Steps toward first free-flying in-orbit cold atom Interferometer

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Cold Atoms Space Payload (CASPA) is a technology demonstration which aims to overcome technology readiness level (TRL) barriers that are preventing cold atom sensor adoption in space. This runs in parallel to another project, Quantify, being carried out by the UK National Quantum Technologies for Sensors and Metrology Hub to investigate the technological challenges and opportunities from utilising cold atom interferometers in low Earth orbit.

CASPA is the only proposed mission that Teledyne e2v are aware of that aims to demonstrate cold atom technology in a free-flying space environment.

CASPA is a cold atom system designed and built to fit inside a 4U envelop of a 6U (10x20x30cm) CubeSat and be autonomously controlled to produce a ^{87}Rb cold atom cloud within a miniaturised vacuum system and MOT design.

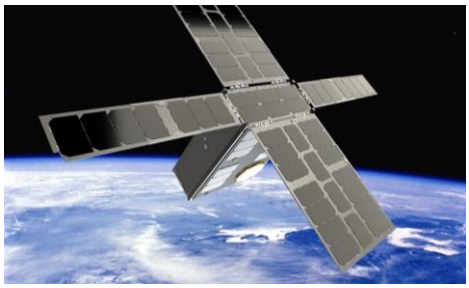

Figure 1: CAD graphic showing CASPA CubeSat during low-orbit flight. Solar panels can be seen on the system's wings to generate additional power to recharge onboard batteries. Copyright © 2017 Clyde Space Ltd. All rights reserved.

In order to realise this system, a bespoke design was created, minimising size and weight, with low power consumption. This system includes the automation and control algorithms to run such an experiment.

Figure 2: CAD graphic showing system architecture including Physics Package, Avionics, Laser and electronics module.

Prospective applications include use in inertial navigation, timing, attitude detection and gravity sensing.

CASPA is a collaborative project between Teledyne e2v, University of Birmingham, XCAM, Clyde Space, Gooch & Housego, Covesion and University of Southampton with funding from Innovate UK and EPSRC.

Keywords: Cold Atoms, Space, Interferometry, CubeSat, Inertial Navigation, Gravity Sensing