ABSTRACT

NASA JSC has supported 3 programs (Shuttle, ISS, and MPCA) and must test electronic devices in a method that will meet the applicable program requirements. NASA JSC has supported 3 programs (Shuttle, ISS, and MPCA) and must test electronic devices in a method that will meet the applicable program requirements.

INTRODUCTION

The majority of JSC laptop hardware is used for Shuttle and ISS is tested using heavy ion Single Event Effect (SEE) testing on a variety of COTS and non-COTS electronic devices and assemblies tested for the Space Shuttle, International Space Station (ISS), and Multi-Purpose Crew Vehicle (MPCV).

ANALYSIS METHODS

This presentation reports the results of recent proton and heavy ion testing on select COTS and non-COTS hardware and individual electronic parts in a series of summary tables. The following section will summarize Proton radiation testing on select COTS, Non-COTS hardware and individual electronic parts in a series of summary tables. Also a summary of the ISS Laptop testing will also be shown in this section along with a summarized table of the hardware tested.

TESTING & EXPERIMENTAL METHODS

A. PROTON TESTING

To analyze the proton data, the SEEs are grouped by type, frequency and severity. The errors are counted and inputted into a program called PROTEST [3]. This program derives the equivalent 10 year MTBF for the hardware, and is directly related to the device's SEE performance. As NASA continues to develop plans for returning to deep space, new radiation-related challenges exist. Mission durations will be longer and the radiation environments are harsher and the electronics used will therefore need to be more reliable, fault-tolerant, and autonomous. The JSC Radiation Effects Team has implemented changes to our current test philosophy and analysis methods in order to meet this challenge.

SUMMARY OF RADIATION TESTING

The following section will summarize Proton radiation testing on select COTS, Non-COTS hardware and individual electronic parts in a series of summary tables. Also a summary of the ISS Laptop testing will also be shown in this section along with a summarized table of the hardware tested.

REFERENCES


ACKNOWLEDGEMENTS

The authors wish to acknowledge the support of the NASA Electronics Parts & Packaging Program, the JSC Engineering Directorate’s Aeronautics & Space Systems Division, International Space Station Program Office, the University of California Lawrence Berkeley National Laboratory, Lawrence Berkeley National Laboratory, and Texas A&M Cyclotron Institute for their support of this work.

Author Affiliations:

K.K. Allums PhD, 39-Stwe PC, Inc., ko.allums@email.com
Ch.T. Nunez PhD, NASA JSC, ch.t.nunez@email.com
B.D. Reddell PhD, NASA JSC, b.d.reddell@email.com
D.R. Bailey, NASA JSC, dbailey@email.com
C.B. Bailey, NASA JSC, cbbailey@email.com

Table I: Summary of Laptop Hardware using Proton Radiation Testing

<table>
<thead>
<tr>
<th>Hardware Component</th>
<th>Total SEE</th>
<th>MTBF (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T61P Laptop</td>
<td>500</td>
<td>10</td>
</tr>
<tr>
<td>SDRAM</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>Intel processors</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

Table II: Summary of COTS & Off-Hardware Tested with Proton Radiation

<table>
<thead>
<tr>
<th>Hardware Component</th>
<th>Total SEE</th>
<th>MTBF (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Memory</td>
<td>200</td>
<td>10</td>
</tr>
<tr>
<td>Wireless Router</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>Processor</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

CONCLUSIONS

This presentation reports the results of recent proton and heavy ion SEE testing on a variety of COTS and non-COTS electronic devices and assemblies tested for the Space Shuttle, International Space Station (ISS), and Multi-Purpose Crew Vehicle (MPCV). This presentation reports the results of recent proton and heavy ion SEE testing on a variety of COTS and non-COTS electronic devices and assemblies tested for the Space Shuttle, International Space Station (ISS), and Multi-Purpose Crew Vehicle (MPCV). This presentation reports the results of recent proton and heavy ion SEE testing on a variety of COTS and non-COTS electronic devices and assemblies tested for the Space Shuttle, International Space Station (ISS), and Multi-Purpose Crew Vehicle (MPCV).