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DECLIC: ON ITS WAY TO DECLIC-EVO

Abstract

DECLIC is a multi-user facility to characterize critical fluids behavior and directional solidification growth structures of transparent alloys.

As part of a joint NASA/CNES physical science / material science / microgravity research program, the DECLIC mini-laboratory has been operated onboard the ISS since October 2009. Housed inside a NASA science rack, DECLIC operates three experiment inserts in turn for periods of 3 to 6 months: HTI (High Temperature Insert, studying critical water), ALI (Alice Like Insert, studying critical sulfur hexafluoride) and DSI (Directional Solidification Insert). Experiments are monitored and controlled from CADMOS control center at CNES in Toulouse, France. The initial scientific program has been completed, and the R (for refurbished inserts) program is under way.

After a 2-year period back on Earth for maintenance (due to a major anomaly on a communication board that occurred in September 2014), DECLIC was sent aloft and returned to the ISS on 17 October 2016 with Orbital's CRS-05. Operations successfully resumed in November 2016, with 6 HTI-R sequences (Nov. 2016-July 2017) followed by DSI-R sequences. However, a laser failure in November 2017 degrading a key interferometric diagnostic significantly impacted the current and planned scientific schedule: as a consequence of the laser failure, it has been decided to return DECLIC facility to the ground at the end of 2018 (once extra DSI-R and ALI-R sequences have been done without interferometric measurements) to have it repaired and upgraded into DECLIC-EVO (for EVOlution). That upgraded facility -which should re-fly early 2021- combined with promising scientific results is paving the way to new perspectives and horizons. It would allow the completion of the full DECLIC scientific program (R and R2 series), as well as new identified scientific objectives hosted in newly developed inserts, to cover at least until 2024, if not beyond. This extended NASA-CNES mission could, among other things, focus on waste disposal for future long-duration crewed spaceflights, using 'supercritical' water to disassemble organic molecules (clean combustion).

This paper aims at presenting the current status on science and operations, plans and strategy for DECLIC-EVO repair and upgrade, and an overview plan for the new scientific objectives.