SPS CONSTRUCTION PERSPECTIVE/SUMMARY

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Studies have been conducted on the construction of Solar Power Satellites and the following paragraphs discuss the perspective which can be drawn from the studies.

The SPS size requires space construction. A 5 GW Satellite may be as large as 54 square KM. The overall density of this constructed Satellite is in the order of .0002 KG/M^3. Launching an assembled Satellite of this density would be impractical for two reasons: 1. The assembled structure would not be able to withstand the launch loads, and 2. The number of launches required to launch assembled structure of this density would require an extensive number of launches thus causing the transportation cost of an SPS system to be prohibitive.

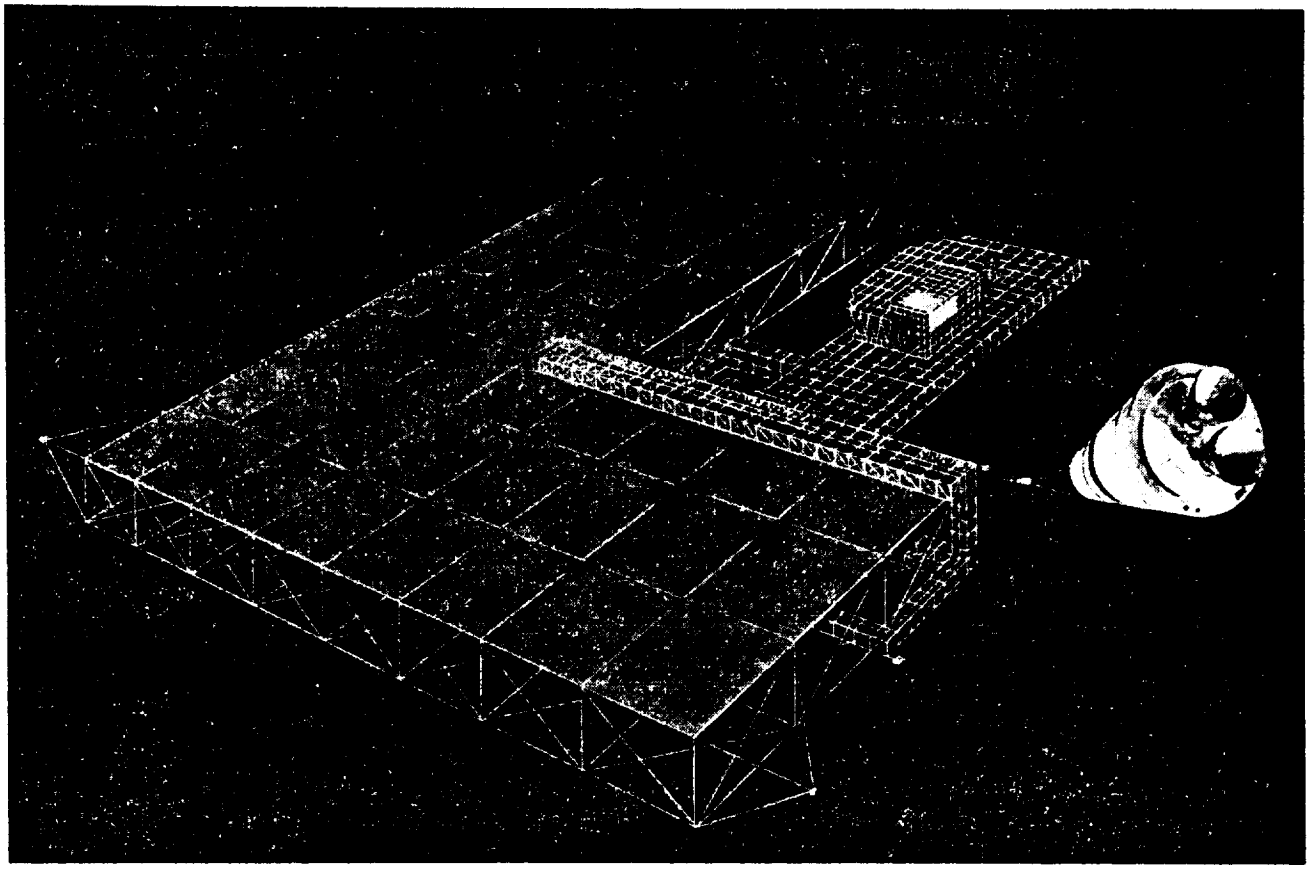
Space construction will consist of simple and repetitive, construction operations. These operations will impact the design of the Satellite. As an example, although studies indicate the mass of a photovoltaic and thermal-cycle Satellite configurations are similar, the construction of the two are different. The photovoltaic configuration is favored since it is a simple geometry which allows repetitive operations. The thermal-cycle system has many different operations such as fluid connections, radiators and a complex geometry.

Studies have indicated that large assembly factories located in geosynchronous orbit (GEO) could build an SPS in space in a period of six months. The power generation system (solar array and structure) and the power transmission system (microwave antenna) would be built at the same time with a crew size in the order of 400. Figure 1 depicts the antenna in red and the solar array in blue. A logistics base in low earth orbit manned with approximately 200 personnel would be required to support the assembly base in GEO.

Construction of an SPS can be accomplished in either LEO or GEO. If LEO is used it will be necessary for the construction operation to build the SPS in pieces in LEO and final assemble the pieces in GEO. This is necessary since the principal loads are aerodynamic and graviety gradient and these loads would be prohibitive on a final assembled SPS in LEO. The debris collision hazard and the earth shadow thermal cycling is also greater in LEO. For maintenance considerations, it will be necessary to provide maintenance facilities in GEO either on the Satellite or facility additions to a construction base located in GEO.

The main crew considerations are the stay time on orbit. Ninety days appears to be a reasonable duty period considering: Remote confinement, zero-G effects on the body and nominal radiation exposure. For GEO, EVA activities will be limited due to increased radiation exposure and storm cellars will be required for major solar events. The primary construction functions will be to maintain and operate equipment, and final assembly and checkout.

In conclusion, it is recognized that the ability to construct an SPS must be developed through an evolutionary process. This process would begin with Shuttle operations and when construction timelines exceed the Shuttle capability small manned bases in LEO will be used. This technology evolution would gather the experience and knowledge to build large bases in LEO and GEO to support an SPS construction capability.



Figures 1. GEO Assembly Base