Geophysical Research Abstracts
Vol. 12, EGU2010-11241, 2010
EGU General Assembly 2010

A Microseismometer for Penetrometer Deployment in the Jupiter System

William Pike (1), Ian Standley (2), Werner Karl (1), Aifric Delahunty (1), and Simon Calcutt (3)

(1) Imperial College London, UK (w.t.pike@imperial.ac.uk), (2) Kinemetrics Incorporated, Pasadena, USA, (3) Oxford University, UK

The internal structure of the moons of Jupiter is an area of great interest. Seismic investigations, either in the long-period band of 0.1 to 1 Hz, or at shorter periods of 1 to 100 Hz, have been studied as a means to determine the depth of subsurface liquid water with a single, triaxial seismometer. A penetrometer would be an ideal deployment for such an instrument as it would ensure excellent coupling, minimise thermal variations, and substantially reduce the radiation environment during operation.

A microseismometer is under development which combines the required sensitivity for identification of the ambient seismicity with the robustness to survive the shock of deployment. At the heart of the instrument is a single-crystal silicon suspension machined through the full thickness of a wafer resulting in a very high quality factor. The movement of the proof mass is determined by extremely sensitive capacitive array transducer. This transducer is coupled to readout and feedback electronics which are designed for very low power operation. A unique combination of open and closed loop feedback enables the instrument to operate over a wide range of tilt angles, a vital consideration for a penetrometer deployment. The current measured noise is 3 ng/sqrtHz at 20 s, with the capability of a further order of magnitude improvement. The suspension has been tested on rocket-sled impacts to simulate a penetrometer deployment, surviving shocks up to 14,000 g with suitable encapsulation.

Such an instrument would have the capability for deployment on the surface of Europa or Ganymede and should provide vital information on the internal structure of these bodies.