DE1

N79-24052

DESIGN GUIDELINES FOR THE CONTROL OF SPACECRAFT CHARGING*

R.E. Kamen and A.B. Holman
Science Applications, Inc.

N.J. Stevens and F.D. Berkopec
NASA Lewis Research Center

A nationwide, state-of-the-art technology survey has been completed that has led to the development of a list of guidelines that can be used by spacecraft design and program technical management personnel faced with the task of hardening their satellite against the effects of spacecraft charging.

The technology survey included a literature search and interviews with government, university and aerospace industry people knowledgeable of spacecraft charging. Information was collected in the areas of 1) spacecraft history, anomalies, designs, testing, specifications, experiments, 2) substorm environment and spacecraft analytical modeling, and 3) materials development and characterization. The information was summarized, compared, evaluated, and compiled in an unpublished dossier. The dossier includes discussions of the state-of-the-art, conflicting opinions, current recommendations and future plans for 19 technology sub-areas in addition to a bibliography with abstracts, raw interview reports and some general background and explanatory information.

The dossier was finalized and reorganized into a monograph titled "Design Guidelines for Spacecraft Charging" which will be published and available from NASA LeRC. The monograph provides DESIGN GUIDELINES in the areas of 1) filtering, 2) spacecraft system design, 3) spacecraft subsystem design, 4) spacecraft analysis and 5) spacecraft testing. The monograph contains a total of 55 design guidelines, organized as shown in Table I. The guidelines state specific requirements for successful design of spacecraft systems; each guideline is supported by a discussion of recommended practices that will assure successful implementation of the guideline. The monograph also includes background information, a summary of the present state of spacecraft charging knowledge, a bibliography, appendices and an index designed to facilitate the use of the document by spacecraft design and technical management personnel.

This paper introduces the DESIGN GUIDELINES Monograph and calls attention to the availability of additional backup information at NASA LeRC. This initial version of the monograph addresses the near-term goal of avoiding spacecraft anomalies. As more information becomes available (e.g., SCATHA flight data), the monograph will be updated and will address the far-term goal of avoiding spacecraft differential charging.

---

*Work supported through contract NAS3-21048 with NASA/LeRC

In conclusion, we wish to thank the following organizations for their contributions to the technology survey: Air Force Materials Laboratory, Communications Satellite Corp., Ford Aerospace, General Electric, Hughes Aircraft, IRT Corp., Jet Propulsion Lab, NASA Goddard Space Flight Center, Naval Research Laboratory, Mission Research Corp., Rockwell International, and Space and Missile Systems Organization.

TABLE 1. - ORGANIZATION OF GUIDELINES LISTED IN MONOGRAPH

I.	Filtering (for the elimination of electronic anomalies)
II.	Spacecraft System Design A. Grounding B. Shielding C. EMC Practices D. Handling/Assembly/Inspection E. Spacecraft Charging Phenomena Monitors F. Spacecraft Charging Control
III.	Subsystem Design A. Electronics B. Power Systems C. Mechanical and Structure D. Thermal Control E. Communications Systems F. Attitude Control G. Other Payloads
IV.	Spacecraft Analysis A. System Analysis B. Design Trade Studies
V.	Spacecraft Testing A. Components, Units and Subsystems B. Flight Systems and Qualifications Models