GENERAL OVERVIEW OF AN INTEGRATED LUNAR OXYGEN PRODUCTION / BRICKMAKING SYSTEM; D.A. Altemir, NASA/Johnson Space Center, Houston, TX 77058

On the moon, various processing systems would compete for the same resources, most notably power, raw materials, and perhaps human attention. Therefore, it may advantageous for two or more processes to be combined such that the integrated system would require fewer resources than separate systems working independently. The synergistic marriage of two such processes —lunar oxygen production and the manufacture of bricks from sintered lunar regolith— is considered.

DESCRIPTION OF INTEGRATED OXYGEN / BRICKMAKING PROCESS. The integration of oxygen production with brickmaking seems to make intuitive sense and indeed is often alluded to in discussions regarding the independent processes. Figure 1 outlines one possible scenario in which oxygen production and brickmaking may be combined. In this concept, one mining operation supports both the oxygen and brickmaking operations. The oxygen production process depicted here assumes the hydrogen reduction of ilmenite and the production of bricks by hot press sintering, although other processes are certainly possible.

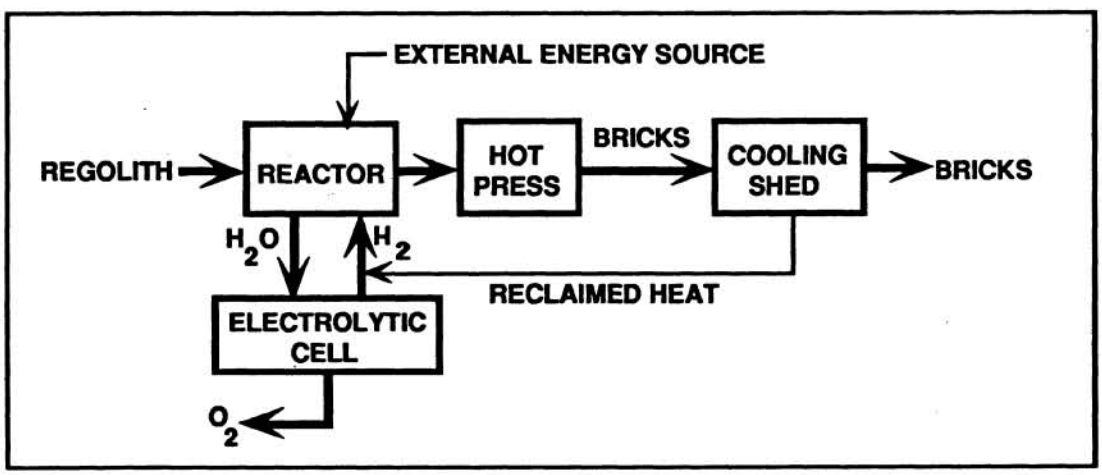

Figure 1. Lunar oxygen production/brickmaking concept.

SYSTEM MODEL OF AN INTEGRATED PROCESS. In general, an oxygen/brickmaking process may be modelled on the basis of mass balance:

$$\frac{M_b}{M_{O2}} = \frac{(1 - f_{O2})}{f_{O2}} \qquad \text{Eq. 1}$$

where

M_{O2} = Mass of oxygen produced
M_b = Mass of bricks produced
f_{O2} = Mass of oxygen produced / Reaction mass

This model assumes that the portion of reaction mass not collected as oxygen is used as feedstock for the brickmaking process. It should also be noted that f_{O2} is a catch-all parameter that includes the influences of feedstock beneficiation, reaction efficiency, chemical equilibrium, *etc.* upon oxygen yield. M_b/M_{O2}, plotted in Figure 2, shows how oxygen production and brickmaking are competing processes.

It can also be shown that the sensitivity of an integrated system to fluctuations in oxygen yield increases with increasing f_{O2} values.

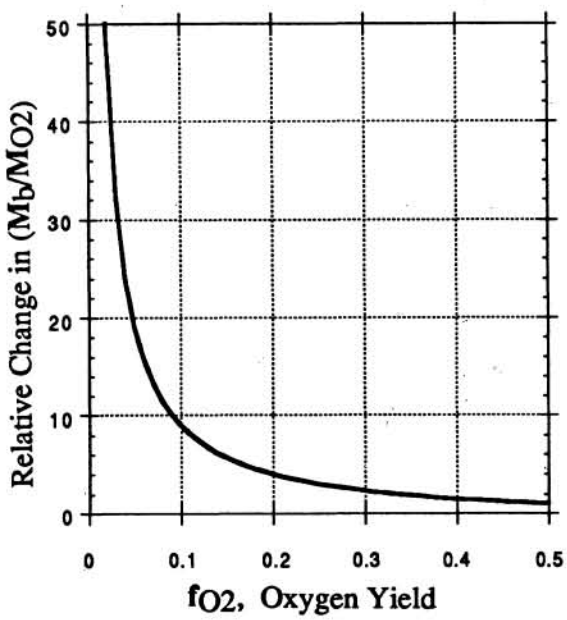

Figure 2. Brick/O2 Ratio vs. oxygen yield

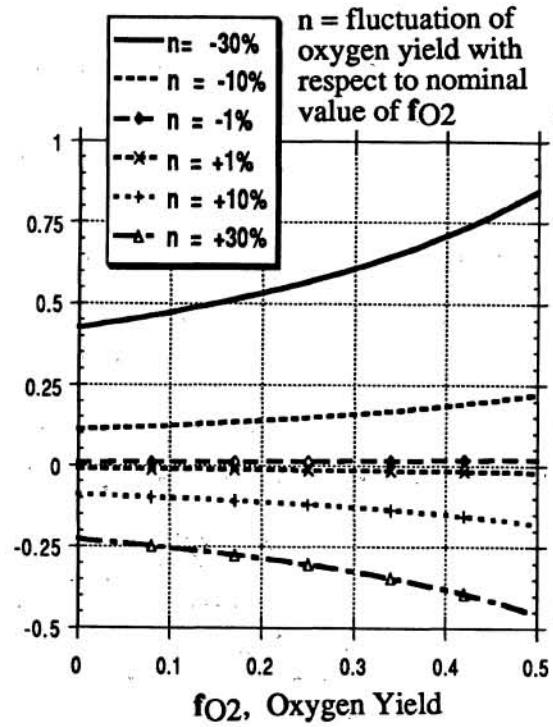

Figure 3. Sensitivity of Brick/O2 Ratio to Fluctuations in f_{O2}

CONCLUSIONS. Conclusions to be drawn from this simple system model may vary depending upon which is valued more —oxygen or bricks. Such value judgments have been the subject of many programmatic studies some of which continue to evolve as new developments arise. Hopefully, the simple system model presented here serves to illustrate some important issues that may arise regarding certain lunar base strategies.