31st IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Space Science Missions (2)

Author: Ms. Abigail Harvey
Surrey Satellite Technology Ltd (SSTL), United Kingdom, aharvey@sstl.co.uk

Mr. Luke Middlemass
Surrey Satellite Technology Ltd (SSTL), United Kingdom, lmiddlemass@sstl.co.uk
Mr. Jonathan Friend
Surrey Satellite Technology Ltd (SSTL), United Kingdom, jfriend@sstl.co.uk
Prof. Neil Bowles
University of Oxford, United Kingdom, neil.bowles@physics.ox.ac.uk
Dr. Tristram Warren
University of Oxford, United Kingdom, Tristram.Warren@physics.ox.ac.uk
Mr. Steve Eckersley
Surrey Satellite Technology Ltd (SSTL), United Kingdom, seckersley@sstl.co.uk
Mr. Steven Knox
Surrey Satellite Technology Ltd (SSTL), United Kingdom, sknox@sstl.co.uk
Mr. Ben Hooper
Surrey Satellite Technology Ltd (SSTL), United Kingdom, bhooper@sstl.co.uk
Mr. Alex da Silva Curiel
Surrey Satellite Technology Ltd (SSTL), United Kingdom, acuriel@sstl.co.uk
Dr. Keith Nowicki
University of Oxford, United Kingdom, keith.nowicki@physics.ox.ac.uk
Dr. Katherine Shirley
University of Oxford, United Kingdom, katherine.shirley@physics.ox.ac.uk
Prof. Martin Sweeting
Surrey Satellite Technology Ltd (SSTL), United Kingdom, m.sweeting@sstl.co.uk

LIRIS – LUNAR INFRARED IMAGING SYSTEM FOR HIGH RESOLUTION VOLATILE MAPPING, A SMALL SATELLITE TO SUPPORT SCIENCE AND EXPLORATION MISSIONS

Abstract

Lunar InfraRed Imaging System (LIRIS) is a mission concept selected for evaluation for the ESA Open Space Innovation Platform call for "Small Missions for Exploration – Destination the Moon". Using proven infrared imaging techniques in low lunar orbit, the LIRIS short/mid wave infrared multispectral imager will produce images that improve on spatial resolution of existing data sets by more than an order of magnitude. This will be supplemented by the complimentary thermal context provided by the Lunar Thermal Mapper, to provide actionable science data for lunar volatile mapping, human activity monitoring and to support upcoming In Situ Resource Utilisation missions.

The LIRIS small satellite concept builds on experience from the Lunar Pathfinder development to design a variant of the Carb+ platform series tailored for the lunar environment. Building on heritage from the DarkCarb imager flown in 2023, the multispectral imager will be capable of providing sub-meter resolution images of the lunar surface in spectral bands around 3μm - the region of the OH/H2O spectral feature. In addition, the spacecraft will host a thermal infrared imager, capable of imaging in the 6-

25μm range, an evolution of the University of Oxford's Lunar Thermal Mapper (flying on NASA's Lunar Trailblazer in 2024) to provide thermal context for environment and surface composition characterisation.

Discoveries of lunar resources and agency directives including the Artemis Accords and the ESA Terrae Novae roadmap have inspired an increase in exploration missions over the next decade. It is anticipated that during the late 2020s and early 2030s, there will be a push for lunar surface missions for exploration and resource investigation, to understand how lunar materials could be utilised to improve life on Earth and to assist exploration of the wider solar system. Advancements in technology, improved lunar infrastructure (including services such as ESA's Moonlight) and increased accessibility enabled by lower cost rideshares, open the field for small satellite missions which can transform the future of the lunar mission landscape enabling valuable science at lower cost and risk.

LIRIS aims to be a reactive mission capable of providing actionable science data. The spatial resolution will enable observation of activity on the lunar surface and detection of disruption to the regolith and displacement of volatiles, supporting the monitoring of safe and sustainable operations and promoting the preservation of outer space heritage. This paper will describe the details of the concept and science case, and the status of the study.