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FINAL REPORT

(PERIOD: 4/1/95 - 12/31/97)

FOR

DEVELOPMENT OF DESIGN STANDARDS AND GUIDELINES FOR ELECTROMAGNETIC COMPATIBILITY AND LIGHTNING PROTECTION FOR SPACECRAFT UTILIZING COMPOSITE MATERIALS

Contract Number: NAS8-39983

Dated: March 30, 1995

**Electromagnetics and Environments Branch
Systems Analysis and Integration Laboratory
Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812**

By

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1. Overall Progress:

This final report presents information concerning technical accomplishments by Tec-Masters, Inc. (TMI) for this contract effort. This effort included the accomplishment and/or submission by TMI of the following items:

- A. "Literature Survey Report, Electrical Properties of Non-Metallic Composites." By Mr. Hugh W. Denny
- B. "Interim Report, Composite Materials - Conductivity, Shielding Effectiveness, and Current Carrying Capability." By Mr. Ross W. Evans
- C. "Fault Current Test Plan." By Mr. Ross W. Evans
- D. "Fault Current Test Procedure." By Mr. Ross W. Evans
- E. "Test Report, Fault Current Through Graphite Filament Reinforced Plastic." NASA CR-4774, Marshall Space Flight Center, Alabama, September 1996. By Mr. Ross W. Evans
- F. "Test Plan, Lightning Effects on Composite Materials." By Mr. Ross W. Evans
- G. "Test Report, Lightning Effects on Composite Materials." NASA CR-4783, Marshall Space Flight Center, Alabama, February 1997. By Mr. Ross W. Evans
- H. "Design Guidelines for Shielding Effectiveness, Current Carrying Capability, and the Enhancement of Conductivity of Composite Materials." NASA CR-4784, Marshall Space Flight Center, Alabama, September 1996. By Mr. Ross W. Evans

These items are not attached but are considered to be a part of this final report.

Efforts on two additional items were accomplished at no increase in cost to NASA/MSFC. These items consisted of updating the "MSFC EMC Design and Interference Control Handbook," and revising the "Design Guidelines for Shielding Effectiveness, Current Carrying Capability, and the Enhancement of Conductivity of Composite Materials."

2. Problems and Corrective Actions Applied to the Contract Efforts:

During the last report periods a more intensive effort was applied to the contract, due in part to the addition of two items which were made a part of the contract at no increase in contract funding. These two items are noted in the last paragraph of Item 1 above (Overall Progress). This more intensive effort resulted in a variance (depletion) of existing contract funds. This variance of \$6,682.97 was applied to the fee of the contract.

3. Effort Performed During The Contract Period:

The accomplishments of this contract are listed in Paragraph 1 above. Thus a restatement or synopsis of these items will not be given in this paragraph. All of the items are available either in quarterly reports or in NASA documents.

4. Additional Information Relative to the Contract:

A. Total Cumulative Costs: The total cumulative cost of this contract, consisting of direct and consultant labor, travel and materials costs, as well as G&A but not fee, was \$296K. This was a total of 100 per cent of the estimated cost for the contractual effort.

B. Estimated Cost to Complete: All contract funds were depleted during the course of the contract. See Items 2 and 4A above.

C. Percentage Completion of Effort: Based on information given above (Items 4A and 4B), and work accomplished, the effort is 100 per cent completed.

D. Relationship of Cumulative Costs to Completion and Comment on Variance:

This contract effort was completed on time and within allocated costs. However, a small variance did occur to the negotiated cost value. This variance would require additional funding in the amount of \$6,682.97 to prevent a reduction in the negotiated fee.

MILESTONE SCHEDULE FOR TASKS

