



The Institute for Space and Defense Electronics



What is ISDE?

ISDE is an engineering and research institute at Vanderbilt University, located just off campus on Nashville's Music Row. Our expertise is in the area of radiation effects on microelectronics. A contract engineering department of the School of Engineering, ISDE was created to meet customer microelectronics reliability needs through circuit modeling, analysis, and design. ISDE brings several decades of "academic" resources/expertise and "real-world" engineering to bear on customer-driven tasks in the following areas:

Design Support

- Radiation-aware compact modeling
 - IC's & discrete devices
- Process modeling with radiation effects
- Test chip design
- Radiation hardened by design implementation & training
- Software tool development

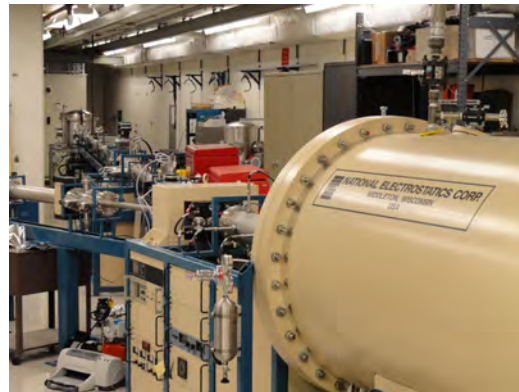
Analysis & Simulation

- In-depth analysis of semiconductor technologies over the entire spectrum of radiation environments
 - Single event effects
 - Transient ionizing dose
 - Total ionizing dose
 - Neutrons
- Industry-standard & in-house-developed simulation tools
- Virtual Irradiation

Task driven support of specific radiation effects engineering needs in government and industry, both large and small.

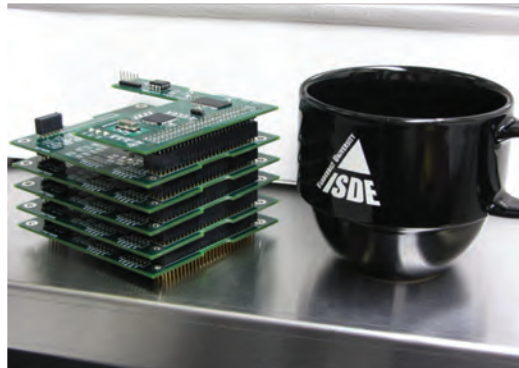
Test & Characterization

- An extensive suite of test and characterization equipment for radiation-effects analysis
 - ARACOR 10-keV X-ray irradiator
 - Two Cs-137 isotopic irradiators
 - 2-MeV proton source
 - Laser testing
 - Cold temperature dewar
- Extensive off-Site test experience
 - Brookhaven National Laboratory
 - Lawrence Berkeley Laboratory
 - Michigan State University
 - Indiana University Cyclotron Facility
 - Tri-University Meson Facility (TRIUMF)
 - Crane Linear Accelerator Facility
 - Sandia National Laboratories Microbeam Facility
 - NAVSEA-Crane



CubeSat Development

- Provides inexpensive on-orbit test capability
- Design, fabrication, and launch support



ISDE Background

The Radiation Effects and Reliability Group (RERG) at Vanderbilt University was established in 1987 and is the largest program of its kind in the U.S. It is the only academic program directly involved in supporting the Department of Defense (DOD) in radiation effects for strategic applications, and one of a very few programs involved in microelectronics research for space applications. In January 2003, ISDE was established to extend the RER Group's capabilities to serve government and commercial customers. ISDE currently has 14 full time engineers located in a limited access, ITAR-compliant facility. Our annual funding is approximately \$5 million, and we support the U.S. Navy, Air Force, NASA, DTRA and over 20 commercial enterprises around the world.

Vanderbilt University

Vanderbilt University, located in Nashville, TN, is a private research university of about 6,500 undergraduates and 5,300 graduate and professional students.



The university comprises 10 schools, a distinguished medical center, a public policy center and The Freedom Forum First Amendment Center. Vanderbilt offers programs in the liberal arts and sciences, engineering, music, education and human development as well as a full range of graduate and professional degrees. In its 2011 ranking *U.S. News & World Report*, placed Vanderbilt 17th among national universities in the United States.



Selected Projects

U.S. Navy FBM (Trident II)

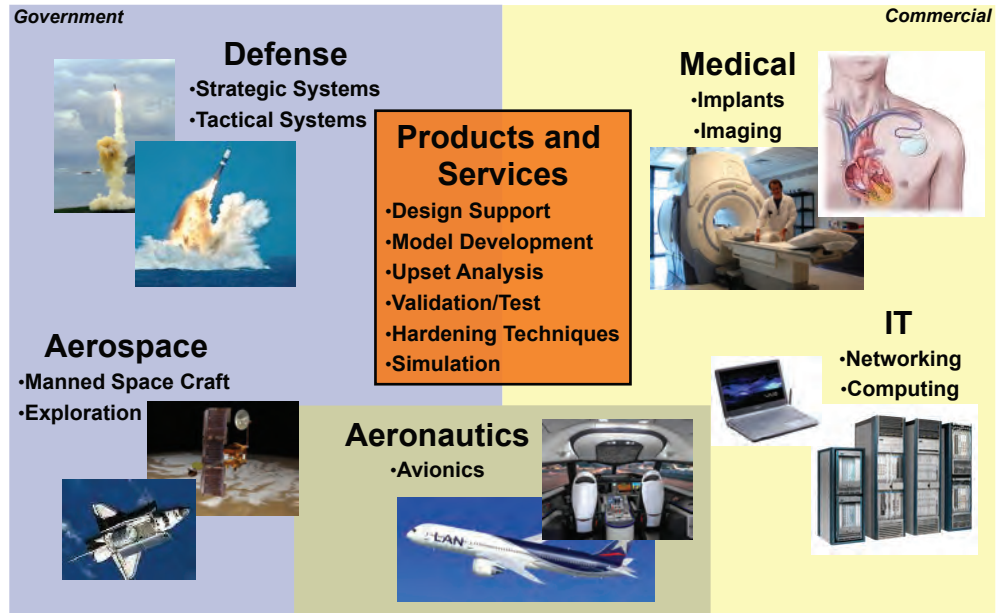
D5 Life Extension Support

- **Sponsor:** U.S. Navy Strategic Systems Programs (SSP)
- **Project Summary:** Provide design and test support circuits for technology characterization and radiation assessment; develop engineering models, tools, and design procedures; analyze radiation response and potential failure mechanisms in designs; apply radiation requirements to part hardness assurance and design qualification



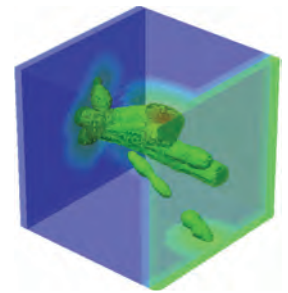
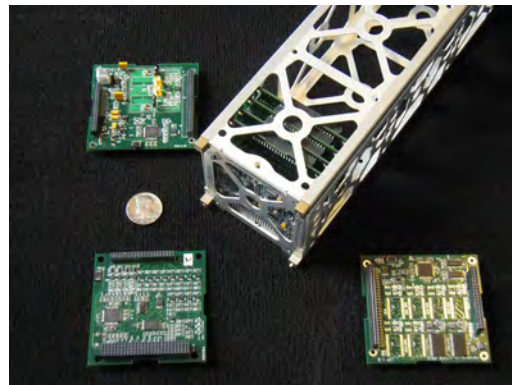
DARPA RHBD Program

- **Sponsor:** DARPA/Boeing
- **Project Summary:** Develop and demonstrate portable circuit/layout design techniques in a commercial foundry across multiple technology nodes and enable rad-hard ASICs on advanced fab processes



RadFxSat - A University Based Satellite Program to Study Radiation Effects on Advanced Nanoelectronics

- **Sponsor:** NASA
- **Project Summary:** Design, development, test, and flight experiments involving radiation effects on microelectronics. The CubeSat format, which is a type of miniaturized satellite for space research that “piggy backs” onto existing space launches as a secondary payload, creates an affordable means for universities and commercial entities to conduct experiments in a space environment.



CRÈME-MC

ISDE hosts and provides widely used radiation simulation tools, including CREME96 and CREME-MC. Monte-Carlo Radiative Energy Deposition (MRED) is a custom radiation-transport code developed in-house, based on the Geant4 libraries. MRED allows simulation of the interaction of radiation with materials and can be used to estimate radiation-induced event and error rates in a wide variety of electronic technologies. MRED is calibrated to data and has a proven record of predicting both terrestrial and space experimental radiation results.

Learn more about ISDE at www.isde.vanderbilt.edu

Contact Barry Templeton for business opportunities at barry.templeton@vanderbilt.edu