

## Development and Testing of a Europa Penetrator for Astrobiology

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### Abstract

Two phases of Penetrator development activities have been funded by ESA. The first phase focussed on the mission and system definition of a penetrator and delivery system for a mission to Europa and the second phase provided an update of the penetrator design for a larger suite of instruments focused on astrobiology and the demonstration of key system technologies through a programme of small scale and full scale testing. The science focus for the Europa penetrator is

Astrobiology while the key science goals can be achieved within the first day of operation but a longer lifetime is required for the transmission of the science data to the orbiter. The extreme temperature environment of the European surface drove the design to a solution of a Penetrator with two separate bays. The front bay will be a short lifetime bay which will sample the surface and complete all analysis and data transfer within 10 hours. The rear bay is a warm bay which will house

the penetrator support systems required to transmit all collected data to the orbiter. The scientific instruments housed by the penetrator includes a optical microimager, a habitability package and a mass spectrometer. A drilling and sampling mechanism is used for accessing the icy material outside the Penetrator for analysis.

Small scale trials have been undertaken at the University of Cambridge Cavendish Laboratory to validate the impact modelling techniques and the robustness of critical components. A range of trials have been carried out to assess survivability of key elements of the design, including the sampling mechanism, potting compounds, accelerometers, shell, batteries and Torlon suspension springs.

Full scale trials have been carried out to test the overall structural integrity of the system and the penetration profile. This programme was carried out in June 2013 at the MoD test range in Pendine South Wales. Two targets (sand and ice) were used to test the survivability

of the design for missions to different planetary surfaces.

This paper will present the Penetrator design and the results of the successful test campaigns and the next steps required in the Penetrator development.