

Challenges for Electronics in the Vision for Space Exploration

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Abstract:

New missions to the Moon and Mars provide grave challenges for the reliable utilization of high-performance modern electronics. Changes in modern integrated circuit (IC) technologies have modified the way we approach and conduct radiation tolerance and reliability testing of electronics in general. These electronics changes include scaling of geometries, new materials, new packaging technologies, and overall speed and device complexity challenges. In this presentation, we will:

- Define briefly the radiation effects on electronics,
- Discuss the specific environment challenges for electronics that relate to the Moon and Mars,
- Provide an overview of the types of electronics that may be required for Exploration as well as discuss a few relevant examples,
- Identify sample radiation and reliability issues for modern electronics that are of import for Exploration,
- Illustrate a four-pronged approach to electronic parts from management to research required for Exploration, and finally,
- Recommend specific research areas that require further exploration to ensure reliability for space electronics utilization.

The focus will be on standard digital technologies, however, other high performance technologies will be discussed where appropriate. The effects of concern will be: Single Event Effects (SEE) and steady state total ionizing dose (TID) response and to a lesser extent, displacement damage.