

43

SPS PROGRAM REVIEW TRANSPORTATION PERSPECTIVE
William W. Wales, Jr.
NASA - Marshall Space Flight Center, Alabama

N82 22704

During the past four years the NASA has teamed with various organizations in industry to assess the technical feasibility and economic viability of the Satellite Power System (SPS). The transportation system required to support this program played a significant role in answering these questions.

The SPS program requirement for the construction of two 35-million kilogram (5- GW) satellites each year demands that approximately 300,000 kilogram (660,000 pounds) of mass per day be delivered to the construction site, at geosynchronous orbit. The transportation system represents a significant part of the overall program cost, from 35-40 percent. Payload delivery cost goals of 15 to 30 dollars per kilogram of mass means that the system elements must have long life, short turnaround times with minimum maintenance, and minimum unit and design/development costs. Orbital mass deliveries will require multiple launches each day, therefore environmental impacts must be considered and held to a minimum. A technology readiness period of approximately 1990 is sufficient to assure the attainment of these goals provided needed funding is made available.

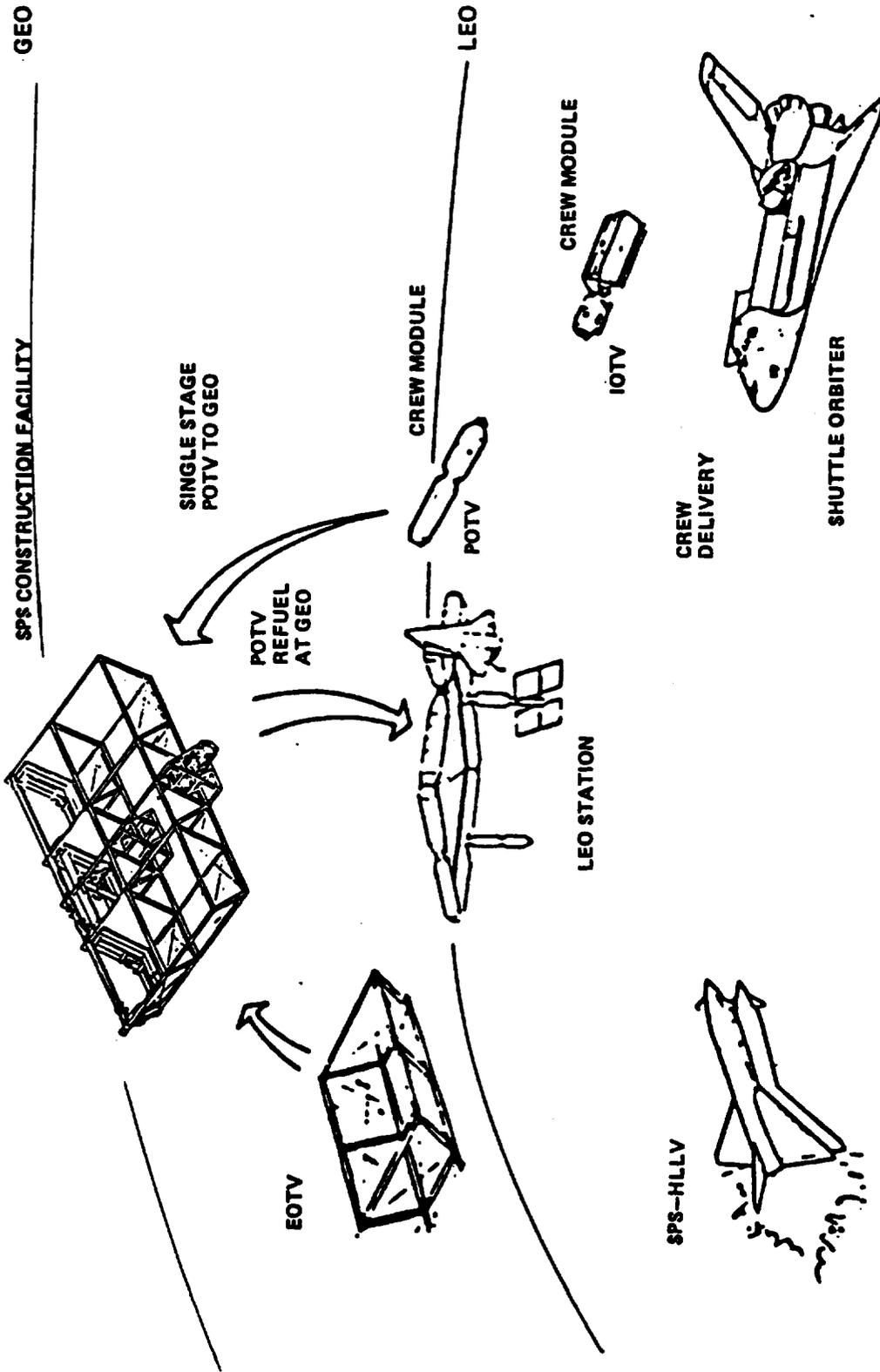
The delivery of cargo and space workers to the construction site requires the development of two different systems, one to handle large cargo deliveries and a smaller system to accommodate crew. The overall scenario of the transportation system is shown on attached Figure 1. Eight major elements comprise the transportation system: Personnel Launch Vehicle (PLV) or Shuttle; Personnel Orbital Transfer Vehicle (POTV); the Heavy Lift Launch Vehicle (HLLV); the Electric Orbital Transfer Vehicle (EOTV); Intra Orbit Transfer Vehicle (IOTV); LEO Support Facility; GEO Support Facility and a Shuttle Derived HLLV (SDHLLV) for supporting the early SPS Demonstration Program. The HLLV and EOTV represent the cargo carriers while the PLV and POTV represent the people carriers. The IOTV is utilized to ferry people and cargo modules over short distances in the vicinity of its station.

In October of 1978, at the request of DoE, NASA established a reference SPS program including the transportation system which could be used in an assessment with other energy systems. The reference system selected depicted the most feasible approach, at the time from the standpoint of technology verification requirements and vehicle performance capability, for accomplishing SPS Program goals.

The reference HLLV concept would be a two stage winged vehicle, either tandem or parallel burn, which has a payload capability of .25M to 1.0M pounds to a 485 Km, 31.6 degree orbit. The reference concept for the EOTV utilizes silicon cells at CR = 1.0 or gallium/arsenide cells at CR = 2.0, generating approximately 335 MW of d.c. power for the Argon-Ion thrusters, in transferring approximately 5.0 M Kg of cargo from LEO to GEO. The personnel carriers are the PLV, from ground-to-LEO, and the POTV, from LEO-to-GEO. The 30-year SPS construction period requires up to 155 POTV flights, 159 PLV flights, 27 EOTV flights, and 722 HLLV flights in a calendar year.

These vehicles are representative of a system which can support the development of the Satellite Power System. Future studies of SPS and its transportation system will continue to investigate new ideas and incorporate new technological developments to arrive at a system best suited to meet the SPS program requirements.

SPS SPACE TRANSPORTATION SCENARIO



ORIGINAL PAGE IS OF POOR QUALITY