

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: _____

Address: _____

Phone No.: _____

Fax No.: _____

E-mail Address: _____

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

Array manufacturer:

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:

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:

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:

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

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

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

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

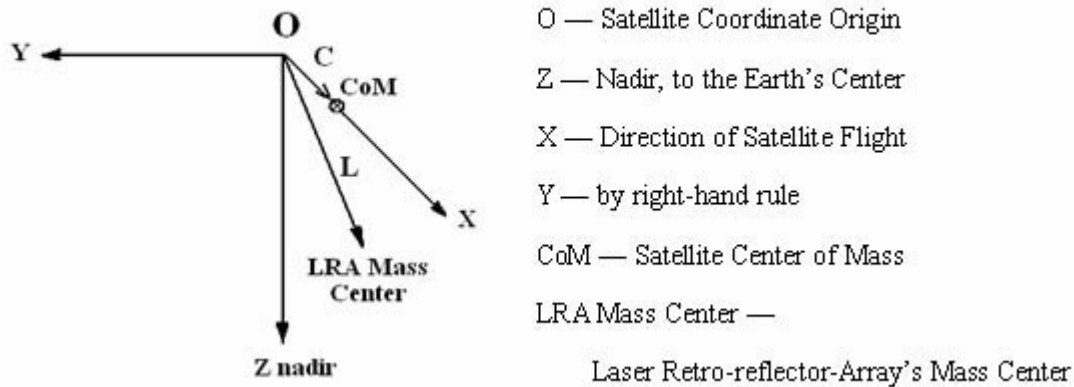
Dihedral angle offset(s) and manufacturing tolerance:

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

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

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

The Position of the Compass-I3 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 90 corner cubes.

$$C = (1075.6, 0.0, -0.4) \text{ mm.}$$

$$L = (673, 573, 1114) \text{ mm.}$$

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-I3 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

$$L' = (673, 573, 1114 - 21) = (673, 573, 1093) \text{ mm}$$

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

$$CP = L' - C$$

So $CP = (673, 573, 1093) - (1075.6, 0.0, -0.4) = (-402.6, 573, 1093.4) \text{ mm}$ in the satellite fixed frame.