Deimos Mission

Vertical Cylindrical Cased Tunnel Shaft Excavations
For Solar and Galactic Cosmic Radiation Protection

Thomas Lee Elifritz
The Archimedes Group
221 East Main Street
Marshall, Wisconsin, 53559
elifritz@charter.net
(608) 345-8891

In another recent essay, I have described in moderate detail the value and procedures for establishing a continuous human presence on the Martian moons Phobos and Deimos, as complementary precursor efforts for the permanent development and colonization of the surface of the planet Mars. The orbital geometries and masses of the moons are leveraged to produce a quick and easy method of solar energy asset deployment and electrical power distribution across the entire surfaces of both of these moons. In this manner electrical energy may be transmitted from the illuminated areas on the moons, to areas that are not currently illuminated, including under the surfaces and in the interiors of the moons. This essay will expand upon one specific aspect of this Martian Moon development and colonization effort, that of providing the immediate capabilities to excavate and case deep vertical cylindrical mining tunnel shafts directly under a landed Deimos Colonial Transport spacecraft, on the very first mission to these moons. Such a construction can then provide massive and immediate shielding against solar proton events and galactic cosmic radiation, the single most urgent problem confronting large scale space development. The excavating design process and the resulting hardware is universally applicable to asteroid mining.

Consider a large cylindrical propulsive rendezvous craft, landing on the surface of Deimos, nose and docking port facing downwards, engines vertically upwards and sitting on at least a four square pad. Such a craft could deliver the tunneling and regolith bagging apparatus to the surface of Deimos, with the cylindrical casing pieces and case assemblies stored on the outside of the cylindrical propulsive stage, ready to deploy downwards as the tunneling proceeds. In order for any rotary drilling apparatus to function on a low gravity asteroid, the system itself must be secured to the surface since it develops torque. In order to defeat the torque and excavate regolith, the weight of the landed craft must generate enough contact friction with the surface in order to compensate for the drilling torque, until the depth of the tunnel shaft is deep enough for cylindrical casing pistons to provide outward pressure on the walls. Ballast mass for the landed craft can thus be provided by the bagged regolith as the tunneling proceeds, by simply removing bags from the tunnel shaft, and either placing them on the landing pads, or into the craft as radiation shielding. Once the shaft is deep enough so that casing can grip the walls of the shaft directly, then any further bags of regolith removed from the initial tunnel still need to be stored, and the logical place to do that is on the landing pads as spacecraft surface ballast, and inside of the spacecraft.

Thus we have a rotary regolith bagging excavator, a bag feeding mechanism for the rotary excavator, a bag removal mechanism once the full bags are sealed and released, a cylindrical casing gripper so that rotary excavation can occur, and the cylindrical casing, the pieces moved into the shaft as it is tunneled. The cylindrical shaft casing would be larger than the diameter of the propulsive stages and the habitats that ultimately would be guided down the cased and lined tunnel, as deep as one might wish to tunnel. Deep tunnels can then provide definitive solar proton event and galactic cosmic radiation protection, and curved, lined circular tunnels in any direction allow one to design artifical gravity trains and loops. Sealed and pressurized tunnel shafts can provide large volumes for surface to orbit spacecraft servicing.