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Time-varying electromagnetic (EM) fields induce eddy currents in planetary interiors, which penetrate to increasing depths at longer periods and thus can be used to probe variations of electrical-conductivity with depth. By jointly measuring magnetic and *electric* fields, the magnetotelluric (MT) method recovers subsurface properties using a single station, without any knowledge of source-field properties. The high sensitivity of EM sounding to saline water enabled the discovery of the Europa subsurface ocean, but a key Lander requirement is to detect any liquid water within 30 km—which could include dikes, sills, or diapirs within the ice shell. The Galileo measurements exploited known source-field structure at long periods, but the geometries of short-period waves that probe within the ice shell are not known a priori. Comparison with an orbital magnetometer—if one was available—would be fraught with plasma distortions. MT can readily achieve this objective because it has high bandwidth, does not require an orbital magnetometer, and is largely immune to plasma distortion. Sensitivity to water is much better than seismology and the measurements can be completed in a few days.

We have just completed a TRL 6 prototype for a Europa Magnetotelluric Sounder (EMS) under NASA COLDTech sponsorship. This system comprises central electronics, two remote-deployable electrodes, and a magnetometer on a mast. We performed functional data-acquisition testing (**Fig. 1**) and separately tested the deployments under Europa conditions. This prototype is the basis for new effort under ICEE-2, a pool of instruments selected for pre-Phase A development for a Europa Lander. The updated EMS will requalify to TRL 6 but now incorporate 3 electrodes, robust cabling, and improved electronics.

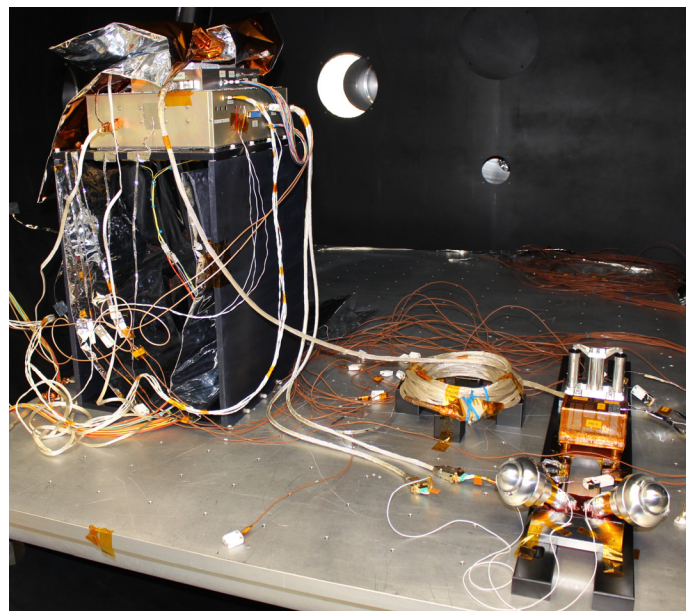


Fig. 1. Europa Magnetotelluric Sounder (EMS: COLDTech prototype) prepared for TVAC functional tests. Baseplate is held at Europa surface temperature and electronics (upper left) at vault temperature. Two electrodes are at lower right; magnetometer is separated from mast at middle right; all mechanisms are undeployed.