Interview with Jim Keravala from the Shackleton Energy Company

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1. What is Shackleton Energy Company (SEC) all about?

SEC was created as a commercial enterprise for a single purpose, within a decade provide rocket propellants and related services in space and on the Moon to all space faring customers at prices substantially below anything available from Earth. The propellants will be derived from the freely available, naturally occurring, ice located in great quantity at the lunar poles. Like other energy companies, SEC will independently conduct all exploration, mining, processing, transportation, integrated logistics support and sales. SEC will most likely evolve into a meshed network of highly specialized companies all structured to provide unique services and products to an ever-expanding space marketplace. When successful, SEC propellant depots will become the network hubs for the in-space transportation system.

2. What's a realistic timeline for when you could get orbital fueling stations up and running? (If you could sketch out briefly: When do you hope to launch scouting missions, then build bases, then start mining operations, then get the orbital fueling stations running?)

Within four years of startup, we intend to launch two robotic lunar prospector (scouting) missions to both poles of the Moon to selected, high probability, ice-laden craters. Because of the extremely harsh operating environments, robotic rovers will perform prospecting operations for at least a year each in the ultra cold, ultra dark craters (we are talking of an area with a temperature of 20 K). We will use sophisticated solar power systems and methods to power the operations. 'Ore' maps will be developed to make follow-on business decisions. We will use NASA lessons learned and rover experience/technology as guides to developing our rovers. This process takes maximum advantage of significant US Government investments for our benefit.

Concurrent with prospecting operations, we will conduct a major systems engineering

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and risk reduction "infrastructure build out" program (Phase 3) leading to human mining missions on the Moon in or near selected craters (Phase 4). In Phase 3 we will deploy several orbiting workstations, wherein all the training, procedures and vehicle assembly will be conducted prior to human lunar insertion and landings. Initially a crew of 6-12 operators will be trained and deployed to the LEO stations to fine-tune all required operations. When Phase 3 is complete, an initial crew of 6-8 will descend to the lunar surface mining area and set up camp. Subsequent missions will deliver all required equipment and consumables on a frequent basis in preparation for mining operations. A 24/7 Integrated Logistics Support Program (ILSP) system will be established for all space operations.

3. When will be the first missions?

In *2018* there will be a launch of two depots and then after that there will be several months after that more launches. The idea is to have the water depots tankers on the moon and then the water will be separated in hydrogen and oxygen. Then by *2022* we can have the first depots providing propellant space in space followed by servicing and other missions. By the 2030s, the expansion of opportunities will require hundreds of people operating in space on different projects as customers or operators, much like any energy exploration program today.

4. Who will your customers be? Mainly government agencies, private companies or a combination?

All of them. Initially, we envision Government space agencies (e.g., US, Russia, China, India, Pakistan, South Korea, Japan) will purchase long-lead propellant contracts with us, followed by private companies for space repair, satellite refueling and space tourism. We eventually plan to be able to provide enough fuel for round trip missions to other locations in space (e.g., Mars, asteroids) as the customer base grows. Of course, a Mars mission is unlikely to occur until the next decade and gives us time to operationalize the full supply chain for such a long mission. Since we will already have established mining camps at both poles and have the infrastructure to expand, we will offer contracting services to governments, science and commercial entities setting up camps elsewhere on the Moon as a for-fee service, much like big industrial service providers. When operational, our pipeline supply chain management services will operate very efficiently much like FEDEX/UPS/DHL today. With even more customers conducting LEO operations over time, the system becomes even more efficient for all – SEC is the catalyst platform to get all this started. Bigelow Aerospace announced it is entering negotiations with several foreign Governments to buy or lease Bigelow space stations. This is exactly what we had hoped for and strongly encourages this activity to expand the market for space services. Planetary Resources, Inc. recently announced their intension to mine asteroids for high value metals and water. This project adds credibility to our venture since we will become their preferred service provider to make them more successful and stimulate others to follow. In addition, having abundant fuels and transport vehicles on the Moon gives us on-demand flight access and mobility to any point on the Moon for a variety of customers or reasons. Our modular, flexible, highly reliable transporters will provide the next generation of in-space "taxi service" to all newcomers and vastly reduce cost and complexity to those customers. We expect demand to grow slowly, then to expand exponentially within ten years of commercial operations in LEO. The largest consumers downstream we believe will be Government exploration programs followed by commercial space initiatives.

5. The Moon is indeed vulnerable to the space environment during all phases of the solar cycle, specifically phenomena such as solar energetic particle events (solar max.) and the galactic cosmic ray background (solar min.). Has Shackleton Energy Company (SEC) considered the