ILRS LLR MISSION SUPPORT REQUEST FORM (version: August 2023)

SUBMISSION STATUS:

◉ New Submission (default)

○ Incremental Submission (accepted only for a follow-on mission; fill-in new information only)

(provide the reference mission and the date approved by the ILRS: _____)

SECTION I: MISSION

INFORMATION: General Information:

Spacecraft Mission Name: _____

Spacecraft Mission Host Organization: _____

Web Address: _____

Contact Information:

Primary Technical Contact Information:

Name: _____

Organization and Position: _____

Address: _____

Phone No.: _____

E-mail Address: _____

Alternate Technical Contact Information:

Name: _____

Organization and Position: _____

Address: _____

Phone No.: _____

E-mail Address: _____

Primary Science Contact Information:

Name: _____

Organization and Position: _____

Address: _____

Phone No.: _____

E-mail Address: _____

Alternate Science Contact Information:

Name: _____

Organization and Position: _____

Address: _____

Phone No.: _____

E-mail Address: _____

Mission Specifics:

Scientific or Engineering Objectives of Mission:
(specify)

Role of Lunar Laser Ranging (LLR) for the Mission:
(specify)

Anticipated Launch Date: _____

Anticipated Lunar Landing Date: _____

Required Ranging Accuracy: _____

Anticipated Location on the Moon:

Main Area: _____

Latitude: _____

Longitude: _____

X: _____ Y: _____ Z: _____

Mission Timeline:

(example)
Should include when LLR is to start within the mission timeline, such as "deposit on the moon" or "launch +N" days.
Include timeframe for adjusting retroreflector pointing.

Tracking Requirements:

Spatial Coverage: ○ global ILRS network ○ custom (specify: _____)

Temporal Coverage: ○ full-time ○ custom (specify: _____)

Normal Point Bin Size (Time Span): _____

(Choose 600 seconds. Justify if other bin size is required.) (See the "Bin Size" of other satellites and Moon reflectors on the ILRS Web site at *http://ilrs.gsfc.nasa.gov/missions/satellite_missions/current_missions/index.html* .)

Prediction Center:

Prediction Technical Contact Information:

Name: _____

Organization and Position: _____

Address: _____

Phone No.: _____

E-mail Address: _____

Other comments on mission information:

(specify) (list backup prediction centers and references/links to non-SLR techniques if available)

SECTION II: TRACKING RESTRICTIONS:

Several types of tracking restrictions have been required during some satellite missions. See *http://ilrs.gsfc.nasa.gov/satellite_missions/restricted.html* for a complete discussion.

1) Elevation restrictions: Certain satellites have a risk of possible damage when ranged near the zenith. Therefore a mission may want to set an elevation (in degrees) above which a station may not range to the satellite.
2) Go/No-go restrictions: There are situations when on-board detectors on certain satellites are vulnerable to damaged by intense laser irradiation. These situations could include safe hold position or maneuvers. A small ASCII file is kept on a computer controlled by the satellite's mission which includes various information and the literal "go" or "nogo" to indicate whether it is safe to range to the spacecraft. Stations access this file by ftp every 5-15 minutes (as specified by the mission) and do not range when the flag file is set to "nogo" or when the internet connection prevents reading the file.
3) Segment restrictions: Certain satellites can allow ranging only during certain parts of the pass as seen from the ground. These missions provide station-dependent files with lists of start and stop times for ranging during each pass.
4) Power limits: There are certain missions for which the laser transmit power must always be restricted to prevent detector damage. This requires setting laser power and beam divergence at the ranging station before and after each pass. While the above restrictions are controlled by software, this restriction is often controlled manually.

Many ILRS stations support some or all of these tracking restrictions. You may wish to work through the ILRS with the stations to test their compliance with your restrictions or to encourage additional stations that are critical to your mission to implement them.

The following information gives the ILRS a better idea of the mission's restrictions. Be aware that once predictions are provided to the stations, there is no guarantee that forgotten restrictions can be immediately enforced.

Are there any science instruments, detectors, or other instruments on the spacecraft that can be damagedor confused by excessive radiation, particularly in any one of these wavelengths (532nm, 1064nm, 846nm, or 432nm)?

○ No ○ Yes (specify the instrument or detector in question, providing the wavelength bands and modes of sensitivity.)

→ Skip the next questions and go directly to SECTION III if you answered "No" to the above question.

Is there a need for a go/no go tracking restriction?

○ No ○ Yes (explain the reason(s) _____)

Is there a need for a pass segmentation restriction?

○ No ○ Yes (Explain the reason(s) _____)

Is there a need for a laser power restriction?

○ No ○ Yes

Under what circumstances? _____

What is the maximum permitted power level **at** the satellite (nJ/cm^2)? _____

Is manual control of laser transmit power acceptable? ○ Yes ○ No

For ILRS stations to range to Lunar reflectors with restrictions, the mission sponsor must agree to the following statement:

"The mission sponsor agrees not to make any claims against the station or station contractors or subcontractors, or their respective employees for any damage arising from these ranging activities, whether such damage is caused by negligence or otherwise, except in the case of willful misconduct."

Please provide signature to express agreement to above statement:

Signature: _____

Date: _____

Name (print): _____

Organization and Position: _____

Other comments on tracking restrictions:

(specify)

SECTION III: RETROREFLECTOR ARRAY INFORMATION:

A prerequisite for accurate reduction of laser range observations is a complete set of pre-launch parameters that define the characteristics and location of the LRA on the satellite. The set of parameters should include a general description of the array, including references to any ground-tests that may have been carried out, array manufacturer and whether the array type has been used in previous satellite missions. So the following information is requested:

Retroreflector Primary Contact Information:

Name: _____

Organization and Position: _____

Address: _____

_____

Phone No.: _____

E-mail Address: _____

Array type:

○ Single reflector ○ Spherical ○ Hemispherical/Pyramid ○ Planar

○ other (specify: _____)

Array dimensions: _____

Number of reflectors: _____

The size of each corner cube: Diameter (_____) mm Height (_____) mm

The material from which the cubes are manufactured (e.g. quartz): _____

Estimated Optical Cross Section (including any significant polarization and velocity aberration dependence): _____

Attach available measurements or simulations of the LRA Far Field Diffraction Patterns (FFDP) for all relevant polarizations and wavelengths at the end of this document.

The refractive index of the cube material

= _____ for wavelength $\lambda = 0.532$ micron

= _____ as a function of wavelength λ (micron)

The group refractive index of the cube material, as a function of wavelength (micron)

= _____ for wavelength λ = 0.532 micron

= _____ as a function of wavelength λ (micron)

The refractive index of the cube material

= _____ for wavelength λ = 1.064 micron

= _____ as a function of wavelength λ (micron)

The group refractive index of the cube material, as a function of wavelength (micron)

= _____ for wavelength λ = 1.064 micron

= _____ as a function of wavelength λ (micron)

Include any additional refractive information for other relevant wavelengths:

Dihedral angle offset(s) and manufacturing tolerance (in arcseconds):

Radius of curvature of front surfaces of cubes

○ Not applied ○ Yes (specify: _____)

Flatness of cubes' surfaces:

_____

Back-face coating:

○ Uncoated ○ Coated (specify the material: _____)

Attach a diagram or photograph of the LRA at the end of this document.

☐ Attached

Array Manufacturer: _____

Link (URL and/or reference) to any ground-tests that were carried out on the array:

_____

_____

Retroreflector Pointing:
(specify) pointing method (lander orientation, pointing mechanism, etc.), pointing accuracy, and any active or passive means for verifying pointing.

Other comments on LRA:

SECTION IV: MISSION CONCURRENCE

The ILRS is a voluntary organization that operates under the auspices of the International Association of Geodesy (IAG). The ILRS adheres to the IAG policy to make all acquired laser ranging data and derived products publicly available. We request that the mission website, as well as mission publications, reference the scientific work derived from ILRS data and derived products, **acknowledge** the role of the ILRS. This acknowledgment is crucial for the continued support from the funding agencies of the ILRS participating organizations.

As an authorized representative of the _____ mission, I hereby request and authorize the ILRS to track the satellite described in this document.

Name (print): _____

Organization and Position: _____

Signature: _____

Date: _____

Please submit this completed form to Claudia Carabajal, Secretary of the ILRS Central Bureau, at claudia.c.carabajal@nasa.gov

SECTION V: ATTACHMENT(S)