

# **A 4-Mbit Non-Volatile Chalcogenide Random Access Memory Designed for Space Applications: Project Status Update**

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## **Abstract**

BAE Systems, under contract to the Air Force Research Laboratory Space Vehicles Directorate, has been developing a non-volatile 4Mb Chalcogenide Random Access Memory (C-RAM<sup>TM</sup>) optimized for operation in stringent radiation environments, especially those encountered in spacecraft applications. A unique combination of features provide a high-density, low-power, non-volatile memory solution that is radiation hardened and meets rigorous reliability requirements. C-RAM will undergo QML Class Q qualification testing during the second half of 2008 under productization and qualification support from the Air Force Space and Missile Systems Center. Class V QML qualification testing is planned to be completed in 2009. A formal product announcement is being released, and significant market interest has already been received. Full flight production of C-RAM will begin in 2009.

The results from recently completed space radiation effects testing (total ionizing dose and heavy ion induced upset) demonstrate the robust nature of the device. There was no observed loss of data or functionality for samples exposed to total ionizing dose levels up to 2Mrad(Si) and there were no recorded parametrics shifts greater than  $\pm 10\%$  of their pre-exposure value. During heavy ion testing, no memory cell upsets were recorded and the majority of the observed upsets were soft transient errors induced in the sense amp circuits which are easily correctable with common error correcting code algorithms.

During the product development phase potential failure mechanisms were investigated in order to be eliminated from concern, such as proximity disturbs and drill-in effects. Other tests involved second order radiation effects, such as the effect of heavy ion radiation exposure on data retention lifetime.

This paper will describe the characteristics and operation of the C-RAM device, discuss the testing related to potential failure modes, and present current results of characterization, radiation assurance and product assurance testing.