

Application of Auto-Rotation for Entry, Descent and Landing on Mars

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ABSTRACT

Entry, Descent and Landing (EDL) on Mars is in the focus of on-going engineering activities in support to future interplanetary missions. Most of the upcoming missions are rover missions, but also other scientific payloads are to be delivered to the surface.

While previous missions targeted for reaching easy to access landing sites with minor precision requirements, the more ambitious scientific missions will have to cope with new issues. Main technology drivers in this context are:

- the requirements to be able to land at higher altitudes,
- to perform precision landing and finally
- to perform hazard avoidance manoeuvres.

A new approach towards Descent and Landing is presented within this paper which shall especially fulfil the new requirements of precision landing and hazard avoidance. During an ESA study EADS Astrium together with SRConsultancy analyzed the idea of landing payloads by means of an Auto-Rotation descent and Landing System (DLS).

Auto-rotation is a state of motion in which the air stream around a free-falling vehicle propels a rotor such that the rotor produces thrust. Helicopters use this principal to land safely in the event of turbine failure. With an auto-rotating vehicle it is possible to perform precision landing while maintaining complete controllability. A Martian DLS based on auto-rotation can, therefore, decelerate after entry like a parachute equipped system and glide to a dedicated landing site reaching down-range capability as high as 26 kilometres. Within this paper such a system concept is presented. The regime of applicability is defined as well as technology demonstration needs identified.