SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Systems I (1)

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HISTORY AND STATUS OF AEROJET MARS LANDER PROPULSION ACTIVITIES

Abstract

All of the U.S. spacecraft that have landed on Mars have utilized Aerojet propulsion with 100% success. This paper presents a history and current status of Aerojet Mars Lander propulsion activities, starting out with a brief history of Aerojet's 3,000N throttleable MR-80 engines used on the original Viking landers, and then progressing through the 300-Newton pulsed MR-107 engines used on Mars Pheonix, the throttleable MR-80B engines that will be used on Mars Science Laboratory, and then a discussion of propulsion for future Mars lander missions.

Aerojet originally developed the MR-80 Viking lander engine in the early 70's. At the time the engine provided twice the thrust of the largest hydrazine thruster developed to-date, and provided a 10:1 throttle range which also significantly exceeded the state of the art. The engine had 18 nozzles to help ensure minimal erosion of the relatively unknown Martian surface. The MR-80 engine was truly a remarkable technological feat at the time, and has spawned a number of successor designs that have seen widespread application.

Mars Phoenix conducted a successful soft landing on Mars in December of 1999 using twelve Aerojet MR-107N 300-Newton thrusters. The Aerojet MR-107 engine was originally developed in the early 1990's for the Peace Courage program and over 2,000 flight engines have been delivered since that time.

Mars Science Laboratory (MSL) elected to once again use a throttleable engine design for descent and so JPL funded Aerojet to develop an upgraded version of the MR-80 engine. The MSL MR-80B engine included the following major improvements from the original MR-80 engine: (a) throttle range was expanded from 10:1 to 100:1; (b) 18 nozzles replaced with a single nozzle; (c) obsolete throttle valve replaced with improved design; and (d) multiple engine producibility improvements/upgrades.

Plans for future Mars landings are focused on the joint ESA/NASA EXOMARs program. Discussions of potential propulsion approaches for EXOMARs are included in this paper.