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Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Technologies (2B)

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AGRICULTURE AT A PERMANENT MARS SETTLEMENT

Abstract

We present an ongoing, overview study of agricultural techniques to build up an agricultural system on Mars. The actual agricultural research should begin immediately, because there may be a very long lead-time for testing agricultural methods with multiple crop cycles, in a closed environment, with Martian resources. It could be the limiting factor of how soon we can live there, exceeding the timeline for developing launchers, landers, habitats, and construction techniques.

There are multiple studies of early Mars round trip exploratory missions. But only a few studies for Martian settlements built with Mars resources. Most of these studies simply assume we will grow food with hydroponic equipment and nutrients brought from Earth. There is little thought to details of transitioning to soil based agriculture.

We consider the agricultural systems needed to start with a very small base. Then transition from initial aeroponic and hydroponic growing systems, to processing compost and regolith for soil based growth. The settlement expands by manufacture of additional greenhouses and equipment made from local, in-situ Martian resources. The target is to expand to a 100-plus person, permanent Mars settlement which is food-independent of Earth. We review the agricultural studies by Yamashita, Morgan Irons, and others, and the agricultural requirements for the Mars Foundation's Hillside Settlement design and Minimum-One-Way proposal.