

AXB Mass Properties for Moving Components

Revision: A

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Several components of the RBSP EFW AXB will be spin balance tested in a configuration different than their final flight configuration, namely, the Sphere (and accompanying Preamp), the Whip, and the Caging Mechanism Door. The following information is provided to assist in evaluating the magnitude of the difference in the spin balance results due to these differences in configuration.

Tabulated below are the measured mass and computed mass properties - center of mass (COM) and inertia tensor components – for the RBSP-EFW AXB sphere and preamp, whip, and caging mechanism door in the top (+Z) spacecraft position. The bottom spacecraft position is in the opposite octant in the BCS and the CG coordinates are simply the negative of the top spacecraft position (-X,-Y,-Z). The MOI does not change for the two units in this coordinate reference frame.

The actual masses of these components were measured as part of fabrication, assembly, and test of the AXBs.

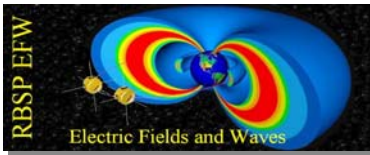
UCB has no way to accurately measure the CG and MOI properties of the whip, sphere, and cage door in their stowed and deployed configurations separate from the assemblies to which they are constrained.

However, all parts are checked for dimensional consistency with the drawings and mating parts at incoming inspection. This incoming inspection verifies form and function, not each individual dimension. Parts that are not produced to the drawings are rejected or the SolidWorks model of the sub-assembly and AXB is brought up-to-date to the final, as-built configuration.

The SolidWorks design model of the AXB then provides a convenient and accurate model for the units from which the part displacements can be extracted. It is known that the actual flight parts meet the dimensions and behaviors of the design depicted in SolidWorks from our rigorous test flow, and thus using SolidWorks to provide the displacements is a sufficient and reasonable method for estimating the desired mass properties.

Many of the parts in question, namely, the Sphere and Whip, have mass properties that are also incorporated into the AXB MICD (RBSP-AXB-ICD-001E Interface Control Drawing, Sheet 2). The Mass Properties tabulated therein are calculated separate from the SolidWorks Application and provide a check on consistency for the values presented. We have verified that the mass properties tabulated below are consistent with the data tabulated in the AXB MICD.

All COM data are presented in m and are referenced to the Boom Coordinate System (BCS) as defined in the AXB MICD (Sheet 1, Notes 8, 9, and 10).



All MOI data are presented in kg-m² and are referenced to the Boom Coordinate System as defined in the AXB MICD.

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Item Description: MOI [kg-m²] (w.r.t. BCS):
 Mass: [kg]
 CG: (X,Y,Z) [m] (w.r.t. BCS)

Cage Cap Stowed 0.046 (-0.002,0.373,0.640)	lxx = 0.025384 lyx = -0.000039 lzx = -0.000057	lxy = -0.000039 lyy = 0.019000 lzy = 0.011029	lxz = -0.000057 lyz = 0.011029 lzz = 0.006513
Cage Cap Deployed 0.046 (0.077,0.373,0.678)	lxx = 0.027720 lyx = 0.001337 lzx = 0.002433	lxy = 0.001337 lyy = 0.021558 lzy = 0.011677	lxz = 0.002433 lyz = 0.011677 lzz = 0.006733
Sphere Stowed 0.040 (0.006,0.369,0.630)	lxx = 0.021241 lyx = 0.000097 lzx = 0.000166	lxy = 0.000097 lyy = 0.015823 lzy = 0.009255	lxz = 0.000166 lyz = 0.009255 lzz = 0.005433
Sphere Deployed 0.040 (0.006,0.004,6.992)	lxx = 1.913143 lyx = -0.000003 lzx = 0.001831	lxy = -0.000003 lyy = 1.913145 lzy = -0.001341	lxz = 0.001831 lyz = -0.001341 lzz = 0.000013
Whip Stowed 0.007 (0,0.187,0.626)	lxx = 0.003033 lyx = 0.000000 lzx = 0.000000	lxy = 0.000000 lyy = 0.002727 lzy = 0.000814	lxz = 0.000000 lyz = 0.000814 lzz = 0.000307
Whip Deployed 0.007 (0,0,6.809)	lxx = 0.322628 lyx = 0.000000 lzx = 0.000000	lxy = 0.000000 lyy = 0.322628 lzy = 0.000000	lxz = 0.000000 lyz = 0.000000 lzz = 0.000000