. The overall objective is to explain the link between advanced science requirements and the needed technologies.