SPS TECHNICAL ISSUES

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Beginning with the earliest studies of Satellite Power Systems (SPS) engineers and scientists have consciously "red flagged" any technical issue which would either seriously impact or potentially negate the integrity of an SPS Program. Issues were identified not only relating to the question of engineering feasibility, but also to the equally important areas of environmental and social acceptability and, especially, economic viability. Much effort has been expended on studies and experiments directed toward obtaining an understanding of these issues and the degree to which they can be resolved. A lot of people feel that many "show-stoppers" exist which cannot be resolved, or worse, that key technical issues have been ignored. It is the intent here to enumerate technical issues which were highlighted some four years ago; to selectively discuss some of the results obtained as to their resolution; and to briefly touch on their current status.

The table shown below is a composite list of technical issues and program concerns covering the spectrum of SPS activities. A set of criteria was developed as a guide in evaluating the issues. These criteria consisted of categorizing the issues into one of the following three levels of criticality:

- Level 1 - Potential "show-stoppers"
- Level 2 - Potential of serious impact
- Level 3 - Potential of undesirable impact

CRITICALITY	ECONOMIC VIABILITY	TECHNICAL FEASIBILITY	ENVIRONMENTAL ACCEPTABILITY
LEVEL 1— POTENTIAL SHOW STOPPERS (KEY ISSUES)	CAPITAL INVESTMENTS TRANSPORTATION COST TO ORBIT FRONT-END OGT&E RESOURCE AVAILABILITY COMPETITIVE COST OF ENERGY	PHASE CONTROL LAUNCH RATES ANTENNA POINTING & CONTROL ORBITAL ASSEMBLY	MICROWAVE EXPOSURE STANDARDS MW IMPACT ON OZONE LEVELS & UV RADIATION LAUNCH VEH IMPACT ON OZONE LAYER SPACE RADIATION LIMITS TO CREW
LEVEL 2— POTENTIAL SERIOUS IMPACT	LIGHTWEIGHT BLANKET PRODUCIBILITY OTV PERFORMANCE CHARACTERISTICS OPERATIONS/MAINTENANCE COST MW ELEMENT LIFE FAILURE RATES PWR CONVERSION DEVICES LIFE/DEGRADATION ATT CONT & STATIONKEEPING THRUSTER PERFORMANCE AND LIFE RECTENNA LAND REQUIREMENTS SYSTEMS COMPLEXITY PAYLOAD PACKAGING DENSITY REFLECTOR FILM DEVELOPMENT ON-BOARD ENERGY STORAGE	DC/RF CONVERTERS WAVEGUIDES SATELLITE POINTING & CONTROL SHUTDOWN/STARTUP OF MW ANTENNA LAUNCH VEHICLE SIZE SPACE MAINTENANCE PROCESSES ORBITAL TRANSFER OF LARGE SPACE STRUCTURES POWER DISTRIBUTION SWITCHING TECHNOLOGY/CAPACITY HIGH-TEMPERATURE HEAT EXCHANGERS PROPELLANT RESUPPLY IN ORBIT RELIABLE FLUID CONTAINMENT REFLECTOR FILMS FLATNESS CONTROL VOLTAGE & CURRENT REGULATION MICROWAVE BEAM DISPERSION ANALYSIS	PUBLIC ACCEPTANCE OF SPS RFI EMI HIGH-VOLTAGE SPACE CHARGING PLASMA INTERACTIONS LAUNCH VEHICLE NOISE & SONIC BOOMS GEO ORBIT AVAILABILITY SPACE COLLISIONS ENERGY BALANCES OTV EMISSIONS
LEVEL 3— POTENTIAL UNDESIRABLE IMPACT	ASSIGNMENT OF MW FREQUENCY LAUNCH VEHICLE RECOVERY/REFURBISHMENT ON-GRND PWR FLUCTUATIONS & STORAGE REFLECTOR FILMS DEGRADATION RECTENNA ELEMENT LIFE/FAILURE RATES/ MAINTENANCE OIL USAGE (LAUNCH VEHICLES) LAUNCH SITE(S) LAND REQUIREMENTS INTERNATIONAL EMBARGOES/CRISES GSE REQUIREMENTS SECURITY REUSABLE PARTS	CONSTRUCTION BASE LOGISTICS POWER CONDUCTION TERRESTRIAL LOGISTICS FUTURE NASA PROGRAMS RECTENNA OPERATIONS DEV PROGRAM SCHEDULE & FLEXIBILITY RECTENNA/UTILITY INTERFACES ENGINEERING AVAILABILITY RECTENNA INFORMATION MGMT SYSTEMS SATELLITE INFORMATION MGMT PROCESSING MANUFACTURING CAPABILITIES/DEMANDS	SAFETY & CONTROL OF LAUNCH VEHICLES ORBITAL CREW SAFETY POLLUTANTS FROM MINING & MANUFACTURING TERRESTRIAL WORKERS HEALTH & SAFETY MW EFFECT ON ECOLOGY, SOIL, WATER, AND ATMOSPHERE POLLUTANTS FROM TRANSPORTATION OPNS FAILED HARDWARE (ON SPS) DISPERSATION LAND USE NEAR RECTENNA

Table 1. Program Issues and Concerns

A Level 1 issue was defined as an issue which, if a negative result were determined or if there were a failure to resolve the issue, could result in the SPS program being labeled as unfeasible. If these issues were not resolved, or a work-around developed, they would be labeled as "show stoppers" and as a result the SPS program would more than likely be discontinued.

For example, if the capital needed to finance materials, equipment, labor, etc., could not be obtained, the SPS program would not get to the operational phase.

A Level 2 issue was defined as an issue which, if a negative result were determined or if there were a failure to resolve the issue, could result in serious impact to the SPS program. For example, if the solar cell cost was significantly higher than current projections, there might be serious impacts to the SPS program since a significant portion of the satellite cost is attributed to the cost of solar cells.

A Level 3 issue was defined as an issue which, if unresolved, would result in undesirable impact to the SPS program. For example, crew safety is considered a necessity but if the current plans for crew safety could not be achieved, then surely work-arounds could be developed to provide the safety requirements without significantly impacting the program.

The table presents the issues subdivided, based on the above Level considerations and into areas of economic viability, technical feasibility, and environmental acceptability. Specific information required for resolution of the issues was developed and a planned overall approach for resolution was identified. Summary results of these analyses are presented in Figure 1.

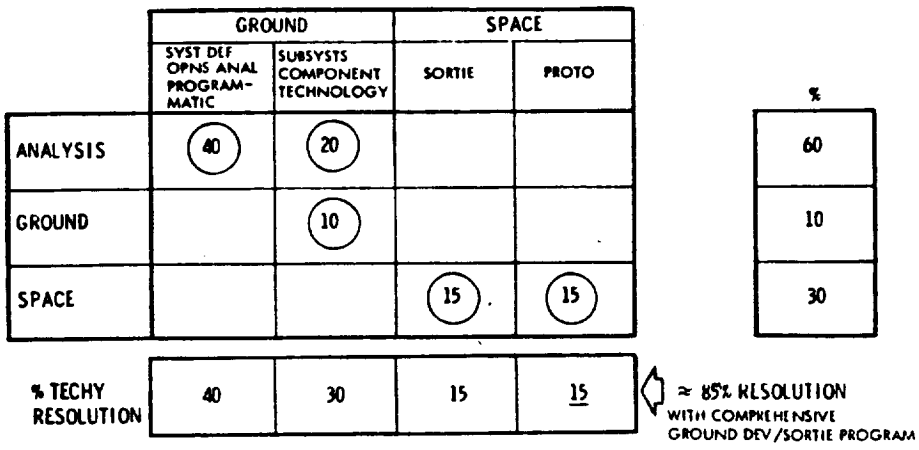

Figure 1. Resolution of Technical Issues

As shown, 60% of the technical issues can be resolved with analysis only; 10% require only ground testing for resolution; and the remaining 30% require space experiments or demonstrations for resolution. The figure also shows that 85% resolution of the issues may be accomplished prior to development of a prototype. Since this table was prepared, some of the issues have been resolved and plans have been developed leading to the resolution of others.