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ESA Technology Reference Studies

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The Science Payload & Advanced Concepts Office (SCI-A) at ESA has introduced a technology development concept called Technology Reference Studies (TRS). The overall purpose of the TRSs is to focus the development of strategically important technologies that are of likely relevance to future science missions. This is accomplished through the study of several technologically demanding and scientifically interesting missions, which are not part of the ESA science programme. Presently the Planetary Studies Section of SCI-A is studying four TRS, the Venus Entry Probe (VEP), the Jupiter Minisat Explorer (JME), the Deimos Sample Return (DSR) and the Interstellar Heliopause Probe (IHP). The TRSs cover a wide range of missions in the solar system and several strategic technologies will have to be developed to enable these missions:

The VEP TRS studies approaches for low cost in-situ atmospheric exploration of Venus. The VEP baseline consists of an orbiter, a relay satellite and an aerobot, which will deploy active probes during flight. The VEP faces several technological challenges such as development of a long lifetime balloon in a demanding environment and development of low mass, low resource microprobes.

The JME TRS aims to study the Jovian system, particularly the smallest of the four Galilean moons, Europa. The baseline consists of two minisatellites, one relay spacecraft in a highly elliptical orbit around Jupiter, and one in circular polar orbit around Europa, and a microprobe. Jupiter has a challenging radiation as well as a low solar flux environment and developing spacecraft capable of surviving this environment will be one of the main challenges for the JME.

The DSR TRS plays a dual role in serving as an example of a sample return on a low gravity body, as well as a sample return of Martian material. The aim is to return a 1

kg sample of Deimos regolith to the Earth. Key technologies that have to be developed in order to enable the DSR mission include a sampling mechanism, a sample retrieval system and a rendezvous system for the both the lander and the return vehicle in Martian orbit.

The IHP TRS aims to travel to the Heliopause and the interstellar medium at a distance of 200 AU from the Sun within 25 years. One of the major challenges for the IHP is the development of a propulsion system capable of delivering a significant mass to this location. Additionally, developments are required for the communication system, power system and the ability to design a spacecraft with a 25-year lifetime.

The TRS all aim to use small satellites (˜ 300kg), with highly miniaturized and highly integrated payload suites. By using multiple low resource spacecraft in a phased approach, the risk and cost, compared to a single, high resource mission is reduced.

This paper provides a top level description of the current four TRS and shows how these missions are used to identify and develop technologies. An overview of the preliminary results of these studies will be given, together with a description of the identified technological challenges.