DESIGNING A 10-TON PAYLOAD MARTIAN LANDER

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We are a team of 4 French students from IPSA, an aerospace engineering school in Paris; and we took place in the international student contest 'Red Eagle' held by The Mars Society to design a 10-ton payload Martian lander, capable of being build and send by 2026. Our design has made it to the semi-finals of, to be held at the end of August. Our idea is based on creating two landers, a smaller, cheaper one that would fit the Falcon Heavy, and a bigger, crew-capable lander able to launch using NASAs' up-coming Space Launch System (SLS).

Key words: student, contest, lander,

1. An overall study

The aim of this contest was to ask to students world-wide what ideas they might have for designing landers for heavy payloads on Mars. The study would only be for the Entry, Descent and Landing (EDL) phase of the flight, not actually getting to Mars, and in orbit around it. All of this required a schedule plannning, but also a cost approximation, as well as, of course, mainly a technically study of the feasability of our designs. In order to perform such work we used multiple tools, first of all we got in touch with the French branch of TMS, Association Planete Mars, in order to have access to studies and work already done the topic. We also were helped by Jerome Daniel, a member of the Association, which made a software calculating different data for EDL depending on a landers‘ geometry and trajectory. We couple this with some student version (understand limited) Computer Fluid Dynamics software and a heavily modded verison of Kerbal Space Program to perform simulations of the landings. All of this allowed us to be able to prove, at least on paper with a first study, that our ideas looked feasible.

2. Two different Landers for two different missions.

Our main idea was to have a first ‚lighter‘ lander, that we would be able to launch using the cheaper Falcon Heavy. This lander would then perform an aerobraking maneuver in order to lower its velocity and orbit around the Red Planet. This would allow for important reduction in fuel requirements, allowing to land a bigger payload with the same launch capability. All of this would be at the expence of time, since aerobraking requires multiples passes through the atmosphere to slow a lander down. The end of the landing would then be a conventional burn to get the payload smoothly on the ground.

This is why there would be a bigger lander, capable of actually landing crews, that would be more ‚traditionnal‘, since it would do most of its landing using a heat-shield and retro-burn. Though both of our landers would use Inflatable Aerodynamic Deccelerators (IADs), a sort of reverse umbrella allowing for a much bigger friction surface when entering the atmosphere, as it is much thinner than of Earth.

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