

## IAF SPACE EXPLORATION SYMPOSIUM (A3)

## Moon Exploration – Part 1 (2A)

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# EMS: FAST TRACK DEVELOPMENT OF A MINIATURIZED MASS SPECTROMETER FOR LUNAR APPLICATIONS

## Abstract

The Astrobotic M1 mission, as the first mission of NASA's Commercial Lunar Payload Services (CLPS) programme, is scheduled to land in the Lacus Mortis region of the Moon in early 2022. Among its payloads it will carry the Peregrine Ion Trap Mass Spectrometer (PITMS), an instrument supplied by NASA GSFC that is dedicated to the investigation of the Lunar exosphere, and which includes as its core component the ESA-provided Exospheric Mass Spectrometer (EMS). EMS is developed by an academic/industrial consortium led by Open University (UK) using a fast track development approach that aims at delivery of a Proto-Flight Model (PFM) instrument after a nominal 1 year development time. With an envelope of H\*W\*D of 168\*143.5\*134mm, a mass of 1.5kg and a typical power consumption not exceeding 7.2 Watts the instrument implies modest resource requirements. EMS can be re-used in different future application scenarios, including investigations of the lunar exosphere, analysis of gases evolved from acquired samples, and monitoring aspects of the environmental impact of landers and vehicles on the lunar environment. In our paper, we will first explain the science goals and requirements for the EMS instrument as part of PITMS. The EMS instrument and its key elements will be described and its capabilities will be explained. The industrial and academic teams that perform the EMS development will be introduced. The fast track development approach, which represents a departure from traditional development strategies and implies adapted management techniques as well as increased development risk, is explained. Key engineering challenges will be highlighted, and lessons learned for managing fast track projects in the ESA environment will be presented. The instrument's potential for re-use on different future exploration missions will be explained, and upcoming re-flight opportunities will be pointed out. The latest status of the PITMS/EMS development for flight on the Astrobotic M1 mission will be provided, and some of the challenges of managing and implementing the project in the framework of the ESA/NASA collaboration on CLPS will be explained.