Solar Thermal Power System for Oxygen Production from Lunar Regolith: Engineering System Development.
Takashi Nakamura[1], Benjamin K. Smith[1], and Robert J. Gustafson[2] [1]Physical Sciences Inc. 2110 Omega Rd. Suite D, San Ramon, CA 94583 Phone: 925-743-1110; Fax: 925-743-1117; nakamura@psicorp.com [2]Orbital Technologies Corporation Space Center, 1212 Fourier Drive, Madison, WI 53717

ABSTRACT

This paper discusses the development of the solar thermal power system for oxygen production from lunar regolith. Physical Sciences Inc. (PSI), under the sponsorship of NASA/GRC and NASA/JSC, has been developing the engineering prototype of the solar thermal power system.

In this solar thermal system, as schematically shown in Figure 1, solar radiation is collected by the concentrator array which transfers the concentrated solar radiation to the optical waveguide (OW) transmission line made of low loss optical fibers. The OW transmission line directs the solar radiation to the thermal receiver for thermochemical processing of lunar regolith for oxygen production on the lunar surface. Key features of the proposed system are:

1. Highly concentrated solar radiation (~ 4×10^3) can be transmitted via the flexible OW transmission line directly to the thermal receiver for oxygen production from lunar regolith;
2. Power scale-up of the system can be achieved by incremental increase of the number of concentrator units;
3. The system can be autonomous, stationary or mobile, and easily transported and deployed on the lunar surface; and
4. The system can be applied to a variety of oxygen production processes.

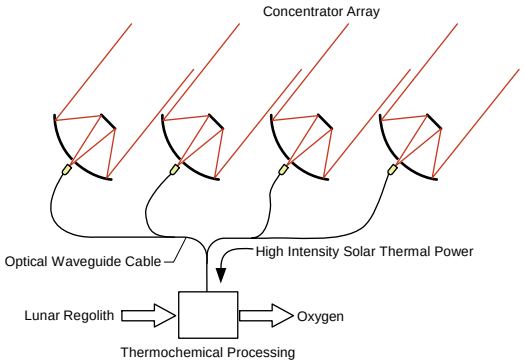

FIGURE 1. The optical waveguide solar thermal system for oxygen production from lunar regolith.

The OW solar thermal system was originally developed for lunar materials processing with NASA/JSC funding support during 1994~1996 (Figure 2). In the present program we are developing and engineering prototype system which is to be combined with the carbothermal oxygen production system being developed by Orbitec. The key components of the engineering prototype system are: (i) the primary solar concentrator array; (ii) the optical waveguide transmission line: and (iii) the power injection optics for the carbothermal reactor. We will discuss the current development status of each component and the performance of the integrated engineering sustem.

.

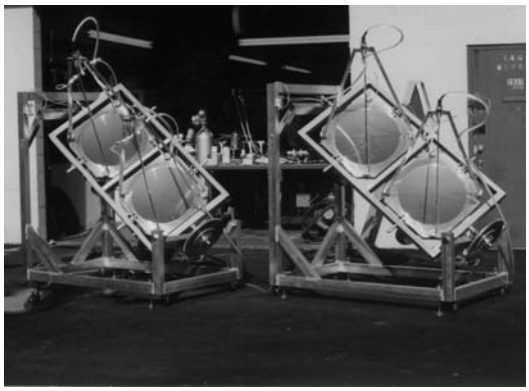

FIGURE 2. The Ground Test Model of the OW Solar Thermal Power System.