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-m^2 and are referenced to the Boom Coordinate System as defined in the AXB MICD.

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Item Description: Mass: [kg] CG: (X,Y,Z) [m] (w.r.t. BCS)	MOI [kg-m^2] (w.r.t. BCS):		
Cage Cap Stowed 0.046 (-0.002,0.373,0.640)	Ixx = 0.025384 Iyx = -0.000039 Izx = -0.000057	Ixy = -0.000039 Iyy = 0.019000 Izy = 0.011029	Ixz = -0.000057 Iyz = 0.011029 Izz = 0.006513
Cage Cap Deployed 0.046 (0.077,0.373,0.678)	Ixx = 0.027720 Iyx = 0.001337 Izx = 0.002433	Ixy = 0.001337 Iyy = 0.021558 Izy = 0.011677	Ixz = 0.002433 Iyz = 0.011677 Izz = 0.006733
Sphere Stowed 0.040 (0.006,0.369,0.630)	Ixx = 0.021241 Iyx = 0.000097 Izx = 0.000166	Ixy = 0.000097 Iyy = 0.015823 Izy = 0.009255	Ixz = 0.000166 Iyz = 0.009255 Izz = 0.005433
Sphere Deployed 0.040 (0.006,0.004,6.992)	Ixx = 1.913143 Iyx = -0.000003 Izx = 0.001831	Ixy = -0.000003 Iyy = 1.913145 Izy = -0.001341	Ixz = 0.001831 Iyz = -0.001341 Izz = 0.000013
Whip Stowed 0.007 (0,0.187,0.626)	Ixx = 0.003033 Iyx = 0.000000 Izx = 0.000000	Ixy = 0.000000 Iyy = 0.002727 Izy = 0.000814	Ixz = 0.000000 Iyz = 0.000814 Izz = 0.000307
Whip Deployed 0.007 (0,0,6.809)	Ixx = 0.322628 Iyx = 0.000000 Izx = 0.000000	Ixy = 0.000000 Iyy = 0.322628 Izy = 0.000000	Ixz = 0.000000 Iyz = 0.000000 Izz = 0.000000