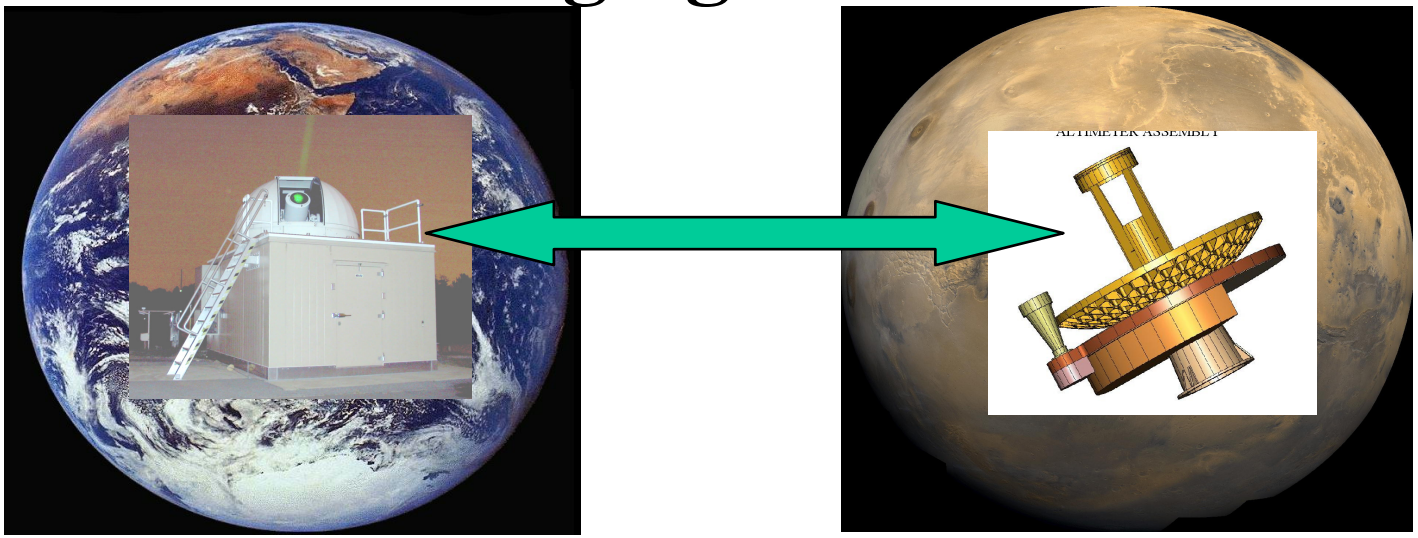
Simulating Interplanetary Transponder and Laser Communications Experiments via Dual Station Ranging to SLR Satellites



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Acknowledgement

- This work was initiated following a lively technical discussion on transponders with Dr. Ulrich Schreiber at the October 2005 ILRS Workshop in Eastbourne, UK.

Why do we need a lasercom and transponder simulator in space?

- High data rate interplanetary laser communications and transponders for highly accurate ranging and time transfer are vital to future NASA programs in Solar System Exploration as well as Fundamental Physics and General Relativity.
- Recent successful GSFC experiments to the Messenger and MGS spacecraft have sparked NASA interest in laser transponders.
- The potential effects of atmospheric turbulence on the upward and downward propagating beams is a subject of much debate and uncertainty which can lead to over-specification of the space and ground terminals and corresponding cost growth. This may have played a role in the recent cancellation of NASA's Mars Laser Communications Demonstration (MLCD).
- The effects of atmospheric turbulence (beam spreading, beam wander, and scintillation) are highly site specific, depend strongly on elevation angle, and probably cannot be well simulated in the laboratory, over ground-to-ground links, or even ground-to-air links.
- Dual station ranging to a passive retroreflector array in Earth orbit can provide a realistic simulated link. Different transponder and lasercom concepts can be tested and evaluated long before a space mission is approved.

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