ILRS SLR MISSION SUPPORT REQUEST FORM (June 2011)

SECTION I: MISSION INFORMATION:

General Information:

Satellite Name: STPSAT-2

Satellite Host Organization: Space Test Program Office

Web Address:

Contact Information:

Primary Technical Contact Information:

Name: Odell Reynolds

Address: AFRL/RD

Bldg 66017 Mt. Washington Road, KAFB, NM 87117

Phone No.: 505-846-1850

Fax No.:

E-mail Address: odell.reynolds.ctr@kirtland.af.mil

Alternate Technical Contact Information:

Name: Kenneth Reese

Address: 3548 Aberdeen Ave SE, Kirtland AFB, NM 87117

Phone No.: 505-853-3095

Fax No.:

E-mail Address: kenneth.reese@kirtland.af.mil

Primary Science Contact Information:

Name: Linda Thomas

Address: 4555 Overlook Ave, SW, Code 8123

Washington, DC 20375

Phone No.: (202)603-0336

Fax No.:

E-mail Address: linda.thomas@nrl.navy.mil

Alternate Science Contact Information:

Name: N/A

Address:

Phone No.:

Fax No.:

E-mail Address:

Mission Specifics:

Scientific or Engineering Objectives of Mission:

The US Air Force Research Laboratory has flown a hollow retroreflector on the STPSAT2 mission. It is a commercial item that is lightweight and allows for testing at any laser wavelength. AFRL will post temperature data for the cube and provide sat. orientation. Temperature effects on the cross section and angular (off-axis) performance will be documented and participating SLR sites will be acknowledged.

Satellite Laser Ranging (SLR) Role of Mission:

Gather data on changes in optical cross section over a period of 4 months. Monitor passes (>45 degree elevation angle). The cube temperature will be recorded during the experiments as well as satellite orientation to assist in the off-axis analysis. The data will be used to determine the utility of this device to provide AFRL with an inexpensive means for carrying out tracking of small satellites.

Anticipated Launch Date: Launched 11/2010

Expected Mission Duration: 4 months

Orbital Accuracy Required:

Anticipated Orbital Parameters:

Altitude: 650 km

Inclination: 72 degrees

Eccentricity:

Orbital Period:

Frequency of Orbital Maneuvers: none

Mission Timeline: Expect tracking to be carried out from different sites as pass geometries and lighting conditions allow.

Tracking Requirements:

Tracking Schedule: Collect on passes exceeding 45 degrees elevation at least once/wk.

Spatial Coverage: Symmetric around site. No spatial preference.

Temporal Coverage: Nominally 60 seconds or more for each pass.

Operations Requirements:

Prediction Center: Space Technology Program Office

Prediction Technical Contact Information:

Name: Kenneth Reese

Address:

Phone No.: 505-853-3095

Fax No.:

E-mail Address: kenneth.reese@kirtland.af.mil

Priority of SLR for POD: Low priority. Radiometric characterization of retro is top priority.

Other Sources of POD (GPS, Doppler, etc.):

GPS

Normal Point Time Span (sec): full rate data desired, or 15 sec normal points.

Tracking Network Required (Full/NASA/EUROLAS/WPLTN/Mission Specific):

Any available network

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. See xxx for the current list. 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.

Can detector(s) or other equipment on the spacecraft be damaged or confused by excessive irradiation, particularly in any one of these wavelengths (532nm, 1064nm, 846nm, or 423nm)?

No.

Are there times when the LRAs will not be accessible from the ground?

No.

(If so, go/nogo or segmentation files might be used to avoid ranging an LRA that is not accessible.)

Is there a need for an altitude tracking restriction? no What altitude (degrees)? _____

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

For what reason(s)?

Is there a need for a pass segmentation restriction? No

For what reason(s)?

_____

_____

Is there a need for a laser power restriction? No.

Under what circumstances?

_____

_____

What power level (mW/cm^2)? _____

Is manual control of transmit power acceptable? _____

For ILRS stations to range to satellites 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 initial here to express agreement: _____

Other comments on tracking restrictions:

_____

_____

_____

_____

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: Gary Hendel

Address:

Phone No.: 505-846-1685

Fax No.:

E-mail Address: gary.hendel@aero.org

Array type (spherical, hexagonal, planar, etc.), to include a diagram or photograph:

Single retro-reflector

Array manufacturer:

PLX OW-05-5E

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

The LRA design and/or type of cubes was previously used on the following missions:

N/A

For accurate orbital analysis it is essential that full information is available in order that a model of the 3-dimensional position of the satellite center of mass may be referred to the location in space at which the laser range measurements are made. To achieve this, the 3-D location of the LRA phase center must be specified in a satellite fixed reference frame with respect to the satellite's mass center. In practice this means that the following parameters must be available at mm accuracy or better:

The 3-D location (possibly time-dependent) of the satellite's mass center relative to a satellite-based origin:

Retro is located centrally on the NADIR face. The STPSAT2 satellite is always NADIR facing so the cube should be visible from the ground above 45 degrees.

The 3-D location of the phase center of the LRA relative to a satellite-based origin:

However, in order to achieve the above if it is not directly specified (the ideal case) by the satellite manufacturer, and as an independent check, the following information must be supplied prior to launch:

The position and orientation of the LRA reference point (LRA mass-center or marker on LRA assembly) relative to a satellite-based origin:

No array assembly. Retro is single unit centrally located on NADIR face.

The position (XYZ) of either the vertex or the center of the front face of each corner cube within the LRA assembly, with respect to the LRA reference point and including information of amount of recession of front faces of cubes:

N/A

The orientation of each cube within the LRA assembly (three angles for each cube):

N/A

The shape and size of each corner cube, especially the height:

1/2 inch diameter.

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

Protected silver

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

In vacuum, so not applicable for hollow retro.

Dihedral angle offset(s) and manufacturing tolerance:

Radius of curvature of front surfaces of cubes, if applicable:

N/A

Flatness of cubes' surfaces (as a fraction of wavelength):

Whether or not the cubes are coated and with what material:

Protected silver coated mirrors

SECTION IV: MISSION CONCURRENCE

As an authorized representative of the STPSat-2 mission, I hereby request and authorize the ILRS to track the satellite described in this document.

Name (print): Kenneth Reese Date 18 Mar 2013

Signature: Ken Reese

Position: STPSat-2 Mission Manager

Send form to:
ILRS Central Bureau
c/o Carey Noll
NASA GSFC
Code 690
Greenbelt, MD 20771
USA
301-614-6542 (Voice)
301-614-6015 (Fax)
Carey.Noll@nasa.gov