“BLITS” MISSION ILRS SLR SUPPORT REQUEST FORM

SECTION I: MISSION INFORMATION:

General Information:

Satellite Name: “BLITS” (The “BLITS” passive laser retroreflector satellite will be launched into orbit as a piggyback load on the Meteor-M(1) spacecraft)

Satellite Host Organization: IPIE

Web Address:

Contact Information:

Primary Technical Contact Information:

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Address: 53 Aviamotornaya st. Moscow, Russia, 111250

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Mission Specifics:

Scientific or Engineering Objectives of Mission: The BLITS (**B**all **L**ens **I**n **T**he **S**pace) retroreflector satellite has been developed and manufactured by the FSUE IPIE in accordance with the Federal Space Program of Russia and Agreement between the Federal Space Agency of Russia and International Laser Ranging Service from January 10, 2006. The mission purpose is experimental verification of the spherical glass retroreflector satellite concept as well as obtaining SLR data for solution of scientific problems in geophysics, geodynamics, and relativity by millimeter and submillimeter accuracy SLR measurements. The "target error" (uncertainty of reflection center relative to the CoM position) is less than 0.1mm, and the Earth magnetic field does not affect the satellite orbit and spin parameters.

Satellite Laser Ranging (SLR) Role of Mission:

SLR is the only source of POD information, as well as of scientific data.

Anticipated Launch Date: June, 2009

Expected Mission Duration: 5 years

Orbital Accuracy Required: During the first phase: 50 – 100 m. During the 2-nd phase: best obtainable for this satellite.

Anticipated Orbital Parameters:

Altitude: 832 km

Inclination: 98.77°

Eccentricity: circular orbit, sun-synchronous

Orbital Period: 101.3 min

Frequency of Orbital Maneuvers: no

Mission Timeline: 1-st phase: Identification of the BLITS satellite immediately after launching and separation from the carrier spacecraft; satellite orbit determination (2 – 4 weeks). 2- nd phase: precision orbit determination; accumulation of SLR data for the analysis of the novel retroreflector satellite concept perspectives, as well as for scientific studies in geophysics, geodynamics, relativity, etc. (during 5years).

Tracking Requirements:

Tracking Schedule: permanent observations

Spatial Coverage: maximum obtainable

Temporal Coverage: maximum obtainable

Operations Requirements:

Prediction Center: Information-Analytical Centre (IAC) TSNIIMASH (former MCC)

Prediction Technical Contact Information:

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Address: 4 Ponerskaya st., Korolev, Moscow region, Russia, 141070

Phone No.: +7(495)5135075

Fax No.: +7(495) 5135075

E-mail Address: vladimir.glotov@mcc.rsa.ru

Priority of SLR for POD: high

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

no

Normal Point Time Span (sec): 30

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

Full

SECTION II: TRACKING RESTRICTIONS:

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

Is there a need for a pass segmentation restriction? no

Is there a need for a laser power restriction? no

Other comments on tracking restrictions:

The BLITS satellite is designed for laser ranging with a wavelength of λ=532nm±5nm.

SECTION III: RETROREFLECTOR ARRAY INFORMATION:

Retroreflector Primary Contact Information:

Name: Vladimir Vasiliev

Address: 53 Aviamotornaya st. Moscow, Russia, 111250

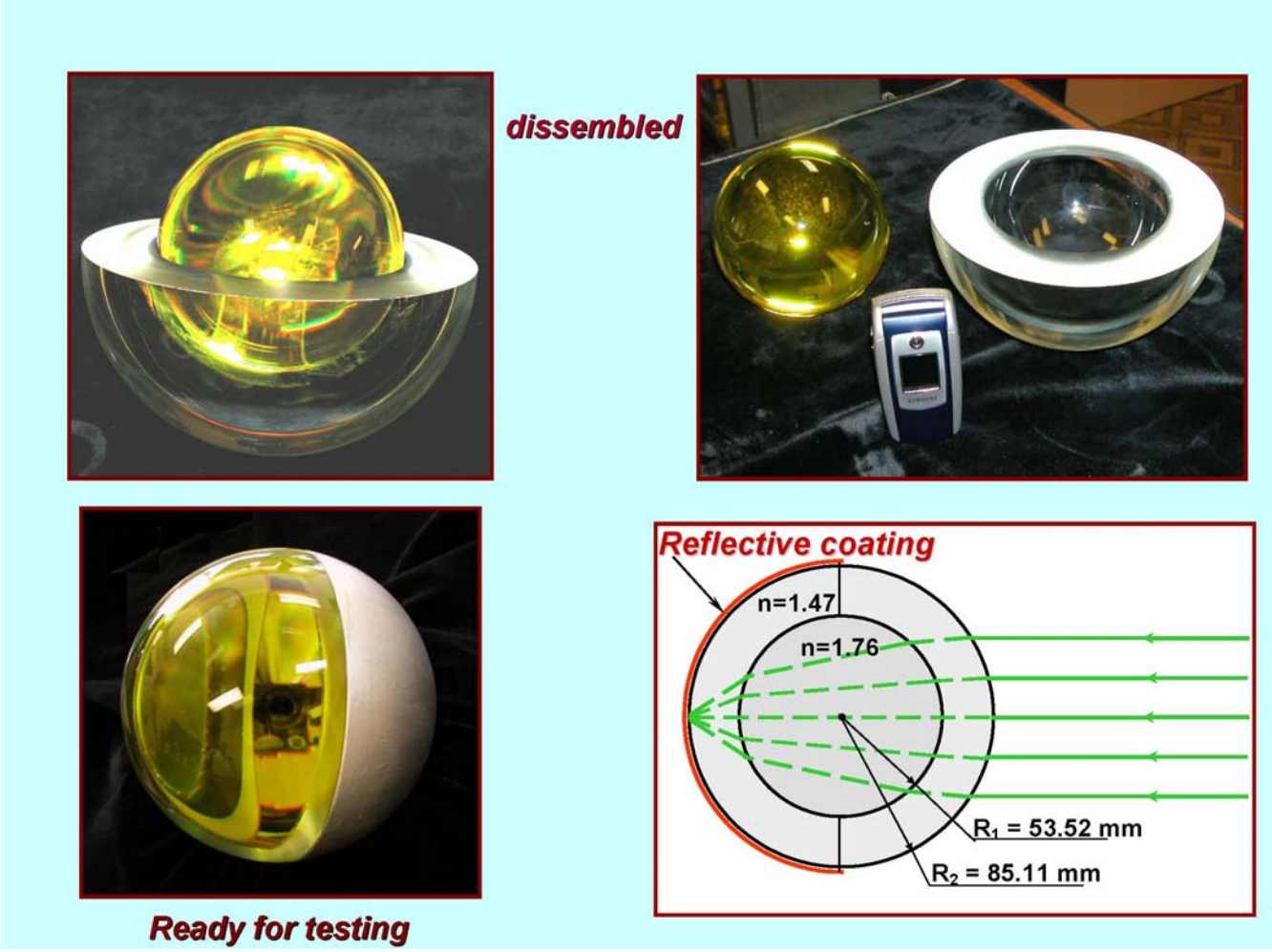
Phone No.: +7(495)7071358

Fax No.: +7(495)2349859

E-mail Address: lavaser@kmail.ru

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

spherical



Array manufacturer:

IPIE, 53 Aviamotornaya st. Moscow, Russia, 111250

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

The BLITS satellite has been tested for effects of mechanical factors (sine and random vibration, and shock) as well as climatic factors (temperature, pressure, humidity). Optical parameters of the BLITS satellite (including the far field diffraction pattern) were measured after all tests. The testing results are documented in the test protocols.

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

The BLITS nanosatellite consists of two outer hemispheres made of a low-refraction-index glass (ЛК6 type) and an inner ball lens made of a high-refraction-index glass (ТФ105 type). The ball lens radius is 53.52 mm, the total radius of the spherical retroreflector is 85.16 mm. The hemispheres are glued over the ball lens; the external surface of one hemisphere is covered with an aluminum coating protected by a varnish layer. All spherical surfaces are concentric. The satellite total mass is 7.53 kg.

A small spherical retroreflector of the same type (6cm in diameter) was fastened to the Meteor-3M (1) spacecraft and tested during its space flight (2001 – 2006).

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

Center of sphere

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

The phase center is 85.16 mm behind the sphere center (the range correction value is + 196.94 mm taking into account the indices of refraction)

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

The CoM is in the sphere center.

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:

N/A

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

Inner sphere: ТФ105 glass. Outer hemispheres: ЛК6 glass.

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

Operation wavelength:532 ±5nm. Refraction indices: outer hemispheres n_{532}=1.4731, inner sphere n_{532}=1.7646

Dihedral angle offset(s) and manufacturing tolerance:

N/A

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

85.16 mm

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

N/A

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

One of outer hemispherical glass parts of the satellite has an aluminum coating on its external surface. The coating is protected by a varnish layer.

Other Comments:

A special-purpose separation system provides spinning of the BLITS satellite after its separation from the Meteor – M(1) spacecraft at a rate of more than 6 (possibly 10 – 20) rpm around the axis normal to its orbit plane, thus providing optimum conditions for observation from the Earth. The reflected signal will thereby consist of regular "bursts" of return pulses, with a "burst" duration nearly equal to one half of the satellite spin period.

The expected retroreflector cross-section of the BLITS satellite is approximately 100 000 square meters at λ=532 nm.

SECTION IV: MISSION CONCURRENCE

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

Name): _Prof. Shargorodskiy_Victor_____ Date _____

Signature: _____

Position: _____General Designer_of IPIE_____