

# High Speed Penetrator Deployable Mass Spectrometers

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Solar System exploration is currently in a phase where in-situ analysis is playing an increasingly important role. A number of future missions are arising that may offer the opportunity to gain access to surface and sub-surface material through the deployment of high-speed penetrator platforms. High speed penetrators are instrumented packages that are unbraked after de-orbit and are designed to survive impacting the surface at very high velocity, typically at around 300 m/s and embed themselves several metres into the regolith. Due to the decelerating shocks of up to 10 000 g payloads need to be highly robust.

Penetrators offer the opportunity of accessing locations that are difficult and often impossible to reach with soft landers. In addition, by the very nature of the landing and deployment system, penetrators eliminate the complicated sample acquisition chain associated with conventional in-situ sampling and analysis systems deployed from soft landers. Our interest is to use penetrators as the delivery system is to allow the deployment of mass spectrometer instrumentation to perform in-situ measurements with the objective of characterising the volatile and organic materials at the penetrator landing site on different Solar System bodies including the lunar poles, asteroids and the icy moons.

A background into Penetrator deployment systems will be given, with a review of previous studies and high speed penetrator field tests carried out in the UK. On-going work on a rugged and impact tolerant mass spectrometer instrument compatible with penetrator deployment will be discussed.