STATUS OF THE RADIO OBSERVATIONS AT LUNAR SURFACE OF PHOTOELECTRON SHEATH PAYLOAD. R. J. MacDowall[1], W. M. Farrell[1], D. C. Bradley[1], and J. Burns[2], [1]NASA/GSFC, Greenbelt, MD, [2] Center for Astrophysics and Space Astronomy, University of Colorado Boulder, (robert.macdowall@nasa.gov).

Introduction: The status of the NASA Provided Lunar Payload (NPLP) Radio wave Observations at the Lunar Surface of the photoElectron Sheath (ROLSES) will be described in some detail. The payload has been designed at NASA/Goddard Space Flight Center, and will be assembled as soon as possible, while dealing with COVID-19. The lander that will take it to the lunar surface is the NOVA-C lander from Intuitive Machines (IM), Houston, TX. The figure at right shows a model of the NOVA-C, with payloads mounted on the exterior.

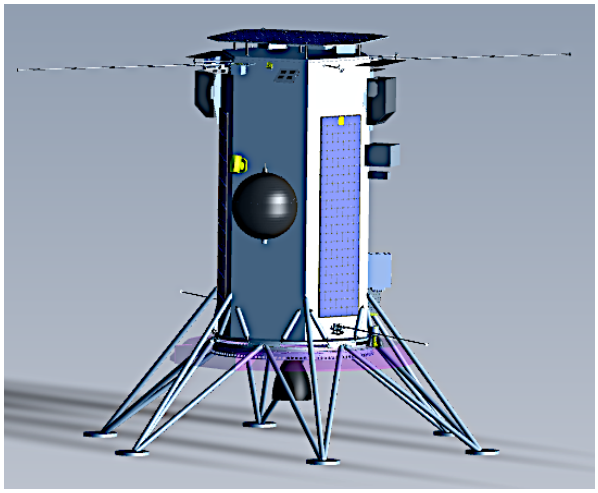
Status: ROLSES consists of 5 payload components, the Main Electronics Box, and four Stacer antenna units, each with a front-end electronics box. The locations of the four Stacer antennas are shown on the lander figure at right. The detailed design of each of the 5 components is completed, but final assembly and testing will be delayed by the NASA/GSFC center closure for all team members. We may be able to complete assembly and testing to allow us to deliver ROLSES to IM as scheduled by 12 Nov 2020. IM indicates our payload will be integrated by 9 June 2021. The IM launch is planned for 13 October 2021, with a 14-day mission on the lunar surface, ending 31 Oct 2021.

Parameters: The ROLSES frequency range is 10 kHz - 30 MHz, using 2 bands from 10 kHz - 1 MHz and 300 kHz - 30 MHz; the data bandwidths will be ~1.9 kHz and 58 kHz, respectively. It will acquire 32-bit data with a time resolution of 4 seconds alternating for each of the two high and two low Stacers. The resulting data rate is 17 kbps, which is the maximum rate that IM plans to provide.

Data and Preparation: ROLSES will determine the photoelectron sheath density from ~1 to ~3 m above the lunar surface, using wave activity and radio source attenuation. The photoelectron density at ~1 m above the lunar surface is modeled to be ~5 x 10^7 m^{-3}, corresponding to electron plasma frequency (f_{pe}) ~ 64 kHz. We are currently reviewing the details of ROLSES measurement of the plasma frequency at heights of 1 and 3 meters, to ensure the results.

The other science goals of ROLSES are demonstration of the detection of solar, planetary, and other radio emission from lunar surface (10 kHz – 30 MHz); measurement of any interplanetary/interstellar dust impacts on the antennas or lander; and measurement of reflection of incoming radio emission from lunar surface and below, to permit some understanding of its structure.

The technical goal of ROLSES is to measure the present range and intensity of terrestrial radio frequency interference (RFI) reaching the lunar surface. This RFI has a negative impact on future, near-side radio observatories for solar radio bursts or terrestrial radio emission. It is important to know the details of this RFI.



The figure above shows the NOVA-C lander with several payloads, including our four deployed Stacer antennas. Two are mounted at ~1 m above the lunar surface; the other two are mounted at ~3 m above the lunar surface. Their front-end electronics units are all connected to the Main Electronics Box, which is not shown.

Summary: The progress for ROLSES development, as a new instrument, has proceeded well, although as of mid-March the closure of NASA/GSFC, due to COVID-19, has interrupted assembly. We are currently planning to deliver the board designs and components to a commercial company that is still working, and have them assemble the boards for us. Then we will conduct the testing of ROLSES when GSFC reopens, planning to complete testing by Nov 2020.