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DSCS III SPACECRAFT GROWTH POTENTIAL

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ABSTRACT

Recent activity in the MILSATCOM architecture arena has resulted in extensive assessment of potential satellite resources. Government and industry participants, striving for continuous, economical and effective communications assets through the rest of the century, have directed attention toward upgrading existing systems as well as defining and initiating new system developments. An example of the more cost efficient approach presently being considered by the government is future upgrades of the DSCS III satellites which are currently under development/production at GE's Space Systems Division in Vally Forge, PA.

Based on Air Force funded product improvement studies and GE internal initiatives to improve the DSCS III spacecraft, the feasibility of growth to a larger, higher power consumption payload has been analyzed. The DSCS III bus can accommodate these changes without major structural design impact. As summarized in this paper, the upgrade accommodations can be achieved with available technology and only partial subsystem redesign efforts. Product improvements for near term performance enhancements will only require requalification at the component and subsystem levels. Not until later updates are the performance requirements enough to demand a requalification at the system level and, at that, a majority of the system design is still unchanged from previously qualified/ flown configurations.

DSCS III BUS MODULARITY

From inception of the DSCS III satellite concept formulation in early 1975, the bus was designed to be modular with a growth capability to accommodate new technologies and added payloads in the late 80's and

early 90's. GE is presently working with the Air Force, users and MILSATCOM architects to identify directions for growth. This paper will present an overview of the baseline DSCS III bus capabilities and outline several growth options. For specific payload improvements, the accommodations required for the bus to meet power generation, thermal dissipation, attitude control and payload panel area needs, will be presented. The paper will conclude with the presentation of a DSCS III spacecraft that has significant increases in equipment panel area, power generation/dissipation capability and satellite dry weight.

The DSCS III spacecraft design was started by General Electric in early 1975, and a Phase I contract was awarded by the beginning of 1976. That design effort and the Phase I study effort were centered on developing a modular satellite that was designed with capability to accommodate future growth. By the time of the Phase II contract award in January 1977, the design had been solidified and the detailed design and development began. The bus that was eventually fabricated consisted of eight major modules:

- o Structure - A center body capable of withstanding the dual launch stresses of a piggyback satellite.
- o Attitude Control - Reprogrammable processor based control system supported by oversized momentum wheels.
- o TT&C - Dual S-band and X-band compatible links with more than 20% margin in both command and telemetry capability.
- o Propulsion - Drop in module with 50% additional tank capacity and compatibility with more efficient propellants.
- o Solar Arrays - Improvable by addition, expansion or modification without impact to structure or deployment design.

- o Electrical - Oversized regulation system to accommodate expandable battery capacity.
- o Equipment Panels - Expandable, independent, thermally balanced North and South equipment panels.
- o Antennas - Modular design allows substitution with minimal impact to equipment panels and structure.

GROWTH THROUGH EVOLUTION

The initial block of flight spacecraft being developed is a 1900 pound dry vehicle with a 1150 watt power handling capability. Through an evolution of planned and projected block changes to the baseline, the growth of the spacecraft is predicted. The growth in power for the modifications is based on a detailed assessment of payload direct requirements and housekeeping improvements to support the payload modifications. Similarly, the weight increases result from payload improvements, additional housekeeping functions, structure modifications, added power generation capability and propellant. The margins identified for each block are based on balanced power generation/dissipation approaches and launch booster capabilities for a satellite carrying sufficient propellant for a 10 year life with stationkeeping. Subsequent configurations show significant growth from earlier configurations and are achievable compatible with the shuttle single payload launch configuration.

Present launch vehicle alternatives are limited to shuttle/IUS configurations with TITAN vehicles for back-up. Approximate availability dates of launch vehicles are presented along with maximum payload weight launchable to synchronous equatorial (geostationary) orbit. The TITAN IIIC/Transtage, which has a total payload launch weight capability of 3650 lbs., will be used to launch the first DSCS III in the summer of 1981. Completion of the IUS will allow launch of the second DSCS III in mid-82 with a TITAN T34D/IUS with the additional weight capability will be used to add propellant to DSCS III. Availability of the Centaur as the third stage in the post 1985 is predicated on its successful development, modification and integration with the Shuttle (STS).