Abstract
We report on the development of new technologies to enable manned missions to Mars, Jupiter, and beyond. On long voyages in deep space, high-energy radiation from galactic and solar sources poses serious and potentially fatal health hazards. A spacecraft with the requisite shielding is too massive to be launched from Earth. We suggest that machines based on high temperature superconductor technology can be deployed on the Moon to extract the lunar regolith, fabricate a shield, and then launch the shield from the lunar surface. We have built a simple model to demonstrate the concept.

Our Idea – Use New Technology
• Use High Temperature Superconductors (HTS) to extract lunar regolith
• Combine regolith and epoxy to make lunar cement
• Employ a 3D house printer to construct a spacecraft radiation shield
• Use superconductors to launch the shield from the Moon

Superconductors for Regolith Extraction and Transport
Ignatiev et al.* have suggested using a travelling wave superconductor motor (left) to extract and transport regolith. The machine (right) has no moving parts, hence no mechanical breakdown, and is energy efficient.

Robotic Fabrication of Large Structures
A 3D printer can be used to fabricate a entire structure in 24 hours.

HTS Space Launch System
The model of an HTS levitation space launch rail by researchers at the Division of Materials Science and Engineering, University of California at Berkeley.

Lunar HTS Launch System
Artist’s concept of a high temperature superconductor launch rail on the Moon. We envision that the track can be built by robots using lunar cement. It may be possible to fabricate permanent magnets or rails from the regolith now that is present in the regolith.

From the Moon To Mars - and Beyond

Arrival At Mars - Safe and Sound
Artist’s concept of a spacecraft arriving at Mars with a radiation shield (lateral view).

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