

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Mars Exploration – missions current and future (3A)

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MARS NORTH POLE WATER ICE ROBOTIC LANDER

**Abstract**

A Mars robotic lander, specifically designed to land on the water ice present on the Mars north pole during the Martian summer will be presented. The vehicle, the Mars North Pole Ice Cap Lander (MNPICL) will, with its science payload and equipment, extract and electrolyze water, and store its constituent's (oxygen and hydrogen). Similarly, it will demonstrate the transfer and pumping of liquid water, liquid oxygen and gaseous hydrogen to outboard supply tank that can be accessed by later arriving vehicles. The acquisition, electrolysis, transfer, storage and monitoring of these elements will demonstrate the ability to provide these needed commodities to future Mars mission vehicles. In addition, the Lander, as a science platform, will explore the surface, the weather, the changing seasons and the atmosphere at the Pole. The Mars north pole ice cap is about 1000 km in diameter during the northern summer, and contains about 1.5 km<sup>3</sup> of water ice. This mission will open up the frontier to this exciting, and heretofore unexplored, region of Mars. Mars polar water ice is a resource from which both rocket propellant and crew consumables can be derived. The technologies and operations necessary to the utilization of these resources will be demonstrated, leading the way for supply to future crewed expeditions needing significant amounts of water and oxygen; including oxygen as propellant for a Mars crewed Ascent Vehicle (MAV). Utilizing onsite polar water ice will reduce the amount of cargo required to be transported from Earth to support future Mars surface crews and their operations. Included in this report will be overviews of the mission trajectory, lander operations and lander design. Lander illustrations, mass estimates, delta-velocity budgets, propellant allocations, payload delivery capability and launch vehicle information will be provided. As an investigation into the potential enhancement to future Mars missions, the Mars Polar Water Ice mission will be shown to provide an advantage from a logistics viewpoint. One solution will show the MNPICL launched from the new NASA Space Launch System (SLS) launch vehicle. This report will come from ongoing analysis done by Boeing's Internal Research and Development (IRAD) team in its Exploration Launch Systems, and Space Systems divisions, located in Huntsville, Alabama and Houston, Texas, USA respectfully.