

SMEI Flight Model Mass Properties

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1. Introduction

This document gives the results for the measurements of the masses and centre of mass locations for the SMEI Flight Model DHU and Cameras.

Revised estimates for the moments of inertia of the units are also given.

These results relate to the following sections of the Coriolis ICD:

- Sect B.2
- Sect B.3
- Sect B.4

Issue 2 of this document makes allowance for the very small mass increase in the cameras resulting from the "EMI fix" modifications, i.e clamping plate and rings, EMI mesh, additional fasteners and three added capacitors. The total mass added is $40 \pm 10\text{g}$ per camera.

2. Results for Measurements of Mass Properties

Measured masses of the units were as follows:

	Mass (kg)
DHU	6.67 ± 0.01
Camera 1	8.2425 ± 0.01
Camera 2	8.2024 ± 0.01
Camera 3	8.1620 ± 0.01
Flight Spare Camera	8.1216 ± 0.01
Intra-Payload Harness	3.36 ± 0.01
Total (excluding FS Camera)	34.6072 ± 0.05

Note: Allowance was made in the above measurements for connector savers and covers where fitted.

Measured locations of centres of mass (in DHU or Camera co-ordinates) were as follows:

	X_d or X_c (mm)	Y_d or Y_c (mm)	Z_d or Z_c (mm)
DHU	-3.0 ± 1.0	-3.5 ± 1.0	$+45.5 \pm 1.0$
Camera 1	-0.5 ± 1.0	$+2.5 \pm 1.0$	$+20.5 \pm 1.0$
Camera 2	-0.5 ± 1.0	$+3.5 \pm 1.0$	$+21.0 \pm 1.0$

Camera 3	-5.0 ± 1.0	$+0.5 \pm 1.0$	$+20.5 \pm 1.0$
Flight Spare Camera	-3.0 ± 1.0	$+2.0 \pm 1.0$	$+20.5 \pm 1.0$

The effect of the additional mass on the location of the centres of mass of the cameras is negligible (less than the error in the measurements).

3. Estimates of Moments of Inertia

In order to estimate the moments of inertia of the DHU, the unit was modelled as a rectangular block of uniform density having the same overall dimensions and mass as the DHU.

Estimates of the moments of inertia (about the centre of mass) are as follows:

Mass (kg)	Length (mm)	Width (mm)	Height (mm)	Ix (kg.m ²)	Iy (kg.m ²)	Iz (kg.m ²)
6.67	300	254	94	0.055	0.041	0.086

The Cameras were modelled as two rectangular blocks, also of uniform density and having the same total mass as the Camera. One of the blocks had the same overall dimensions as the Strong-Box and E-Box combined, whilst the other had dimensions typical of the mean Baffle dimensions.

Estimates of the moments of inertia (about the overall centre of mass) are as follows:

Model Component	Mass (kg)	Length (mm)	Width (mm)	Height (mm)	Ix (kg.m ²)	Iy (kg.m ²)	Iz (kg.m ²)
S-Box / E-Box		170	180	145			
Baffle		280	400	150			
Total	8.20				0.061	0.112	0.081

The effect of the additional mass on the estimated moments of inertia of cameras is negligible (less than the error in the estimates).

4. Conclusions

The total mass of the SMEI Flight Model Instrument, ~~after~~, was measured at 34.7 kg, compared with an ICD value (including contingency) of 33.1 kg. Most of the increase is due to the Intra-Payload Harness.

The positions of the centres of mass lie within the uncertainties quoted in the ICD.

Revised estimates of the moments of inertia have been produced.
