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: Zhang Zhongping

Address: Shanghai Astronomical Observatory,China

Phone No.: 86-21-64696290

Fax No.: 86-21-64696290

E-mail Address: zzp@shao.ac.cn

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

Planar

Array manufacturer:

Shanghai Astronomical Observatory,Chinese Academy of Sciences

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:

This type of cubes was used on the Compass-M1 Module in April 2007

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:

(1082.0,-0.4,-0.5)mm

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

(649.9,-562.5,1112.3)mm

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:

(649.9,-562.5,1133.3)mm

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:

The plane of the front faces of the cubes is +14.0mm in the Z direction from LRA mass centre

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

Random

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

Circular,Diameter of 33mm,24.0mm in height

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

Quartz

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

1.46 at 532nm

Dihedral angle offset(s) and manufacturing tolerance:

0.6+/-0.3aresec

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

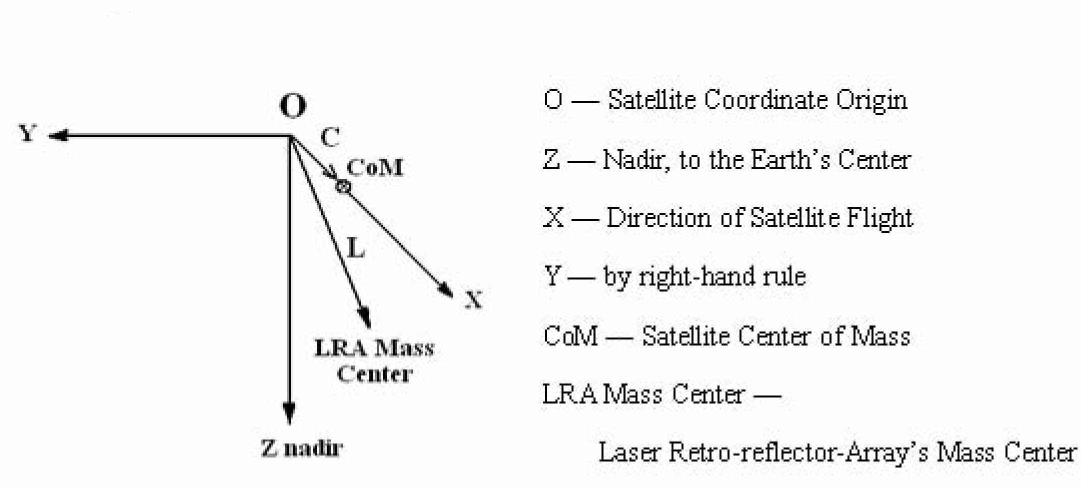
Flatness of cubes' surfaces (as a fraction of wavelength):

0.1 wavelength

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

Uncoated

The Position of the Compass-M3 Laser Retro-Reflector Array Phase Center



Vector C is from the satellite coordinate origin to the satellite's center of mass (CoM).
Vector L is from the satellite coordinate origin to the mass center of the LRA containing 42 corner cubes.

C = (1082.0,-0.4,-0.5) mm .

L = (649.9,-562.5,1133.3) mm.

The plane of the front faces of the cubes is +14.0 mm in the Z direction from the LRA mass center.

The cubes' phase centers are $-h\times n$ in the Z direction from the plane of the cubes.

For the Compass-M3 cubes, h = 24.0 mm, n = 1.46. So phase centers are - 35.0 mm in Z.

So z-component of array phase center is (-35.0+14) = - 21.0 mm from the LRA mass center.

Let L′ as the vector from the satellite coordinate origin to the phase center of the LRA. We have

L′= (649.9,-562.5, 1133.3-21.0) = (649.9,-562.5, 1112.3) mm

Finally, the vector CP from the satellite center of mass to the phase center of the LRA is

CP = L′－C

So CP= (649.9,-562.5, 1112.3) - (1082.0,-0.4,-0.5) = (-432.1, -562.1, 1112.8)mm in the satellite fixed frame.