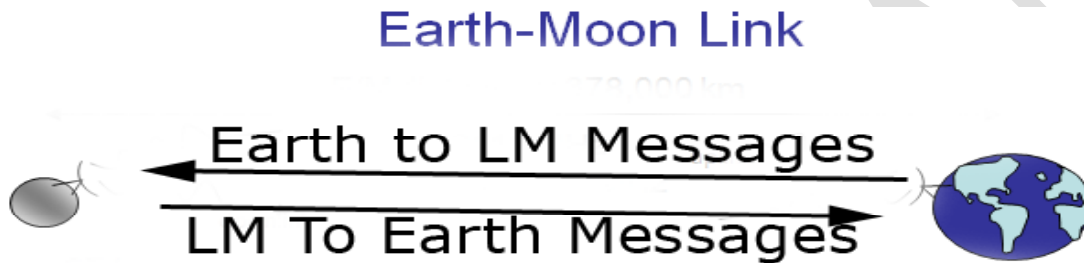


Summary of VagaLune Lunar Module (LM) Communication Message Types

Introduction

The data encoding choices made between a spacecraft and an Earth station dictate the manner in which data is transmitted between them. The VagaLune project will incorporate a proprietary encoding scheme for both Earth station to Lunar Module (LM) and Earth station to Moon Rover (MR). The focus of this document will be to outline the message types that will be exchanged between the Earth station and the LM.



Flight Control Message Types

The Flight Control Messages are used to exchange data from the Flight Control System (FCS) operating on the LM and the Earth station. Also these messages are used to issue commands to the satellite link and override the FCS to make orbital changes.

LM to Earth Station Messages

Current Position Data

Message used for exchanging current position in spherical Earth centric coordinate systems.

Current Velocity Data

Message used for exchanging current calculated velocities.

Current Chronometer Reading

Message used to exchange the current value of the onboard chronometer.

INS State Readings

Message used to relay the current state of the Inertial Navigation System (INS).

Navigation Diagnostic Report

Shows fault codes and status of all INS hardware and software components.

Current Engine / Fuel Status



VAGALUNE PROPRIETARY PROJECT DATA

Message for exchanging the status of the Ion and conventional propulsion systems, and a fuel status of these systems.

Earth Station to LM Messages

Request for Data

Message for requesting the status of the INS, Navigation or Software Report.

Thruster Firing Control

Message for relaying instructions to manually override the FCS and fire the spacecraft thrusters

Flight plan update

Message for transmitting an updated flight plan into the FCS memory

Change reporting settings

Change the intervals at which the LM transmits Status Messages

Flight Termination System (FTS) Initiation Message

Message for initiating the automatic self destruct protocol of the Vagalune probe, initiates handshake and 3-level authentication before initiation of FTS.

Spacecraft Robotic Control Software Message Types

The Spacecraft Robotic Control Software (SRCS) messages are used to gather information on the status of the mechanical systems operating on the spacecraft. Also, they can be used to go issue commands for realignment of the solar panels or LM communications antenna. Lastly, the SRCS messages can be used to issue power management commands to the LM, if the need arises to adjust the power usage due to flight damage then the commands to the power sub system can be exchanged via these message types.

LM to Earth Station Messages

Solar Panel Deployment Status

Message for relaying the current mechanical orientation of the solar panel , as well as a measure of the current generated power from the panels.

Antenna Deployment Status

Mechanical Orientation readings from the LM antenna

Current Power Usage on the LM

Output of onboard power management system, status and reported power draws. Also any reported faults from the power system

Robotic Systems Status Report



VAGALUNE PROPRIETARY PROJECT DATA

Status and Fault Code reporting on any robotic control system.

Earth Station to LM Messages

Request for Data

Message for requesting the status of the Solar Panels, Antenna , Power or Robotic Control Systems.

Manual Position of Solar Panels

Message for relaying the instructions to manually override the SRCS and reposition the solar panels.

Manual Position of Antenna

Message for relaying the instructions to manually override the SRCS and reposition the antenna array.

Power Management control message

Message for adjusting the power management on the LM.

Reporting Interval Update Message

Message for changing the pre-defined message reporting intervals for the SRCS on the LM.

LM Communication Monitoring Software Message Types

The LM Communication Monitoring Software (LMCMS) operates as the software front end on both the LM to Earth station and Earth station to LM communication link. The message types for this sub system focus on the management and status of the communication systems.

LM to Earth Station Messages

Communication Chain Status Messages

Message for relaying the current status of the communication chain, uplink / downlink

Earth Station to LM Messages

Request for Data

Message for requesting the status of the Communications Link.

Reporting Interval Update Message

Message for changing the pre-defined message reporting intervals for the LMCMS on the LM.

LM Lunar Descent and Landing Routine Messages



VAGALUNE PROPRIETARY PROJECT DATA

The LM Lunar Descent and Landing Routine (LDLR) messages are used to issue commands to the LDLR and related sub-systems. Specifically these messages will report the status of the Airbag Landing System (ALS), the explosive -bolt payload-bay opening system and the onboard laser altimeter.

LM to Earth Station Messages

ALS Status

Results of onboard diagnostic check of ALS system.

Payload Delivery Status

Status of explosive bolt payload bay opening system.

Laser Altimeter Status

Status of the onboard laser altimeter

Earth Station to LM Messages

Request for Data

Message for requesting the status of the LDLR systems.

Reporting Interval Update Message

Message for changing the pre-defined message reporting intervals for the LRLD on the LM.

Landing Update Message

Sends updated landing flight path.

Computed Landing Location message

Message for overriding the FCS's positional input into the Moon Rover (MR).

Initiate Descent Routine

Message for starting the landing routine, used to override FCS control of LDLR

