Calculation of the mass and moment of inertia of the Primary mirror assy about it's rotation axis in face of mirror

EIS-opt-desnote-moi_mir
CMB (NRL)
01-Jul-99

Dimensions from Bob Moye's conceptual design 6/13/99 - moving parts only.
For rods & disks, Icg = 1/2mr^2. For rectangular slabs, Icg = 1/12m(a^2 + b^2)
|| axis theorem: I' = Icg + mb^2, where b is the distance from the cg to the new axis
For Cylindrical slabs, Icg = m(l^2/12 +r^2/4)
Torque due to ball screw drive & motor is TBD

Properties of rotating part (mirror & cell)

item	# req'	matl	dens	length/thk '	w cm	h cm	dia cm	Vol cm^3	mass(g)	Iyy (gcm^2) @CG	|| axis part	Iyy at axis
Mirror	1	Zerodur	2.53	3			16	603.19	1526.06	25560.36	3433.64	28994.00
mirror cell blank	1	al	2.7	4.224			17.058	965.32	2606.36	51270.47	11625.77	62896.24
mirror cell pocket	-1	al	2.7	3.7465			16.1036	763.07	-2060.28	-35800.15	-7229.64	-43029.79
							Total rotating parts		2072.14	41030.68	7829.76	48860.44

Masses of Sliding parts (mirror & cell repeated from above)									Mass, g	Mass, g	
No lightweighting is included in this calculation											
Mirror	1	Zerodur	2.53	3			16	603.19	1526.06		
mirror cell blank	1	al	2.7	4.224			17.058	965.32	2606.36		
mirror cell pocket	-1	al	2.7	3.7465			16.1036	763.07	-2060.28		
								Mirror & cell assy		2072.14	
Moving Frame blank	1	al	2.7	5.08	20.342	21.194		1164.05	3142.93		
Cutout	-1	al	2.7	5.08	17.2303	17.3837		808.72	-2183.55		
Piezo Brkt	1	al	2.7	1.3	13	2.6		91.26	246.40		
PZT	1	Various	5	9.5			2	29.85	149.23		
PZT shaft	1	ss	7.8	4.9			1.2	5.54	43.23		
Precision shaft	3	ss	7.8	5.72			0.95	4.05	94.87		
Ball Nut Block	1	al, etc.	2.7	5	5	5		67.50	182.25		
Ball Screw nut	1	Various	5	5.3975			2.2225	20.94	104.70		
Ball Screw hole	-1	Various	5	5.3975			0.762	2.46	-12.31		
Ball Nut bore	-1	al, etc.	2.7	5			2.2225	19.40	-52.37		
								Moving Frame Assy		1715.37	
Fixed components											
Shim plate <2cm thk	1	al	2.7	2	24	23.2		1503.36	4059.07	upper limit thickness	
cutout	-1	al	2.7	3.7565	21.194	21.142		1209.83	-3266.53		
frame	1	al	2.7	3.7565	21.19376	20.40536		1167.66	3152.68	can lightweight	
cutout	-1	al	2.7	3.7565	17.38376	17.10536		802.86	-2167.72		
Lin Brg mount	3	al	2.7	7.239	1.59	2		8.59	69.55		
Linear Bearing	3	Various	5	2.276			1.5875	4.50	67.57		
Linear Brg hole	-3	Various	5	2.276			0.95	1.61	-24.20		
lvdt body	1	Various	5	5.8649			0.6426	1.90	9.51		
lvdt shaft	1	ss	7.8	4			0.305	0.29	2.28		
lvdt mounts	2	al	2.7	0.79052	0.79052	0.79052		1.69	9.11		
lvdt bores	-2	al	2.7	0.79052			0.6426	0.26	-1.38		
Ball Screw Shaft	1	ss	7.8	7.6835			0.762	3.50	27.33 *		
Ball screw Brg Hsg & Brgs	1	Various	3	3.7465	3.7465	6.35		71.37	214.11 *		
Ball screw Brg Hsg Mount	1	al	2.7	3.7465	0.43434	6.35		7.45	20.11 *		
Gearhead	1	Various	5	4.26466	4.3815	3.81		83.47	417.34 *		
Motor	1	Various	5	4.00812	3.175	3.62966		57.62	288.10 *		
								Total Fixed parts		2876.93	
								Total Primary Assy		6664.45	

* A commercial motor/ballscrew assembly has been identified that is reported to weigh 400g - potentially replacing these estimates and saving 566g

Total Primary Assy with savings	6100.00