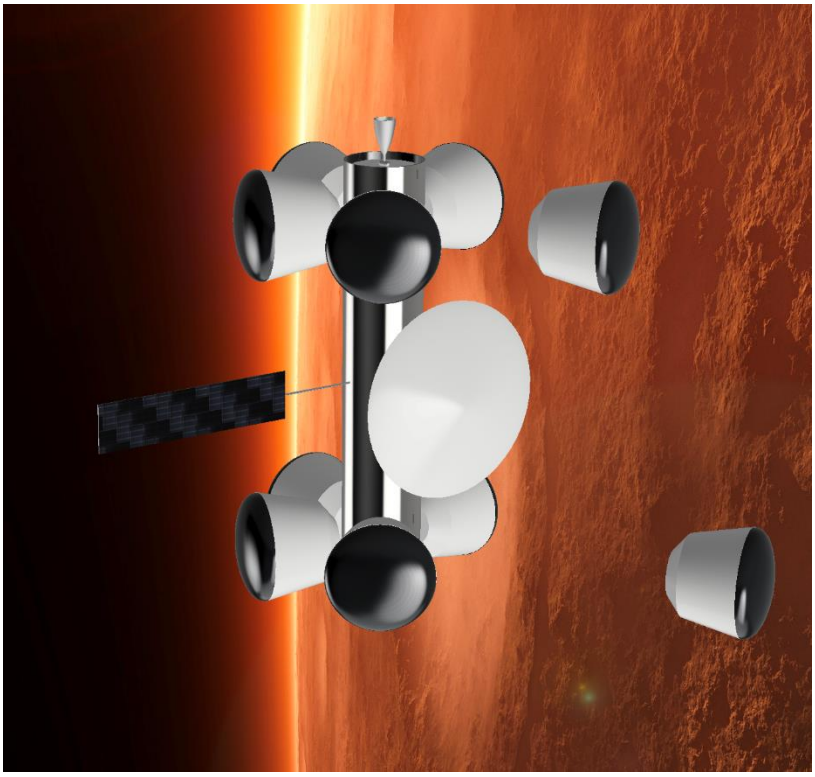
DSE22: Mars Deploy

Jury Summary – 16th June 2021

Before humans can set foot on the surface of Mars in the near future, a detailed understanding of Mars' interior workings needs to be developed. Next to that, knowing the location of aquafers (underground water wells) and geo-heating sources is crucial for sustained human presence on the Red Planet. The mission statement for this DSE therefore reads **MNS:** ***"Investigate the tectonic and geologic behaviour of Mars to benefit the search for heat and water sources in preparation of human exploration of the planet."*** Prior missions have shown that seismometers and surface heat flux measurement system can aid in gaining that understanding. However these measurements work best if they are conducted at different location around the planet at the same time. Therefore, the objective for this DSE is **POS:** ***"Design with ten students in ten weeks, a distributed geologic measuring system for the surface of Mars, without using thrusters to aid the descent."***

After discussing the wishes of our client, four feasible mission concepts quickly emerged: the Glider, the Impactor, the Classic, and the Powered Flight which were initially sized and traded-off. As their name suggests, these concepts were fundamentally different in their descent configuration as this is the main challenge of the design. After assessing them according to their scientific return, sustainability, technical risk, and total mission cost, it was clear that Mars Deploy will be an unmanned scientific multi-probe impactor mission. Not only does this configuration carry less risk than the others due to it is inherent simplicity, it also yields the most scientific knowledge for its cost.



The initial design of the multi-probe mission is now complete, where ten Mars probes will be accompanied by an orbiter, serving as a communications relay. After the unguided probes are released at 500.000 km from the surface and slows down in the atmosphere, the challenge of landing arises. The probe is to penetrate into the surface at a velocity of around 250 m/s and decelerate at 10,000 g in order to deploy the measurement systems. These bullet shaped systems are ejected at impact using a pyrotechnic cartridge to maximise the kinetic energy they carry. They are designed to impact at least 4 m deep and are tethered to communicate.

As sustainability has been at the core of the design process up until now, during the last week the team will asses the sustainability of the mission from manufacturing to end-of-life. Next to that, feedback from critical experts will be discussed and implemented to improve the feasibility and accuracy of the design, meaning this Mars Deploy project will be completed.