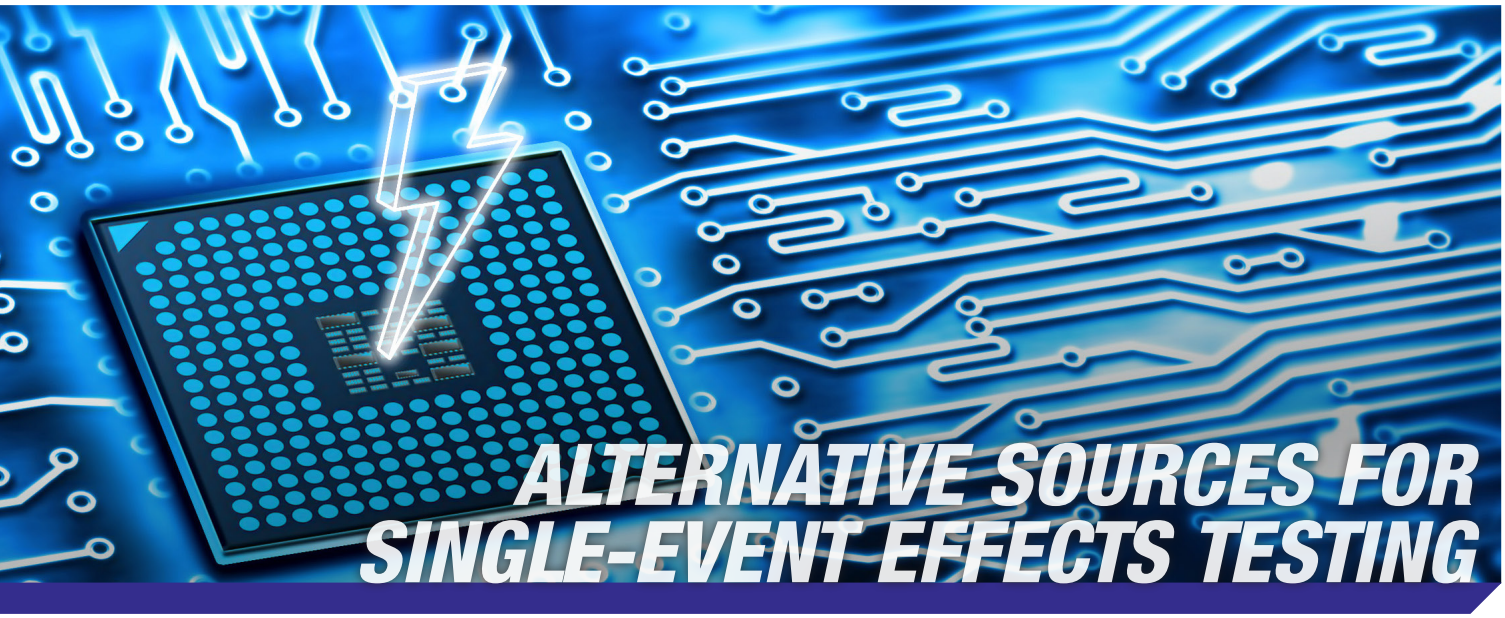
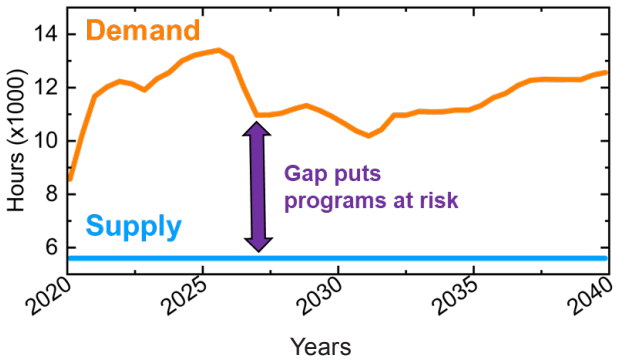
AEROSPACE



ALTERNATIVE SOURCES FOR SINGLE-EVENT EFFECTS TESTING

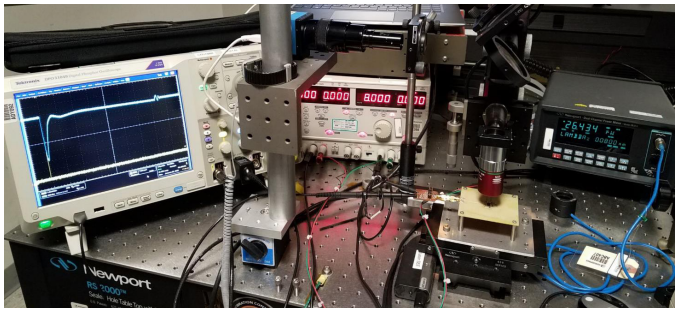
In the past couple of decades, The Aerospace Corporation has seen an increase in demand for single-event effects (SEE) testing which rely on heavy-ion facilities located around the world. As there are only a few U.S.-based facilities, the demand for testing hours is significantly exceeding the supply of hours available across all of the facilities. This gap, depicted in the graphic to the right, increases the risk for programs which require more urgent and/or time-sensitive SEE testing.

As a response, The Aerospace Corporation has been developing alternative SEE testing methods that do not rely on heavy ion facilities. These alternative methodologies have, and will continue to, offset the time and costs associated with heavy-ion based SEE testing resulting in a more rapid insertion of new technologies in next-generation spacecraft.

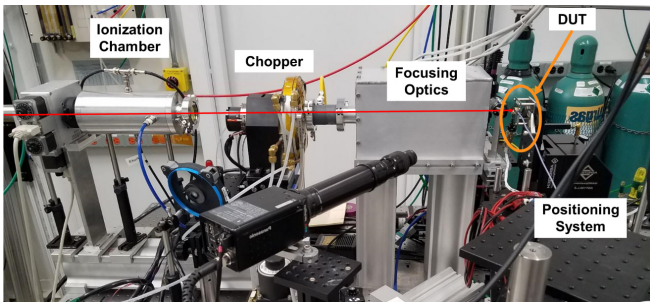


Existing Methods

785-nm Pulsed-Laser Setup — The Aerospace Corporation has a simple, in-house pulsed-laser setup for SEE testing using 785-nm optical wavelength. This setup induces single-photon absorption in silicon-based devices and is useful for screening SEEs in semiconductor technologies with little to no top-side metal coverage as the metal blocks the light.



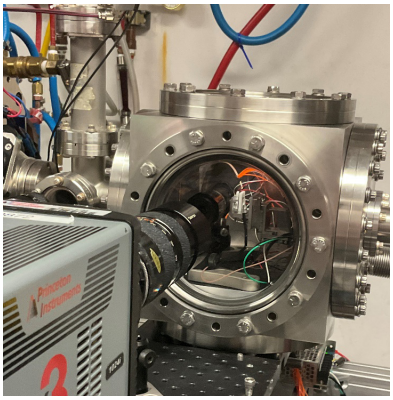
1550-nm Pulsed Laser Setup — The Aerospace Corporation has acquired a commercial pulsed-laser SEE tester manufactured by PULSCAN. This specific model uses 1550-nm optical wavelength which induces two-photon absorption into silicon-based devices. The two-photon process (in comparison with the single-photon) enables testing to be done through the backside of silicon, overcoming the limitation of devices which are covered with top-side metal. This turnkey system comes with a comprehensive software suite for motor control, switching between testing conditions and other complex tests (e.g., 3-D latch-up mapping).



Pulsed X-ray (Offsite) — The Aerospace Corporation has pioneered the technique for pulsed x-ray SEE testing by working with the staff at the Advanced Photon Source (APS), which is based out of Argonne National Laboratory in Illinois. This technique uses 10-keV x-rays to excite charge in devices and emulate SEEs. Unlike lasers, x-rays can penetrate through metals and packaging, reducing the level of prep work needed for SEE testing (e.g., de-lidding, polishing). The Aerospace Corporation has agreements in place with APS for such experiments to support our customer needs.

Methods Under Development

The Aerospace Corporation is actively working on developing new methods for alternative SEE testing. If the effort is successful, SEE testing and hardness assurance for most programs/missions can be off-loaded to these alternative methods and forego the need for heavy-ion testing altogether. This will free up the heavy-ion beam time, allowing it to be used only for the most critical, least risk-tolerant programs, balancing the U.S.-based supply and demand for heavy-ion testing.



Pulsed Electrons — Electrons have the benefit of being highly penetrative while still depositing energy in a material. Aerospace is working with collaborators to create a pulsed, focused electron cloud which deposits energy in a device similar enough to a heavy-ion track such that it can reproduce any SEE in electronics. If successful, such a system can be commercialized and installed in laboratories in need of rapid SEE testing.

Pulsed X-rays — Building on the seminal work done by Aerospace at APS using pulsed x-rays for SEE testing, Aerospace is attempting to create a more compact source x-ray source using inverse-Compton scattering methods. This source will generate pulsed, focused x-rays such that the pulse will deposit energy similar to that of a heavy-ion into a device. Like pulsed electrons, the pulsed x-ray source is proposed to be commercialized and, if successful, can be installed in laboratories which are in need of rapid SEE testing.

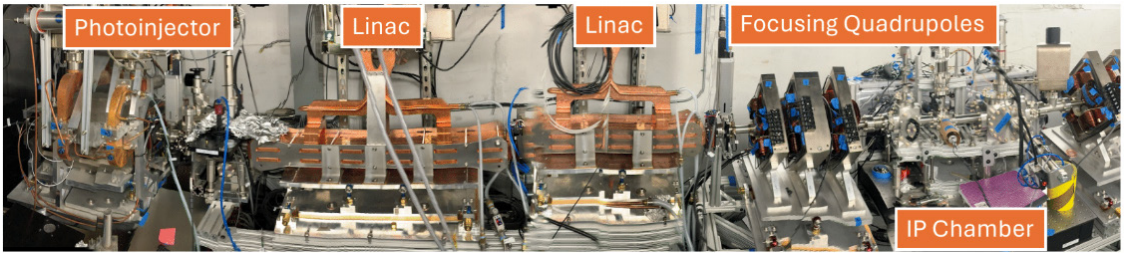


Photo courtesy of RadiaBeam, an Aerospace collaborator.

The Aerospace Corporation

The Aerospace Corporation is a leading architect for the nation's space programs, advancing capabilities that outpace threats to the country's national security while nurturing innovative technologies to further a new era of space commercialization and exploration. Aerospace's national workforce of more than 4,600 employees provides objective technical expertise and thought leadership to solve the hardest problems in space and assure mission success for space systems and space vehicles. For more information, visit www.aerospace.org.

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