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Author: Dr. Nicholas H. Crisp
The University of Manchester, United Kingdom, nicholas.crisp@manchester.ac.uk

LAUNCH, OPERATIONS, AND FIRST EXPERIMENTAL RESULTS OF THE SATELLITE FOR ORBITAL AERODYNAMICS RESEARCH (SOAR)

Abstract

The Satellite for Orbital Aerodynamics Research (SOAR) is a 3U CubeSat that has been designed to investigate the aerodynamic performance of different materials at low orbital altitudes. The spacecraft has been developed within the scope of DISCOVERER, a Horizon 2020 project that aims to develop foundational technologies to enable sustainable operations of Earth observation spacecraft in very low Earth orbits (VLEO) i.e., those below 450 km.

SOAR features two payloads: i) a set of steerable fins that can expose different materials to the oncoming atmospheric flow developed by The University of Manchester, and ii) a forward-facing ion and neutral mass spectrometer (INMS) that provides in-situ measurements of the atmospheric density, flow composition, and velocity from the Mullard Space Science Laboratory (MSSL) of University College London. These payloads enable characterisation of the aerodynamic performance of different materials at very low altitudes with the aim to advance understanding of the underlying gas-surface interactions in rarefied flow environments. The satellite will also be used to test novel aerodynamic attitude control methods and perform atmospheric characterisation in the VLEO altitude range.

SOAR will perform the first in-orbit test of two novel materials that are expected to have atomic oxygen erosion resistance and drag-reducing properties, providing valuable in-orbit validation data for ongoing ground-based experimentation. Such materials hold the promise for extending operations at lower altitudes with benefits particularly for Earth observation and communications satellites that can correspondingly be reduced in size and cost.

The platform for SOAR is largely based on GOMX-3 heritage and the spacecraft was assembled, integrated, and tested by GomSpace A/S. The satellite has been delivered for integration and launch on the SpX-22 commercial resupply service mission to the International Space Station in Q2 2020 (scheduled 3nd June 2021) and will be deployed into orbit shortly thereafter.

This paper will present the final preparations of SOAR prior to launch and provide an overview of the planned operations of the spacecraft following deployment into orbit. The first in-flight results will be presented as they become available.

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