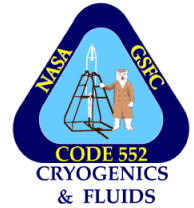




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Cryogenics and Fluids Branch

STATUS OF THE AMS-02 CRYOCOOLER

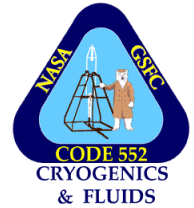
**Presented by
Kimberly Shirey**

October 28, 2002



Cryocooler Status Update

Progress Since May 2002 TIM



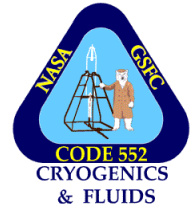
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Cryogenics and Fluids Branch

- MIT/Goddard Space Act Agreement Amendment
 - Modification to Goddard milestone and payment schedules
 - Aligned with July 2005 launch readiness date
- Magnetic compatibility test
 - Completed
- Bracket design
 - Held Preliminary Design Review
- Cold finger Allowable Loading Specification
 - Performed FEA
- Operation with ETH-provided breadboard electronics (EM#1 and EM#2)
- Trend Analyses
 - EM#1 accumulated hours: 2,521; EM#1 thermal performance: no change from baseline
 - EM#2 accumulated hours: 3,555; EM#2 thermal performance: no change from baseline



Magnetic Field Compatibility Test



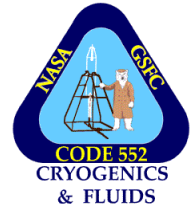
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- Additional tests were conducted in June to determine the cause of the thermal performance degradation at high fields
- Confirmed causes of thermal performance degradation
 - Energy dissipation in the flexible mount caused by magnetic hysteresis damping of the balancer
 - Primary cause of thermal performance degradation
 - Modified balancer to reduce magnetic hysteresis effects
 - Motor inefficiency
 - No effect other than small decrease in thermal performance
- Reinforced that there are no indications the thermal performance degradation was due to piston rubbing due to field-induced misalignment.
- Cryocoolers tested in twice the maximum expected magnetic field.

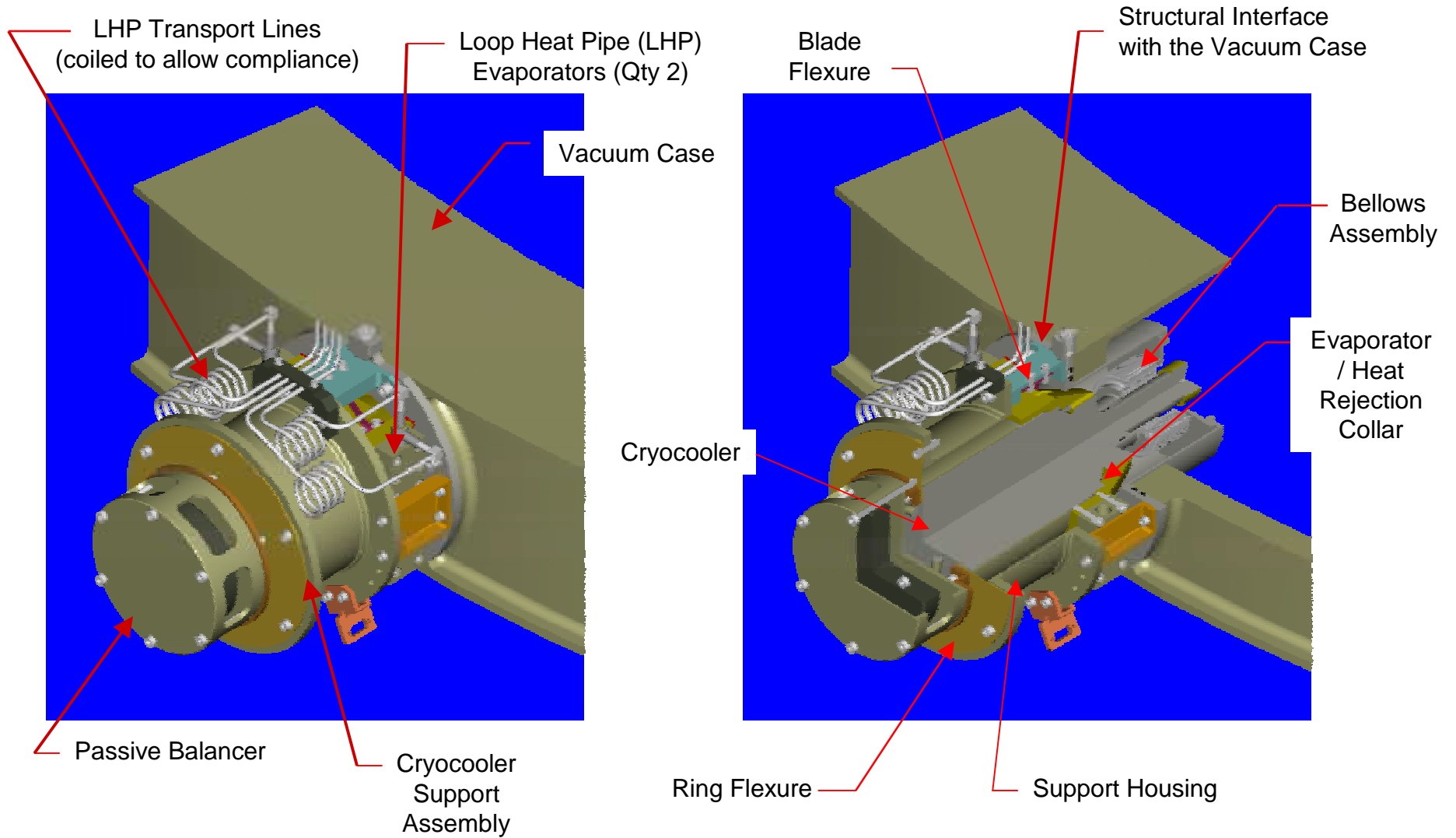


Bracket Design Description



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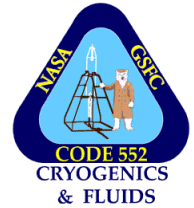
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AMS General Meeting

4



Bracket Status



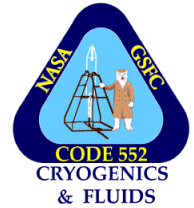
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- Held Preliminary Design Review in September
 - Package reviewed by GSFC technical panel and AMS colleagues
 - Lockheed Martin, Space Cryomagnetics, Carlo Gavazzi, OHB Systems, ETH
 - Meets all interface and performance requirements
 - Structural and thermal analysis complete
 - Meets structural and thermal requirements
- Final design drawings complete
- Machining of engineering model will begin in November
- Qualification test program of cryocooler bracket assembly will follow

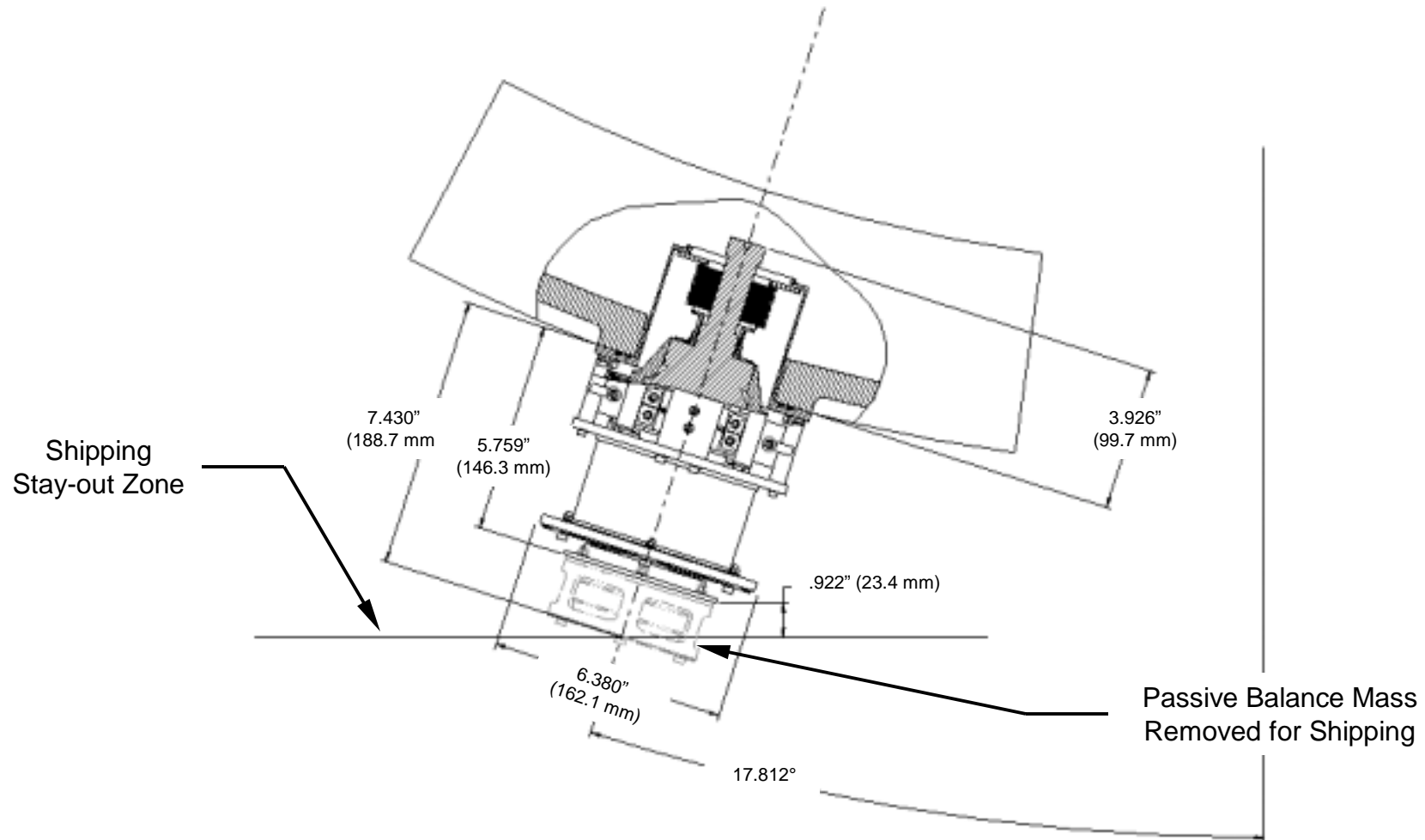


Compliance with Keep In Zone



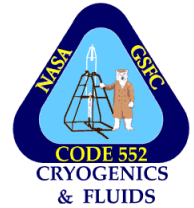
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Mass Property Summary



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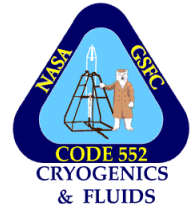
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Drawing Number	Part Title	Weight per Item (lbs)	Quantity	Weight of Quantity (lbs)	Weight of Quantity (kg)
B8163	EVAPORATOR COLLAR	3.40	1	3.40	1.54
B8164	PULL RING	0.24	1	0.24	0.11
B8165	BALANCE MOUNT	0.20	1	0.20	0.09
B8166	RING FLEXURE	0.13	1	0.13	0.06
B8167	SUPPORT HOUSING	0.54	1	0.54	0.24
B8168	SUPPORT BRACKET	0.04	2	0.08	0.04
B8169	FLEXURE BRACKET	0.08	2	0.16	0.07
B8170	POWER CONNECTOR, BRACKET	0.03	1	0.03	0.01
B8171	SENSOR CONNECTOR, BRACKET	0.03	1	0.03	0.01
B8173	PAD, STOP	0.002	8	0.02	0.01
B8174	INTERFACE PLATE, BOOT	0.29	1	0.29	0.13
B8175	FLANGE, BOOT	0.17	1	0.17	0.08
B8176	HOUSING, BOOT	1.91	1	1.91	0.87
B8177	BLADE FLEXURE	0.03	2	0.06	0.03
B8178	SHIM	0.005	4	0.02	0.01
	SUNPOWER CRYDCOOLER	6.98	1	6.98	3.17
	BALANCE MASS	1.73	1	1.73	0.78
	BELLOWS	0.09	1	0.09	0.04
	EVAPORATOR BLOCK	0.33	2	0.66	0.30
	MISCELLANEOUS (HARWARE, O-RINGS, ETC.)	0.50	1	0.50	0.23
	TOTAL (NO CONTINGENCY)			17.2	7.8

- Items not included:
 - Wiring
 - Blanketing
 - LHP transport lines and brackets
- Parts associated with moving mass are highlighted
 - Total moving mass = 13.5 lbs (6.1 kg)



ETH Breadboard Electronics Testing



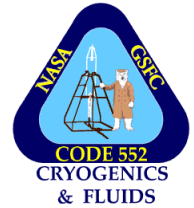
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Cryogenics and Fluids Branch

- Tested ETH Phase 2 (PD02) Breadboard Electronics with EM#1 and EM#2
 - Efficiency of electronics is high, in the 90% + range
 - However, interactions with cryocooler result in poor thermal performance
- GSFC studied, developed, and tested an H-bridge control algorithm that would mitigate the loss of efficiency in cryocooler.
 - System efficiency in the 90% range
- Results in low impact design changes to currently provided electronics.



ETH Breadboard Electronics Testing



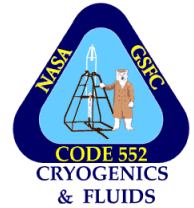
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Cryogenics and Fluids Branch





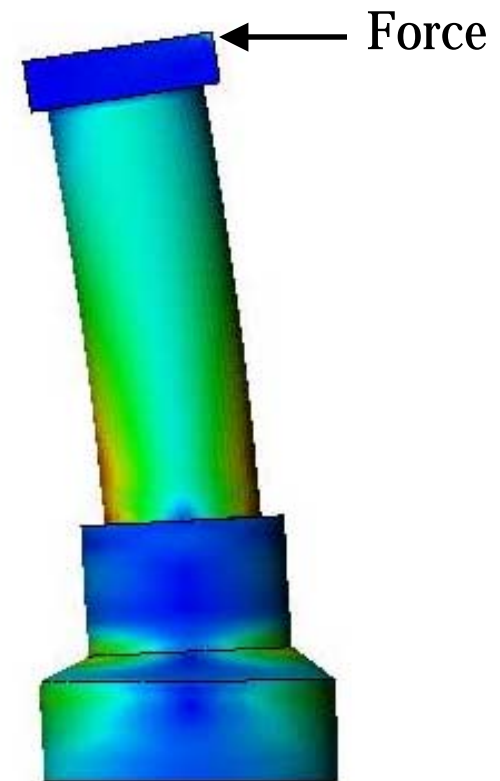
Cold Finger Loading



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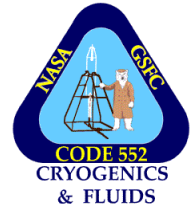
Cryogenics and Fluids Branch

- Obtained allowable axial and radial loadings from Sunpower
- Supplied SCL with detailed geometry of cold finger and allowable coldfinger loadings
- Performed FEA to confirm tip deflections did not result in high stresses or buckling





Program Status



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Cryogenics and Fluids Branch

- Cryocooler Bracket
 - Machining of engineering model bracket
 - Qualification testing of cryocooler/bracket assembly
- Off-conductance measurement of cryocooler
- Gas bearing analysis
 - Information received from Sunpower
 - Analysis to begin this quarter
- Preparing for flight buy of cryocoolers and flight build of brackets