PHOOTPRINT : A EUROPEAN PHOBOS SAMPLE RETURN MISSION. S. Barraclough[1], A. Ratcliffe[1], R. Buchwald[1], H. Scheer[1], M. Chapuy[1], M. Garland[1], D. Rebuffat[2], [1]Airbus Defence and Space, Stevenage, UK, SG1 2AS, [2]ESA ESTEC, Noordwijk, Netherlands

Introduction: Phootprint is an ESA funded feasibility study for a European Phobos Sample Return Mission. Phobos as a destination is receiving significant attention from the international community as there is both a strong scientific interest due to the unknowns surrounding the nature of its formation and a technology drive as a mission could represent a unique opportunity to test some of the key components of a Mars Sample Return Mission.

The study developed a technical baseline for the mission and addressed the key technological challenges identified by ESA and industry including ERC design, GNC proximity operations, sample acquisition and transfer and landing leg design. The concept baselined is a 3 stage composite spacecraft consisting of a Lander, Earth Return Vehicle (ERV) and Earth Re-entry Capsule (ERC). Unlike Phobos-Grunt, Phootprint will select the landing site during the mission and will use data collected during an observation campaign in a Quasi-Satellite Orbit (QSO) and during a series of fly-bys. The study evaluated the relative merits and impacts of both a direct descent and descent with hover station which revealed interesting insights into surface contamination issues and landing accuracy. Due to the higher gravitational forces on Phobos, compared to NEOs, Phootprint baselines a soft landing using four deployable legs which also allows a longer surface stay compared to a touch-and-go approach. During the surface stay the major activity will be to successfully select a sampling point and retrieve a sample from the surface using a novel Rotary Brush mechanism. Upon completing the surface operations, the ERV ascends from the surface and begins a transfer back to Earth. An ERC based on the Hayabusa aeroshell shape has been selected and tailored for a hard-landing which allows g-levels on the sample to remain below 1500 g in the worst case conditions.

The paper will provide the results of the study including the system level activities which brought together the main technologies and subsystems to deliver an overall composite configuration capable of returning a sample from Phobos. Insight will also be given into the European technology roadmap which addresses the development of key technologies and spacecraft components required to provide European sample return capability.