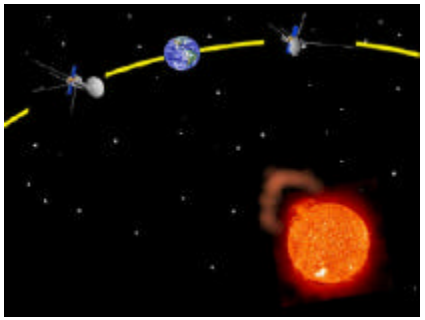

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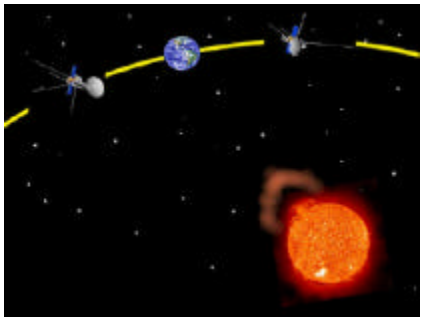
Stereo Impact Telescoping Boom

Mechanical
2nd Peer Review

I. Current Status
II. 6 March 2001 Peer Review: Action Item Responses

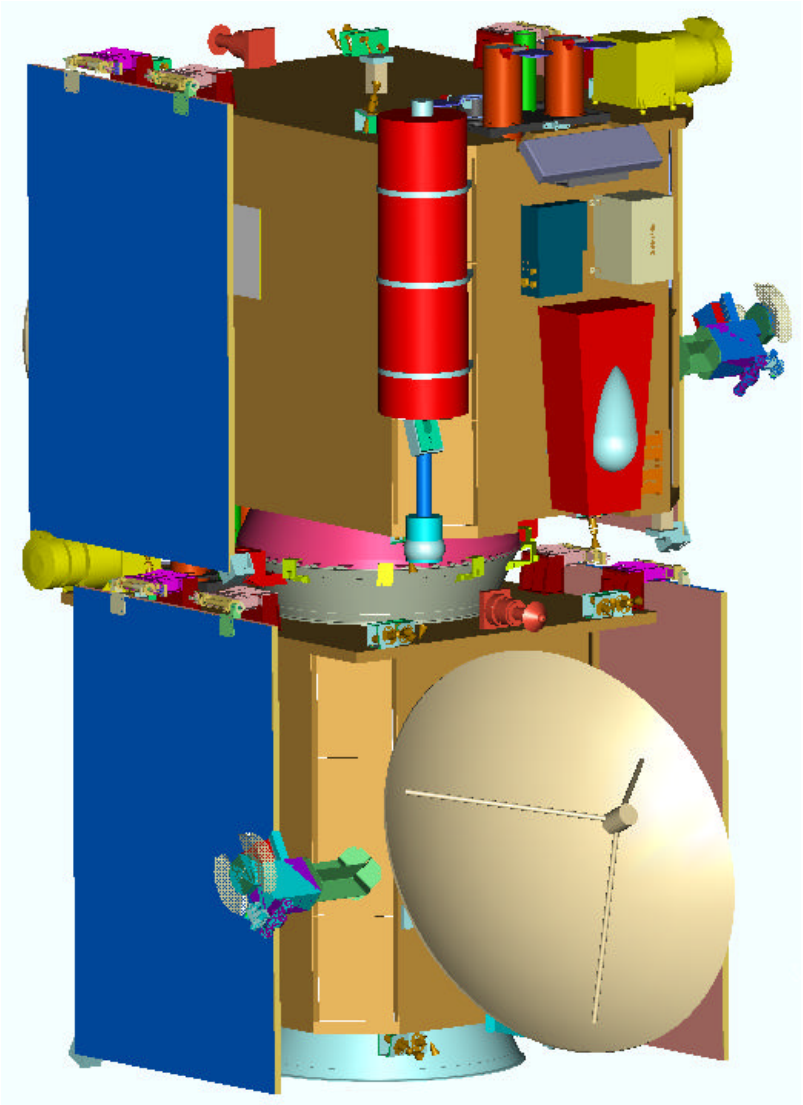
UC Berkeley, Space Sciences Lab
2 August 2001
Robert Ullrich
Lead Mechanical Engineer

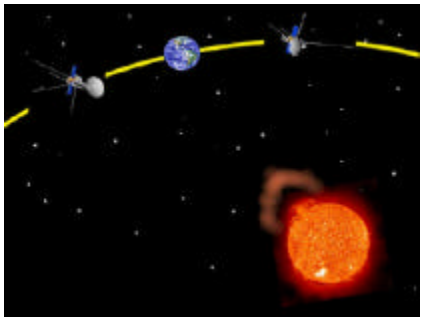


Stereo Impact Telescoping Boom

Overall view:

Boom stowed, mounted on spacecraft. Old picture. Still courtesy of APL.

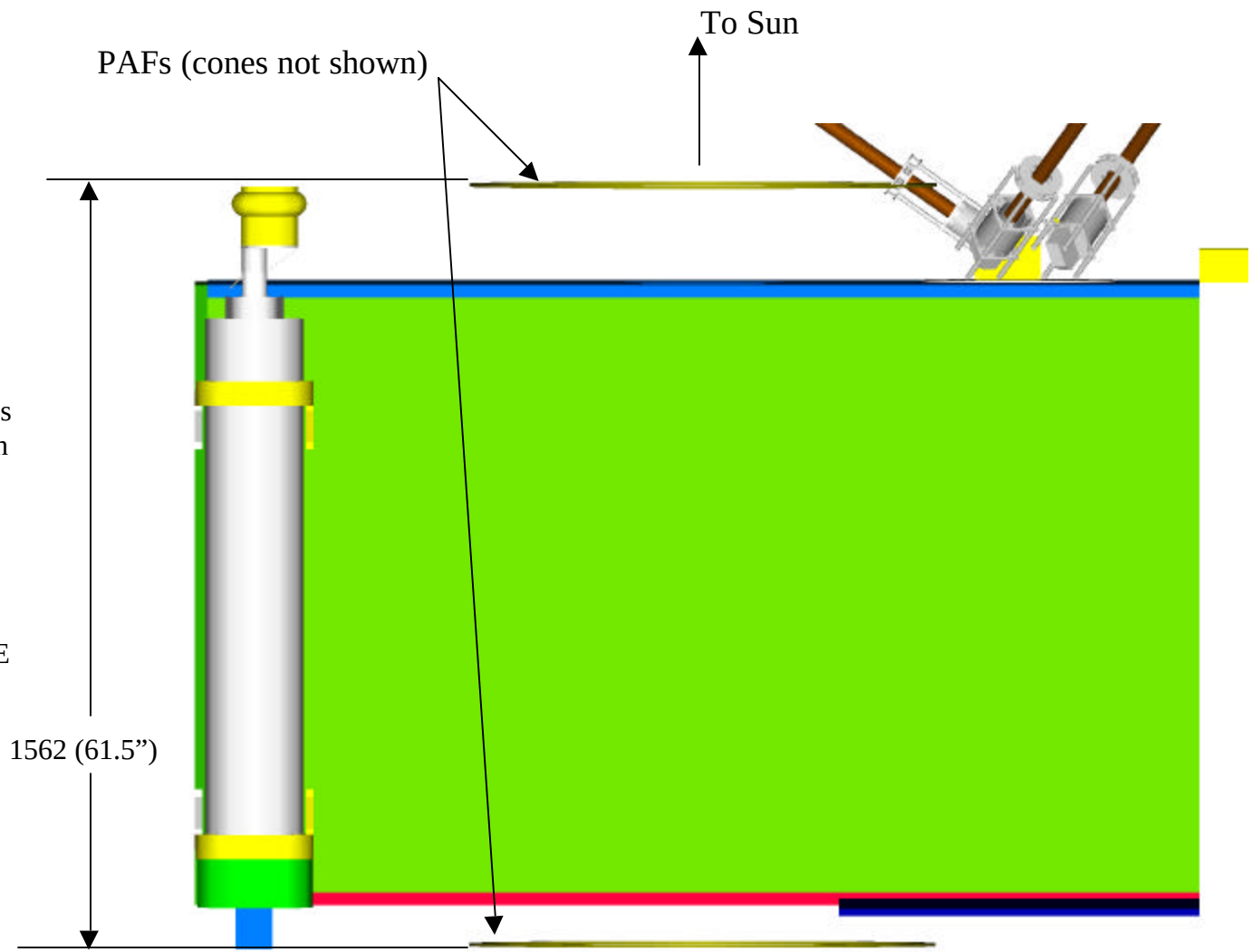


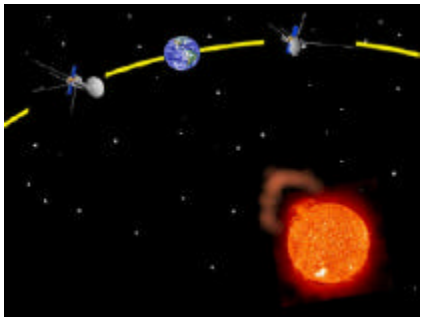


Stereo Impact Telescoping Boom

Stowed View
Lead Spacecraft:

Older (20Jun01) spacecraft (it's all I have a picture of) although the current height is correct. The boom shown has 5 sections, for the 4m extension version. The base (green) contains the spool for the harness, SMA, and inward STE (blue)



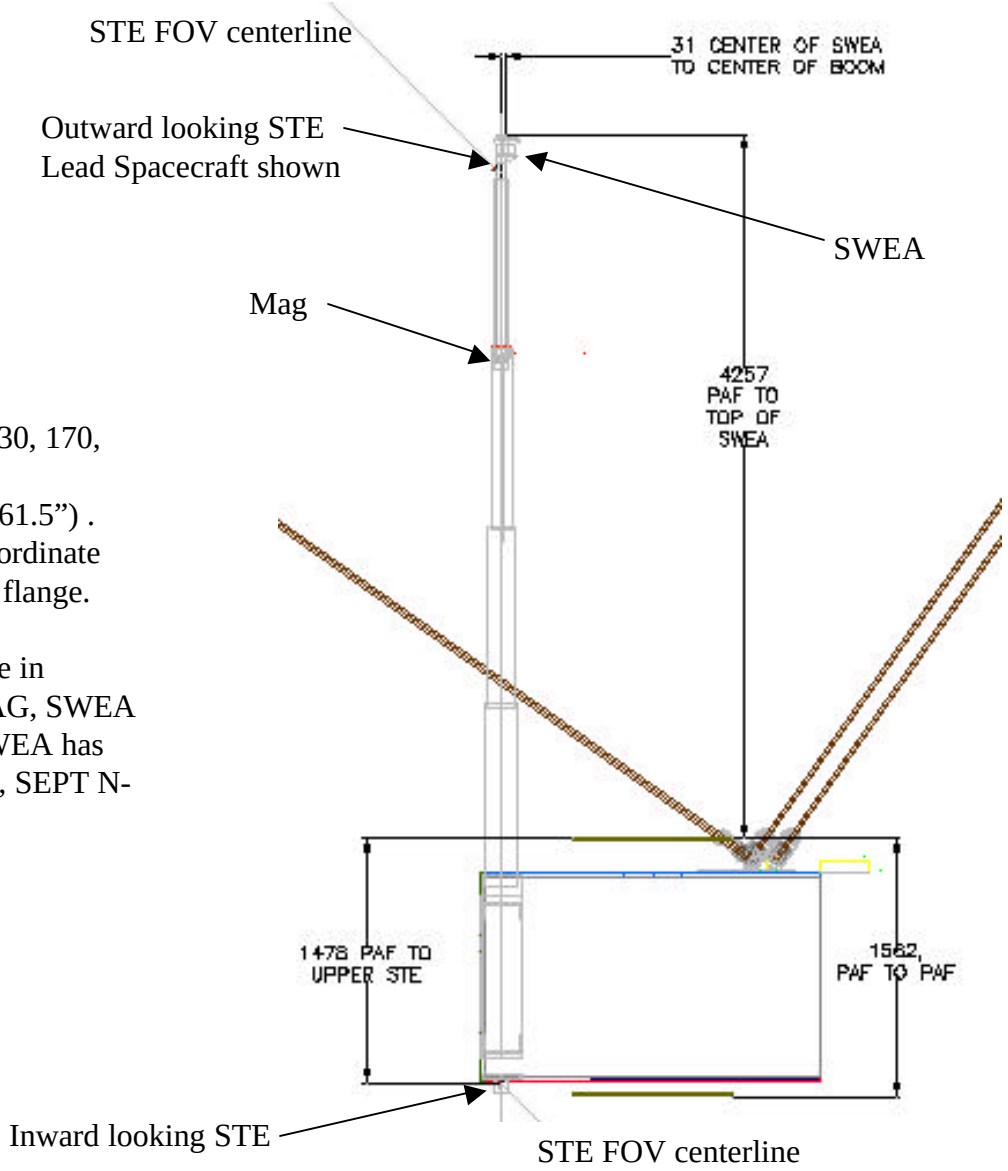


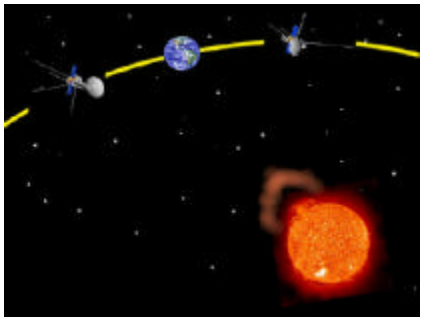
Stereo Impact Telescoping Boom

Deployed View Lead Spacecraft

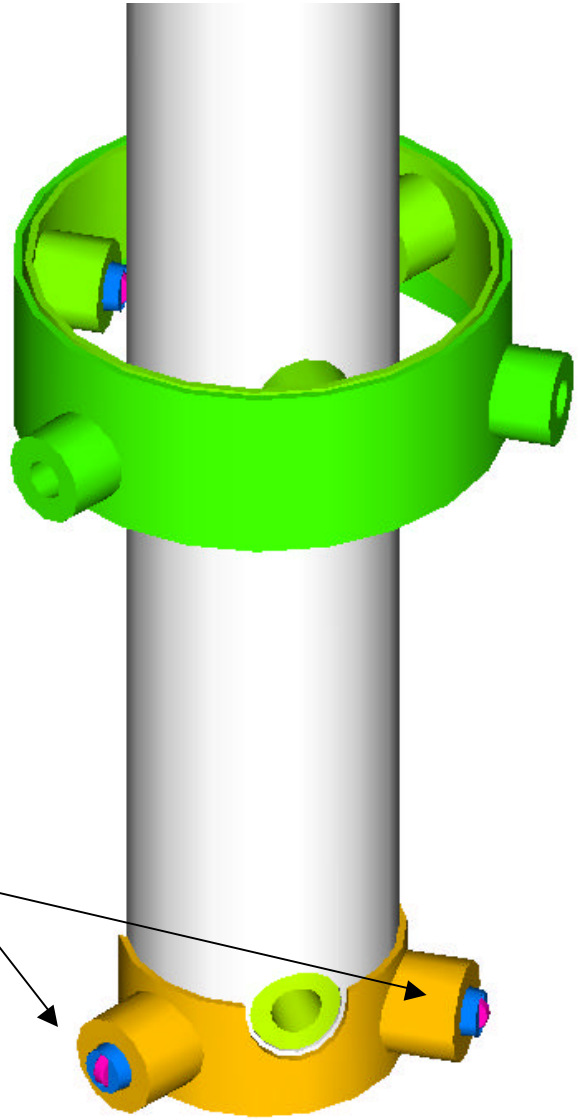
Current Status:
5 Gr/E tubes, 50 x 1200; 90 x 1160; 130, 170, 210 x 1125mm; diameter x length.
Length of stowed unit: NTE 1.562m (61.5") .
Deployed length overall, in agreed coordinate reference, 4.26m from payload attach flange.

STE split into 2 separate housings, one in original location, other as shown. MAG, SWEA unchanged since previous review. SWEA has known FOV issues: both solar panels, SEPT N-S, corner of S/C are in view.





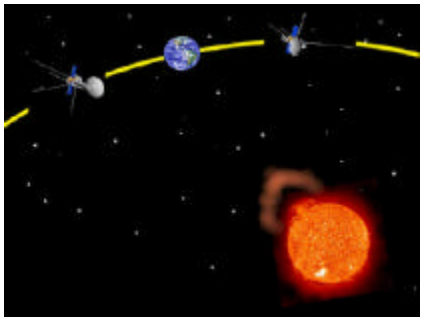
Stereo Impact Telescoping Boom



Boom Assembly:
Partial deployment of inner tube. Outer tube, guide track removed. Rollers ride on tube surfaces.

Restoring moment given by springs. Worst case: pins at sockets, not engaged. Restoring moment, at any pin / socket location, is 0.04 kg-m, for current spring design. For a zero extension situation, ie. release operates, Stacer does not deploy, the restoring moment is 4.95 kg-m.

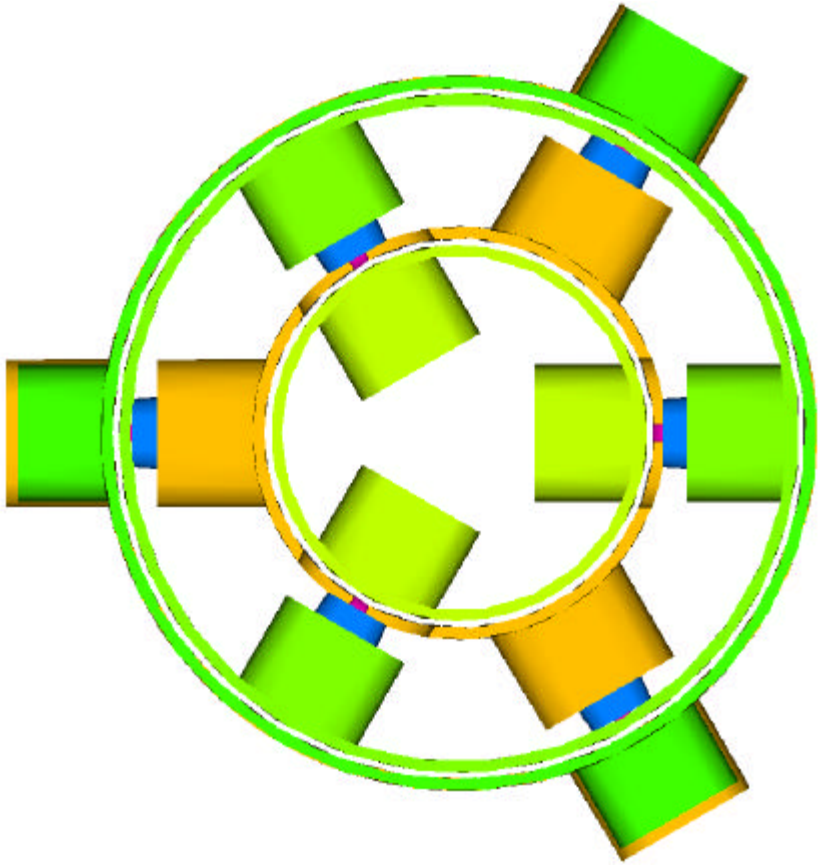
Rollers travel on inside of 80mm tube (not shown)

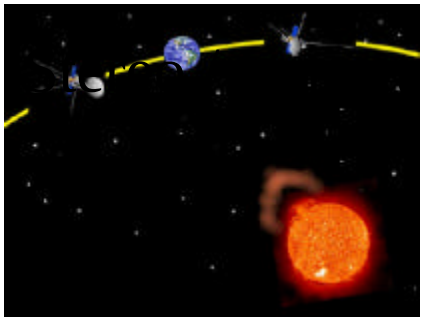


Stereo Impact Telescoping Boom

<u>Boom Assembly:</u>
Stowed position, top view. Rollers rest on tube surfaces. Innermost 2 tubes shown. Pattern repeats for all 5 tubes. Pins are blue, rollers magenta, Gr/E tubes are thin white rings between green and orange rings. Pins travel 8mm to mate with sockets, both with an included cone angle of 10^0 to provide a self-locking interface. The offset of 3 of the sockets takes up play of pins in guides, providing a kinematic (although over-constrained) mounting.

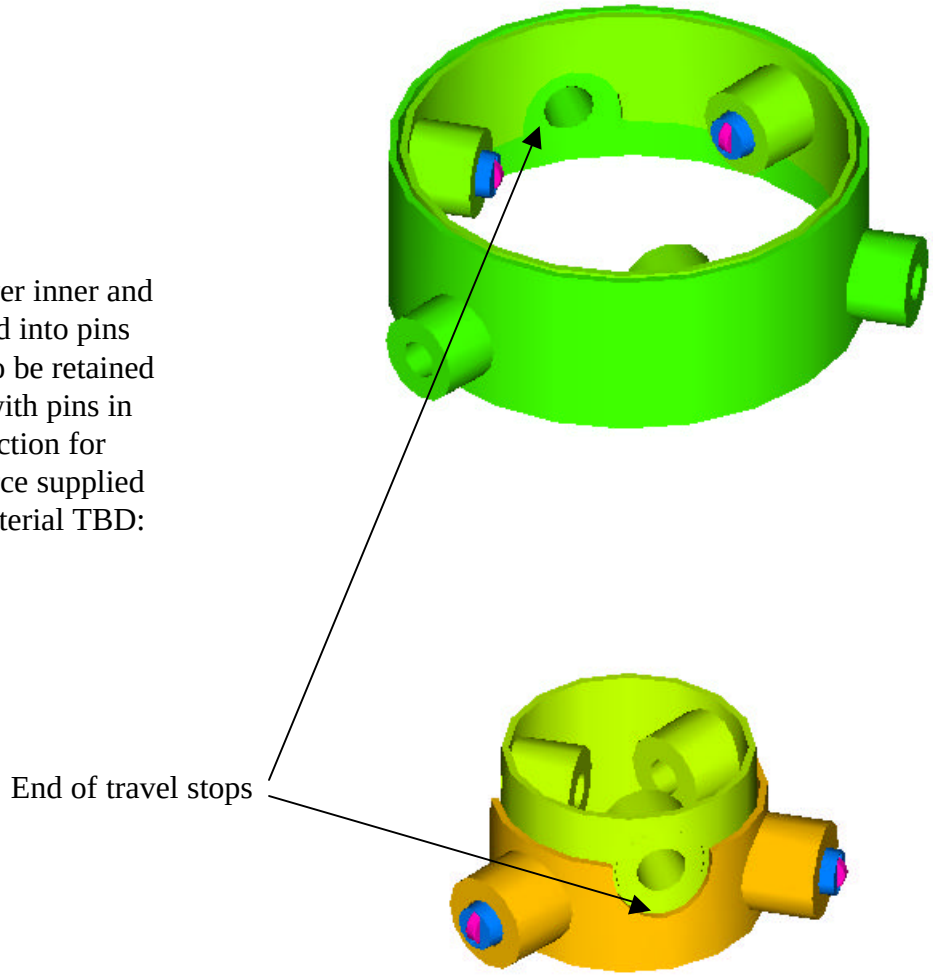
Background information for stowed design:
For launch, tubes are retained by SMA pinpuller through Stacer tip piece, which in turn is connected to the innernost tube. Kick springs in base of boom initiate deployment when SMA triggered, Stacer provides extension force. When end of travel is reached, pins lock into sockets to give rigid boom.

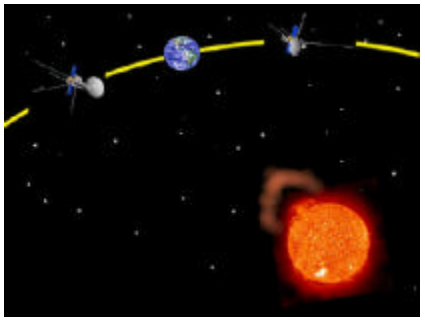




Stereo Impact Telescoping Boom

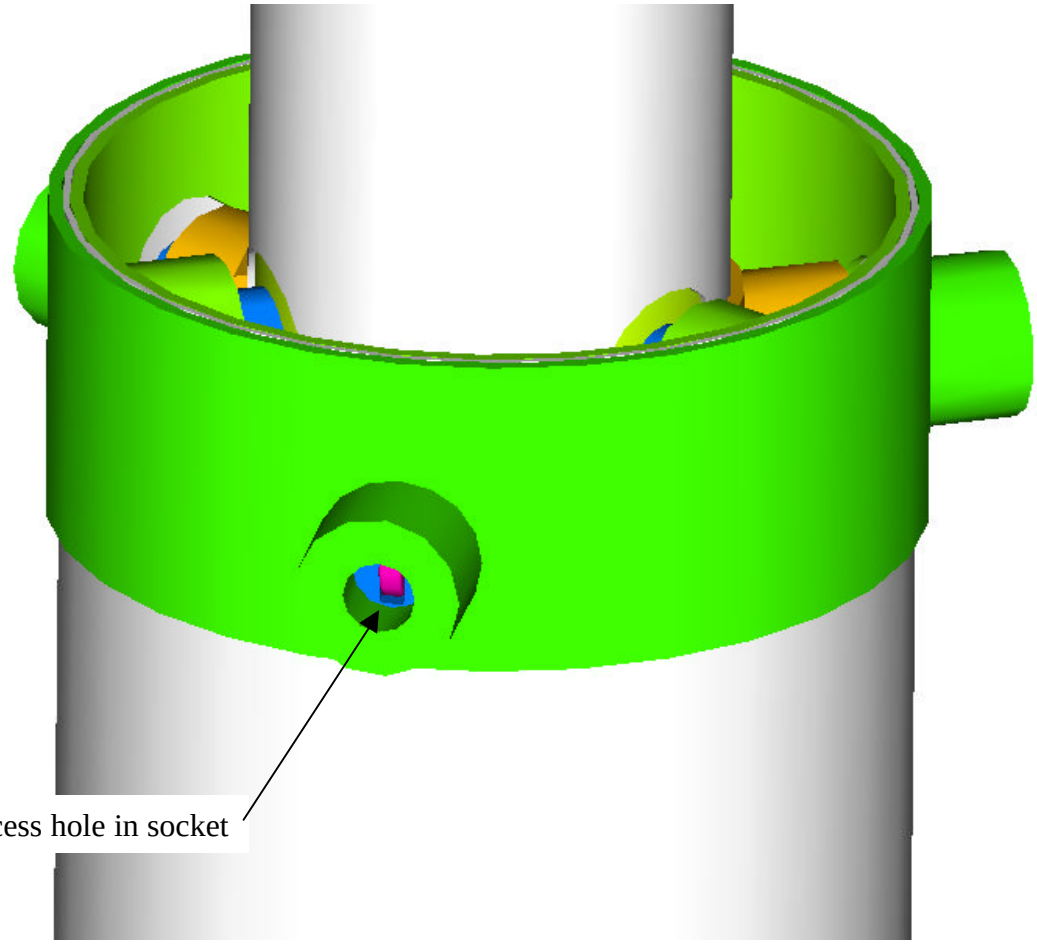
<u>Ring / Pin Subassemblies:</u>
Upper inner and outer rings, lower inner and outer rings. Rollers to be retained into pins by spring pins (SSt 300). Pins to be retained and guided by slotted grooves with pins in housing. Also used for pin retraction for stowing (not shown). Spring force supplied by coil compression springs (material TBD: BeCu or SSt300).

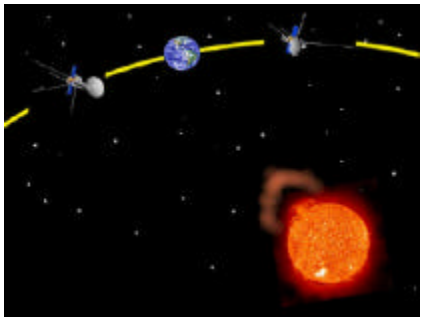




Stereo Impact Telescoping Boom

<u>Boom Assembly:</u>
Inner tube fully deployed, pins inserted into sockets. Current offset value of lower pin center to upper pin center: 10mm.
Anticipated stiffness: >0.5 Hz.

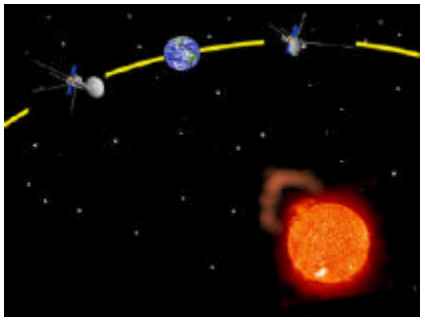




Stereo Impact Telescoping Boom

First Peer Review Action Item Responses

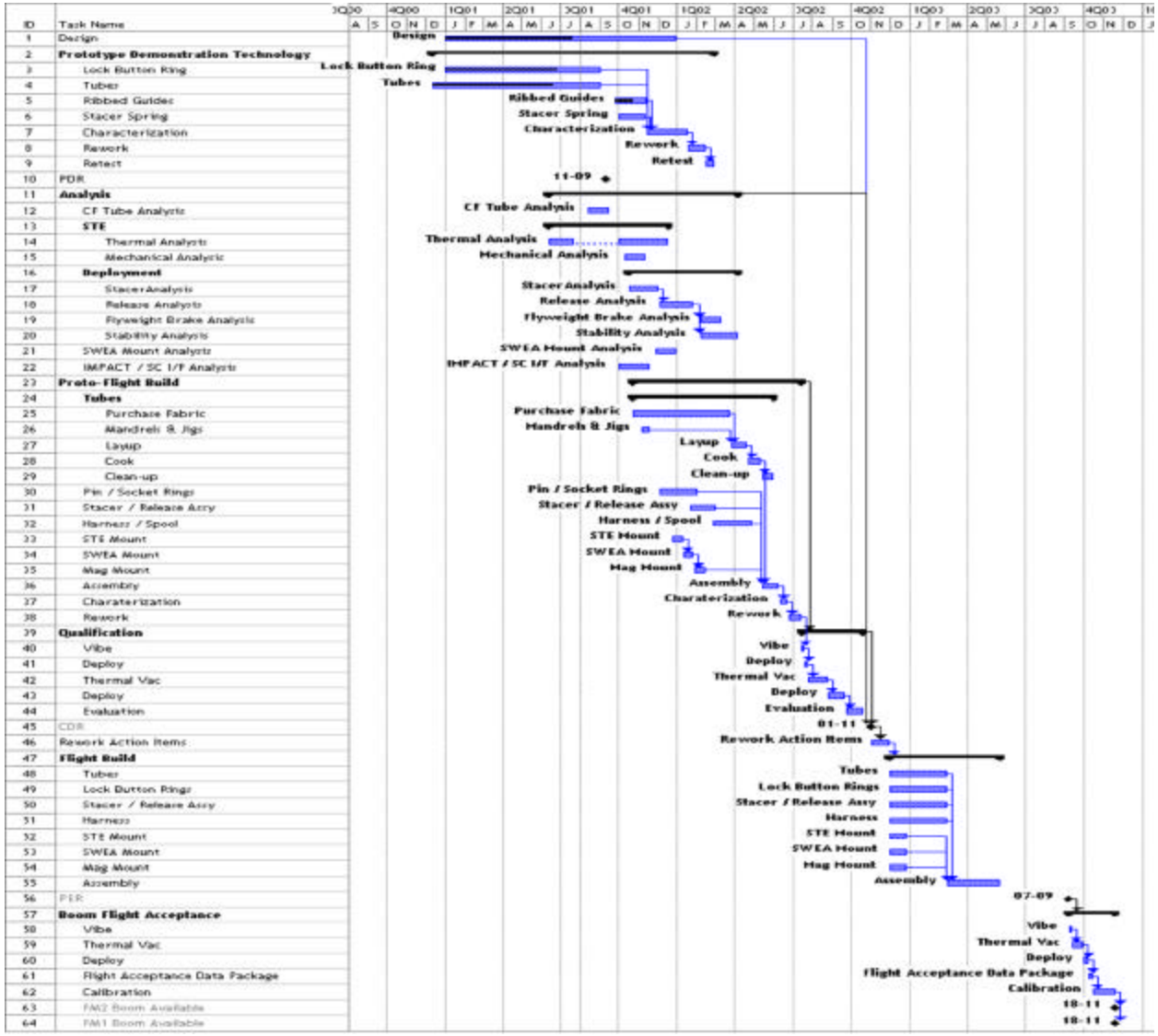
Item	Action	Status	Status
130	Boom Development Plan	See Boom Presentation slide 10	Open
131	Define Boom Stowed Configuration	See Boom Presentation slides 3 and 5	Open
132	Boom deployment end-stops	Added, See slides 6 and 7	Closed
133	Boom Frequency Requirement	Previously discussed, slide 5	Open
134	Boom Mass Estimate	7.75kg See Boom presentation slide 11	Closeable
135	Boom Stiction	See Boom presentation slides 5, 7 and 8	Open
136	Boom Coax Size	Still TBD	Open
137	Boom Stiffness Requirement	See Boom presentation slide 5	Open
138	Boom Stiffness, unlocked	See Boom presentation slide 5	Open
140	Boom Surface Characteristics (Conductivity vs Contamination)	Sample of normal surface preparation to be provided to GSFC for contamination analysis	Open

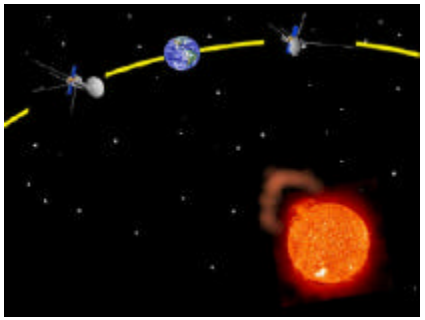


Stereo Impact Telescoping Boom

Current Development Plan

With latest known millstone dates. As shown, boom availability is 2 years before launch date.



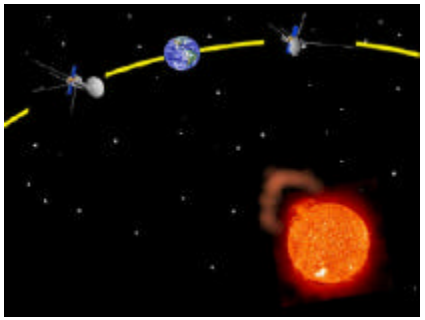


Stereo Impact Telescoping Boom

Current Mass Estimates

5 tubes, 4.2m extension.

Item	Mat'l	Density	Volume	Mass/unit	Qty	Total	
		gr/mm^3	mm^3	gr		gr	
50mmtube#1	Gr/E			285	1	285.0	
90mmtube#2	Gr/E			432	1	432.0	
130mmtube#3	Gr/E			551	1	551.0	
170mmtube#4	Gr/E			718	1	718.0	
210mmtube#5	Gr/E			883	1	883.0	
250mmtube#6	Gr/E			1050	0	0.0	
Pin	brass	8.47E-03	439.4	3.72	36	134.0	
Spring	SST	8.03E-03	49.4	0.40	36	14.3	
Roller	PEEK	1.32E-03	157.2	0.21	36	7.5	
axle pins	SST	8.03E-03	2.7	0.02	72	1.5	
50mm lower inner ring	6061-T6xx Al	2.71E-03	13466	36.49	1	36.5	
50mm lower outer ring	6061-T6xx Al	2.71E-03	15339	41.57	1	41.6	
90mm lower inner ring	6061-T6xx Al	2.71E-03	18045	48.90	1	48.9	
90mm lower outer ring	6061-T6xx Al	2.71E-03	22240	60.27	1	60.3	
90mm upper inner ring	6061-T6xx Al	2.71E-03	15741	42.66	1	42.7	
90mm upper outer ring	6061-T6xx Al	2.71E-03	21887	59.31	1	59.3	
130mm lower inner ring	6061-T6xx Al	2.71E-03	26065	70.64	1	70.6	
130mm lower outer ring	6061-T6xx Al	2.71E-03	32124	87.06	1	87.1	
130mm upper inner ring	6061-T6xx Al	2.71E-03	22737	61.62	1	61.6	
130mm upper outer ring	6061-T6xx Al	2.71E-03	31615	85.68	1	85.7	
170mm lower inner ring	6061-T6xx Al	2.71E-03	34085	92.37	1	92.4	
170mm lower outer ring	6061-T6xx Al	2.71E-03	42009	113.84	1	113.8	
170mm upper inner ring	6061-T6xx Al	2.71E-03	29733	80.58	1	80.6	
170mm upper outer ring	6061-T6xx Al	2.71E-03	41342	112.04	0	0.0	
210mm lower inner ring	6061-T6xx Al	2.71E-03	42105	114.10	0	0.0	
210mm lower outer ring	6061-T6xx Al	2.71E-03	51893	140.63	1	140.6	
210mm upper inner ring	6061-T6xx Al	2.71E-03	36729	99.54	1	99.5	
210mm upper outer ring	6061-T6xx Al	2.71E-03	51070	138.40	1	138.4	
250mm upper inner ring	6061-T6xx Al	2.71E-03	43725	118.49	0	0.0	
250mm upper outer ring	6061-T6xx Al	2.71E-03	60797	164.76	0	0.0	
Mounting Brackets	6061-T6xx Al	2.71E-03	141514	383.50	2	767.0	
Cable Spool	PEEK	1.32E-03		300	1	300.0	
SMA Release	var.			30	1	30.0	
Glue						250.0	
SWEA mount	PEEK	1.32E-03	73783	97.39	1	97.4	
STE Mounts	PEEK	1.32E-03	30705	40.53	2	81.1	
Mag Mount	PEEK	1.32E-03	162891	215.02	1	215.0	
Tube Guides	PEEK	3.32E-03	11013	36.56	4	146.3	
Stacer assembly	Various			1500	1	1500.0	
Blankets	12 layer MLI					49.6	
					Total:	7722.2	gr



Stereo Impact Telescoping Boom

Remaining Items:

1) Harness design:
   Current coax sample is OK, finalize (for now) number of STP and singles, build up a 1m section for mechanical testing.

2) Estimated frequency of boom in unlatched conditions:
   Determine centers of percussion for various failure scenes, and back out natural frequency from there.

3) Acceptance of boom tube element cleanliness:
   Sample is ready for cleaning: ultrasonic in acetone, then isopropyl alcohol.
   Deliver to Harry Culver, GSFC.