



**New Millennium Program
ST 8 Validation Experiment**

**On-Board Science Data Processing for
NASA Science Missions**

**Fault-Tolerant Spaceborne Computing Workshop
Sandia National Laboratory**

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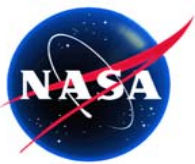
- **On-Board Science Data Processing a Needed Capability**
- **Objectives of the ST 8 Dependable Multiprocessor Validation Experiment**
- **Current Status**

- **Improved on-board processing is the means to future improved performance**
 - **Monitoring data streams to detect and downlink important data**
 - Change detection and feature monitoring used to detect clouds and dust devils on Mars (ST 6 on MER)
 - **Information extraction from large data sets**
 - Radar and SAR
 - Hyperspectral Instruments
 - **Autonomy**
- **Improved by using COTS equipment for space science**

- **System-level computing capability**
 - **300 MOPS/W**
 - Specified space radiation environment
 - Reliability and availability > 0.995
 - Confidence level of 0.95
 - While executing realistic, benchmark parallel codes
 - **Fault tolerance**
 - Simplex, duplex, and triplex operating modes
 - Duplex and triplex parallel processing modes
 - Algorithm-Based Fault Tolerance
 - Hybrid (NMR and ABFT)
 - **Validated model used to scale test article to 20-node processor**
- **Validation at TRL 6 by the New Millennium Program**



ST 8 Dependable Multiprocessor Experiment



- **Honeywell leads effort to validate Dependable Multiprocessor Technology Advance**
 - **Test bed of a rad-hard controller and three COTS processors with necessary communications**
 - **Radiation testing – proton and heavy ion**
 - First round of proton tests complete
 - **Fault Injection testing**
 - Test software complete
 - **Model development**
- **Principal Investigator: John Samson**

Dependable Multiprocessor Is a First Step to High Performance Computing for NASA Science Data Processing Using COTS

- COTS Based
- Parallel Processing
- Fault Tolerance
 - Replication and ABFT
- Validation Experiment
 - Radiation testing
 - Fault Injection
 - Modeling
- A Beginning

