LGWA Tilt-Platform Design and Performance Constraints

Suresh Doravari
IUCAA

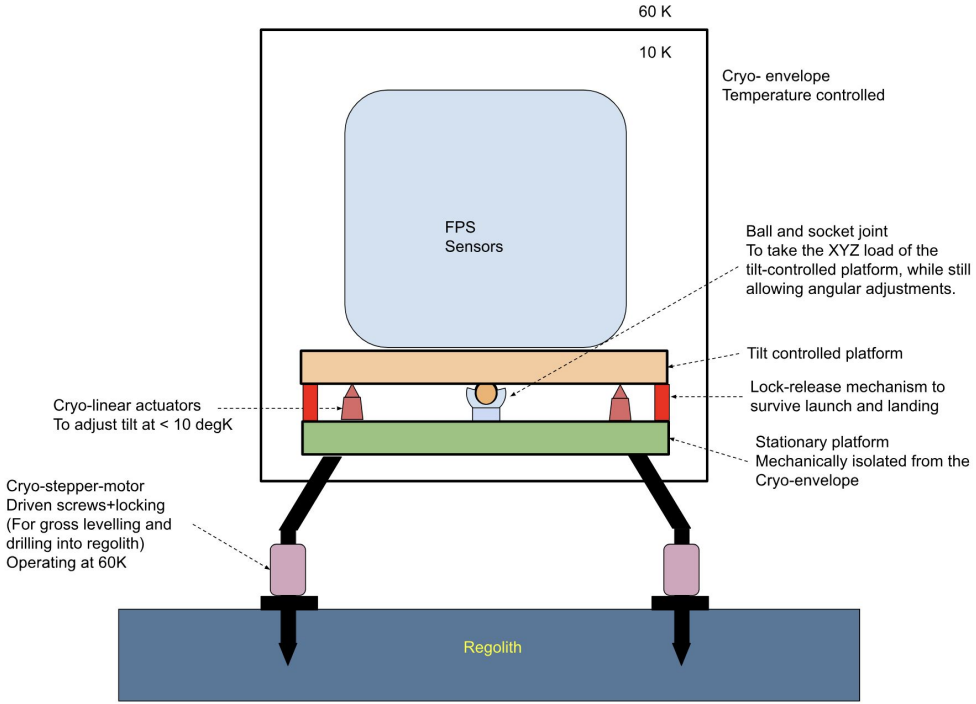
Inter-University Center for Astronomy and Astronomy
Pune, India

Basic Considerations

- Payload requirements
  - Lunar operation : cryogenic operation, structural rigidity,
  - Lab tests on Earth : thermal cycling, Weight on earth
- Mission requirements
  - Power consumption, Radiation hardening, redundancy/failure of mission critical components, weight limitations,
- Launch requirements
  - Vibration load, shock load, locking mechanism
- Landing requirements:
  - Landing shock, Deployment strategy, Unlocking mechanism
- Operation requirements:
  - Alignment precision, In-situ calibration, health checks, lunar quakes, regolith settling, data-handling and transmission, long term operation,

Basic Structure

- Two levels of actuators
  - Coarse control - on regolith, 50-100 K supporting whole platform + sensors
  - Fine control - minimal load, < 10 K
  - Independent of locking/unlocking mechanism
- Potential cryo-linear actuators
  - JPE : CLA2602
  - To be tested
  - Not yet-space qualified
- Fine Control actuators
  - do not need to support load of the sensors / platform
  - Ball and socket joint to take the load and provide XYZ, θ_z constraints
  - Not in contact during launch / landing



Ongoing work

- Payload team is working on a detailed specifications list.
- Requires constraints from full mission parameters
- Assessment of technological readiness of various components
- Proposals for development of testing platforms and tilt sensors underway

Platform Levelling System Specifications for LGWA

Operating Temperature:	15 K - 100 K *(operation during testing at room T?)*
Thermal cycling	
15 K to Room T	100 cycles
15 k to 100 K	1000 cycles
Life cycle	
roundtrips of 60 mm	50
roundtrips of 5 mm	100
roundtips of 0.1 mm	10000
Payload mass on the platform:	30 kg
Levelling platform width:	50 cm
Duration of the mission:	10 yrs

Excerpt from the tilt-platform specs

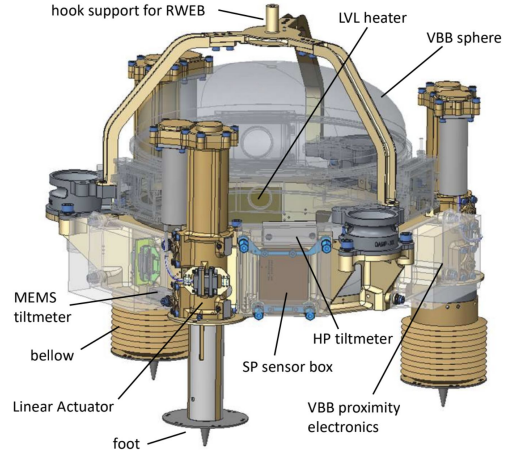


Figure 1. The SEIS Leveling System carries the seismic sensors

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Plans for the near future

- Requires a joint study including the space technology community
- Requires planning in conjunction with the Strategic Mission Plan
- Requires demonstration of all technologies till TR6 level within 3 years
    - Planned testing activity at IUCAA

        (in collab with NPL, UniCam, GSSI)
    - Planned testing facilities at GSSI

Lessons from Mars Insight Mission
- Tested technologies
- concepts we can borrow

https://x.com/NASAInSight/status/1571892419624599552

Questions / Remarks / Comments

Welcome!

Thank You!