

IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
Space-based PNT (Position, Navigation, Timing) Architectures, Applications, and Services (1)

Author: Prof. Fabio Dovis  
Politecnico di Torino, Italy, fabio.dovis@polito.it

Dr. Andrea Nardin  
Politecnico di Torino, Italy, andrea.nardin@polito.it

Dr. Alex Minetto  
Politecnico di Torino, Italy, alex.minetto@polito.it

Dr. Claudia Facchinetti  
Italian Space Agency (ASI), Italy, claudia.facchinetti@asi.it

Mr. Mario Musmeci  
ASI - Italian Space Agency, Italy, mario.musmeci@asi.it

Mr. Giancarlo Varacalli  
Italian Space Agency (ASI), Italy, giancarlo.varacalli@asi.it

Mr. Joel Parker  
NASA, United States, joel.j.k.parker@nasa.gov

Ms. Lauren Konitzer  
NASA, United States, lauren.konitzer@nasa.gov

Mr. Siddhartha Sanathanamurthy  
NASA Goddard Space Flight Center Greenbelt MD 20771, United States,  
siddhartha.sanathanamurthy@nasa.gov

Mrs. Lisa M. Valencia  
NASA, United States, lisa.m.valencia@nasa.gov

Mr. James Miller  
National Aeronautics and Space Administration (NASA), United States, jj.miller@nasa.gov

Mr. Frank H. Bauer  
NASA Goddard Space Flight Center Greenbelt MD 20771, United States, frank.h.bauer@nasa.gov

Dr. Samuele Fantinato  
Italy, samuele.fantinato@qascom.it

Mr. Efer Miotti  
Italy, efer.miotti@qascom.it

Ms. Matilde Boschiero  
Qascom s.r.l, Italy, matilde.boschiero@qascom.it

Dr. Matteo Pulliero  
Qascom s.r.l, Italy, matteo.pulliero@qascom.it

Mr. Simone Tedesco  
Italy, simone.tedesco@qascom.it

Mr. Fabio Bernardi  
Italy, fabio.bernardi@qascom.it

MISSION STATUS AND UPDATES ON THE LUNAR GNSS RECEIVER EXPERIMENT

## Abstract

The use of in-orbit Global Navigation Satellite Systems (GNSS) in the Space Service Volume (SSV), beyond GEO altitudes, has become of great interest in view of the future missions to the Moon. Nevertheless, the usability of Earth GNSS at such distances has been proved only up to around 150,000 km away from the Earth's surface. In July 2020, the NASA-Italian Space Agency (ASI) Lunar GNSS Receiver Experiment (LuGRE) was selected as the 10th payload of CLPS Task Order 19D. In February 2021, NASA awarded this task order to Firefly Aerospace. Firefly's Blue Ghost Mission 1 (BGM1) will deliver LuGRE and the other CLPS 19D payloads to 18.6 N, 61.8 E in the Moon's Mare Crisium. The goal of the LuGRE project is to demonstrate the use of GNSS-based navigation and timing to the Moon, collecting and processing GNSS measurements along the mission. The payload, developed by Qascom srl, consists of a GNSS receiver specially designed and built for lunar applications, and it is based on their low altitude QN400-SPACE receiver product line. It will receive and process both Global Positioning System (GPS) and Galileo signals in the L1/E1 and L5/E5a bands, the results of which will be transmitted to Earth for further scientific processing. In fact, the Science Definition Team (SDT) of the LuGRE project worked in the past year to define a set of 20 science and engineering investigations to be undertaken by the project.. The LuGRE payload was delivered to Firefly in February 2023 and it has been integrated together with the other payloads of the mission. As part of the mission a ground segment is being realized. The main components are Firefly Blue Ghost Mission Control Center (MCC), the Payload Operations Center (POC), the NASA/ASI Science Processing Center (SPC) and the Remote Science Processing Center (RSPC) and Remote Troubleshooting Center (RTC). Real-time operations will occur in the Blue Ghost MCC, where Firefly and LuGRE teams will have access to payload operations terminals. The experiments will be configured and monitored at the POC. The RTC will have the responsibility on the monitoring of receiver functionalities and GNSS data processing. Offline scientific data analyses will occur at the SPCs. All the data gathered from the LuGRE payload on the moon surface will be used released to Scientific community at the end of the mission and will support to further develop GNSS-based navigation systems for future missions to the Moon.