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A HIGHER SCIENCE RETURN WITH MODULAR INSTRUMENTS?

Abstract

Technology is moving fast. The development of a high end facility takes time, creating the risk that it will be slightly outdated as soon as it is ready. Based on the same principle, and because not all equipment fits in a cubesat, multi-user instruments have been build that allow exchange of science materials. With two instruments in orbit (SODI and Transparent Alloys) and the COLIS flight model integration ongoing, a reflection can be made highlighting the benefits and drawbacks of this approach.

SODI has been operational for 10 years and has successfully completed 5 test campaigns. Transparent Alloys' third set of cartridges is to be processed next month. After test, the instrument is stowed. Once in orbit, the benefits are clear; the preparation and qualification of another set of cartridges or cells can be completed in six to nine months. A quick, low cost project with high technology science return.

So what does it take to build a multi-user instrument? The three instruments developed by QinetiQ Space are to be operated inside the Microgravity Science Glovebox, which defines the allowable envelope, available power and the maximum thermal dissipation. With different prime investigators, each focusing on a different aspect, setting the baseline requirements is the most difficult part. A solution is to be found with minimal compromises. As most scientific materials pose a toxic hazard, the design will be complicated even more as all levels of containment are to be maintained, even when exchanging materials. SODI and COLIS use static cells with lots of windows to ensure accessibility to all camera's, whereas Transparent Alloys houses a dynamic process making use of a double sealed door mechanism to slide the cartridge in and out of the instrument.

It should be clear, increased complexity takes time. Time to understand all the needs, to create a compliant design, to fit all elements during integration and to fully validate all functionalities. Building a multi-user instrument takes several years and comes with a cost, but also with added value. The more experiment can be processed, the higher it's added value.

The largest risk currently seen is the mismatch between an instrument's design lifetime and the schedule of all next experiments. Let's aim for a life extension similar to SODI to obtain a maximum science return.