STEP Status and Strategy

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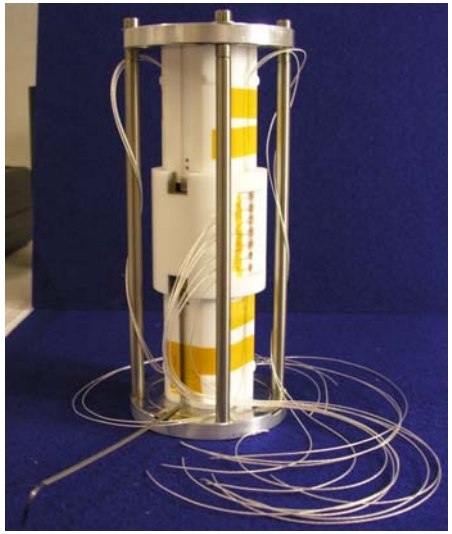
Agenda

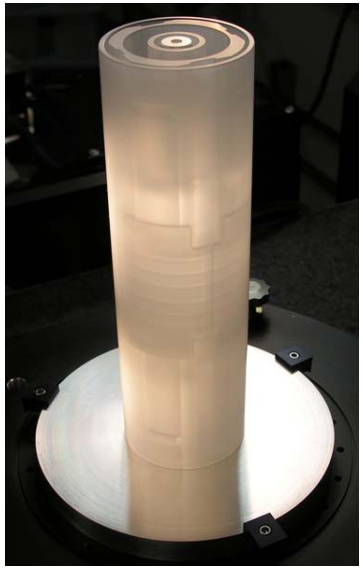
- STEP Technology Development Status
- Advocacy Planning
- Goals for Collaboration

Inner Accelerometer Development



Assembled Brassboard

Engineering Model Quartz Parts

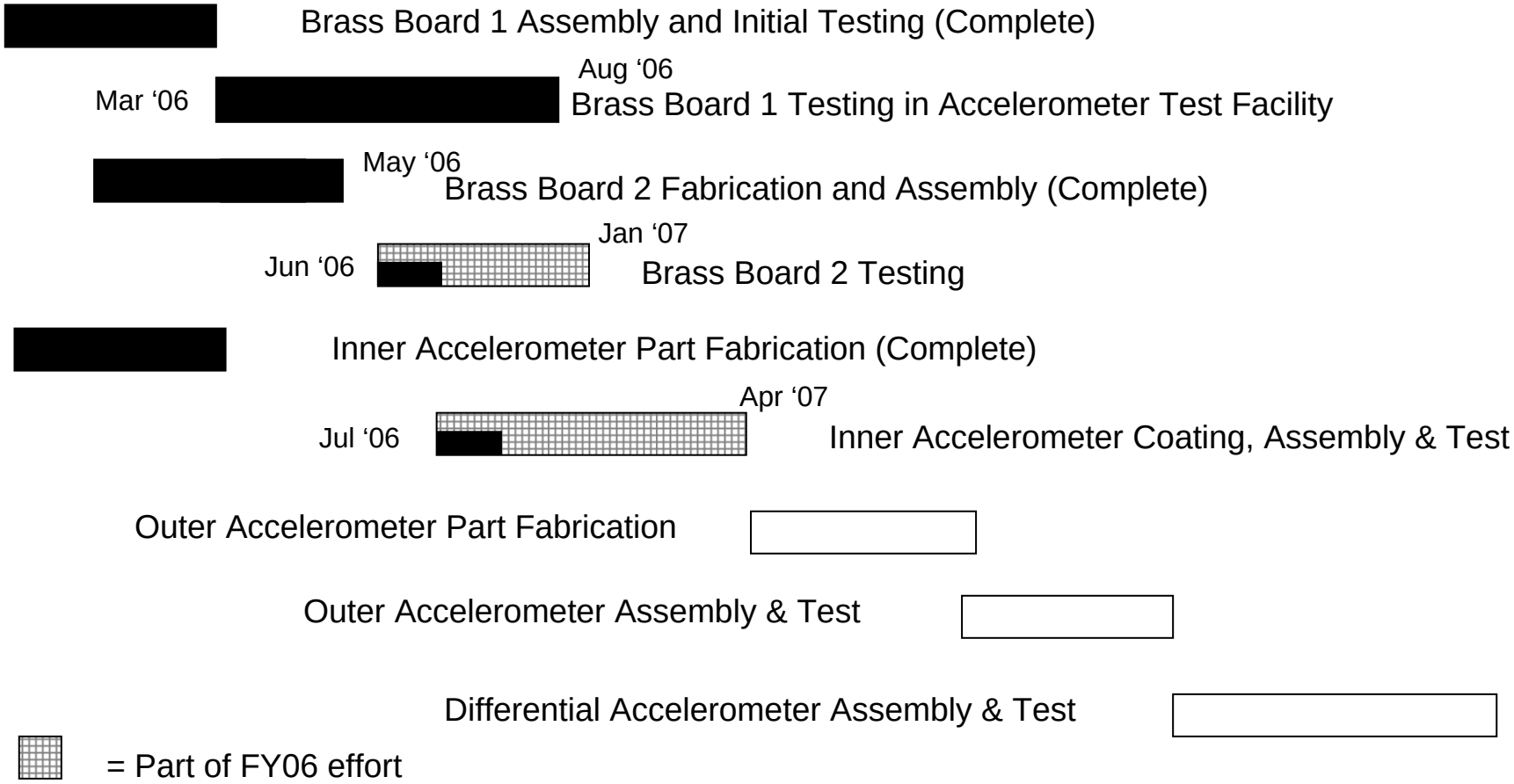


Engineering Model Fit Check

Coated Quartz Parts

Completed Engineering Model Early 2007

Technology Development Plan for STEP Differential Accelerometer



Note: Schedule in development & depends on funding. Status as of October 2006.

Brass Board 1 Results

- First STEP accelerometer with flight-like gold-coated housing (20 separate electrode surfaces)
- Developed accelerometer electrical design, including cables, connectors, and cable routing
- Finalized grounding and shielding scheme for EM
- Demonstrated expected electrode capacitance to test mass for each of the 10 EPS detection electrodes
- Demonstrated expected test mass capacitance minimum along three axes with housing coatings at ground
- Observed long-term mechanical instability caused by movement of housing components; will address for EM
- Demonstrated BB1 testing in ATF; Need improved electrical cable to test mass; Reduced cable capacitance in BB2 and EM

Brass Board 2 Test Status

- First STEP accelerometer with flight-like EPS position detection electrodes and SQUID readout coils
- First cryo testing of a STEP accelerometer
- Improved EM coil manufacturing process to ensure niobium trace superconductivity
- Demonstrated flight design SQUID readout coil is superconducting and of expected coil inductance
- Demonstrated functionality of superconducting cable
- Plan to measure in coming months:
  - EPS electrode coupling to SQUID readout coil at 4 K
  - Magnetic bearing coupling to SQUID readout coil
  - Effective magnetic shielding of inner accelerometer to external disturbances
  - Test mass positioning using caging mechanism

Engineering Module Build Status

- First STEP accelerometer with flight configuration gold coated quartz housing (20 separate electrode surfaces), SQUID readout coils, and caged test mass
- Demonstrate at room temperature expected test mass capacitance minimum with housing coatings at ground
- Demonstrate reproducibility after thermal cycle, especially electrode capacitance and coil inductance
- Calibrate EPS position detection electrodes
- Demonstrate SQUID readout coil calibration using EPS position detection electrodes
- Will repeat all BB1 and BB2 tests; expect errors reduced to micron levels

STEP Benefits to MSFC

- Science related to string theory and other fundamental physics theories
  - Potential for “scientific revolution”, per NRC
  - Potential Nobel Prize-quality science
- Builds on GP-B experience and technology
- Continues MSFC tradition of science satellites
- Helps advance fundamental research
- Continued relationship with prestigious university
- Potential for international collaboration

General Advocacy Strategy

- Use GP-B experience and results where practical
- Pursue multiple flight options
  - NASA spacecraft, or instrument on ESA spacecraft
- Continue technology development as funding allows
  - Needed regardless of flight option
- Work to broaden the advocacy for STEP to other organizations
- Expand advocacy to fundamental physics, not just STEP
- Cultivate relationships with European fundamental physics community

Current US Actions

- Continue planning for GP-B announcement in Spring 2007. This will be part of a more comprehensive "campaign" with announcements and events approximately every 6 months through 2008. Probable milestones include:
  - Completion of the Inner Accelerometer Engineering Model (winter 2007)
  - GP-B science results (spring 2007)
  - Fundamental Physics Workshop at Stanford (fall 2007)
  - Completion of the Outer Accelerometer Engineering Model (spring 2008)
- Identify the applicability of the current STEP work to other future missions, study possible ways to make the STEP technology development more useful to the other missions, and develop a roadmap for presentation to NASA HQ
- Explore technology funding with HQ/Science Mission Directorate
- Plan to present at next year's SMD technology conference
- Resume MSFC-Stanford-Europe periodic telecons and discuss possible areas of cooperation and/or in-kind agreements
- Broaden the advocacy for STEP by engaging other scientists in the field. Intent is to award small grants from 2007 funds.
- Broaden the scope of the advocacy toward fundamental physics, and not just STEP
- Maintain awareness of potential future competed opportunities.
- Continue increase in MSFC technical involvement
  - Current areas include error analysis, requirements definition and verification planning, drag-free control algorithm development, caging mechanisms, and aerogel technology. (Latter 3 being talked as possible IRAD proposals.)
  - Note: MSFC director visiting Stanford today

STEP/GAUGE Collaboration

- Overall intent is to find ways STEP and GAUGE can help each other move forward
- Goals
  - Tentative agreements on technical collaboration
  - Establish framework for periodic communication
  - Begin working together more to advocate fundamental physics in space