

# **Refining the Search for Water on Mars Using Balloon-Borne Gamma Ray Neutron Spectrometers**

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**ABSTRACT:** The search for water on Mars is critical for planning future human missions to the Red Planet. Having a substantial source of accessible water at an intended landing site will provide life support consumables (atmospheric O<sub>2</sub> and crew water) and mission propellant. These two elements (crew water and propellant) represent a substantial mass for any Mars mission and leveraging this in-situ resource can be considered an enabling resource for any human mission to the Red Planet. Locating surface and near-subsurface water remotely on Mars can be accomplished using gamma-ray neutron spectrometers as was done on the Mars Odyssey Mission. Mars Odyssey orbited at an altitude of 400km and provide a global data set of water-equivalent hydrogen (WEH) abundance with a special resolution on the order of 300km. Orbit-based gamma ray neutron spectrometers are limited to this resolution range therefore in order to identify high-water content candidate landing sites for a future human Mars mission a higher resolution WEH survey is needed. The use of an air-borne gamma ray neutron spectrometer flying over the Martian surface at an altitude of 2-4km would provide km scale spatial resolutions of WEH. A survey of WEH even in a limited area of the Mars would aid both a localized search for Martian water and allow for an educated extrapolation of regional Martian water abundance estimates across Mars.