THE RADIO-QUIET CONE ABOVE THE FARSIDE OF THE MOON AND THE "RLI" SPACE MISSION

Claudio Maccone

Co-Vice Chair, SETI Permanent Study Group of the International Academy of Astronautics
Address: Via Martorelli 43 - Torino (Turin) 10155 - Italy
E-mail: **clmaccon@libero.it**

Abstract. The Farside of the Moon is a unique place. Radio emissions coming from the Earth, and notably the from Telecommunication Satellites orbiting the Earth, don't get there since they are all shielded by the Moon's spherical body. A radio telescope located inside Crater Daedalus (just at the center of the Farside) would thus sense no man-made RFI (Radio Frequency Interference) and would be ideal for radio astronomy and SETI searches. The selection of crater Daedalus as the optimal place for a future "Moon Farside Radio Lab" was the central topic of a "Cosmic Study" commissioned to this author by the International Academy of Astronautics (IAA).

Above the Farside itself, a conical region extends into space, called by this author the "Quiet Cone", that is tangent to the Moon surface and has its apex approximately some 16,000 km from the center of the Moon. This region too is radio-quiet because shielded by the Moon spherical body. This author proved mathematically that a satellite orbiting the Moon at less than, say, 10,000 km from the surface and in a plane along the Earth-Moon axis, would cross the Quiet Cone for a time that in no case may exceed 42 minutes. Thus, a radiometer installed aboard such a satellite of the Moon could explore for the first time how quiet is actually the radio sky above the Farside of the Moon. This space mission would pave the way to the future landing of a radio telescope inside crater Daedadus.

Such a Moon orbiting radiometer is the RLI, an acronym for the three Italian words "Radiometro Lunare Italiano", currently under construction in Italy. This author was the originator of the RLI project. Paul Blase of TransOrbital, Inc., was looking in 2001 for some good scientific application of the TrailBlazer space mission, that is the first American commercial space mission to the Moon, fully described at the web site http://www.transorbital.net/TB2k1_C.html. Blase approached Maccone, and the result was the RLI concept. Blase and Maccone presented a joint paper at the Houston World Space Congress in October 2002. In the fall of 2002, this author gathered in Italy the support of what is now the RLI Team, a group of some 10 engineers and technically skilled people. The RLI design is technically led by senior engineer and amateur radio astronomer Flavio Falcinelli, http://www.radioastrolab.it/default.html. Salvo Pluchino, Domenico Caliendo, Luca Derosa, Davide Bruzzi, Dario Kubler, Giovanni Greatti, Corrado Marchetti, Diego Sappa and others actively contributed to the design the RLI. Distinguished contributions also came from the Director of the CNR Radiotelescopes located at Medicina (near Bologna), Ing. Stelio Montebugnoli, and from his staff, notably from Ing. Jader Monari and Dott. Marco Poloni, http://www.ira.cnr.it/.

Essentially, the RLI will work in two different bands: the SHF band and the triple ULF-ELF-VLF band:

1) SHF band, more precisely the bandwidth in between 10.7 and 11.8 GHz. This is a radiometric measurement of the "total power" emitted on the surface of the Earth by the European television network and, in part, also by the American television network. The signal integration will be done by a suitable series of electronic devices. A huge difference of some 100 dB or more is expected in the total power when RLI will be facing the Earth vs. when it will be inside the Quiet Cone. A precise measurement of this kind was never done before (except possibly by secret military spacecraft) and will help the future Lunar Farside Radio Lab.
2) ULF-ELF-VLF band, more precisely the bandwidth in between 10 Hz and 10 kHz. These radiometric measurements will give a better understanding of the phenomena of the very thin Moon atmosphere. The relevant receiver will have a direct amplification and a low noise, characterized by a well-defined band-pass. FFT spectral analysis will be performed by either the on-board or by the on-the-ground computer. The antenna utilized in this frequency bandwidth will be made by a solenoid having a suitably insulated and shielded ferrite core.

This paper is a technical description of the RLI space mission.