Air Force SBIR

Transition

An example of Air Force supported SBIR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.

SBIR Topic Number:
AF99-314

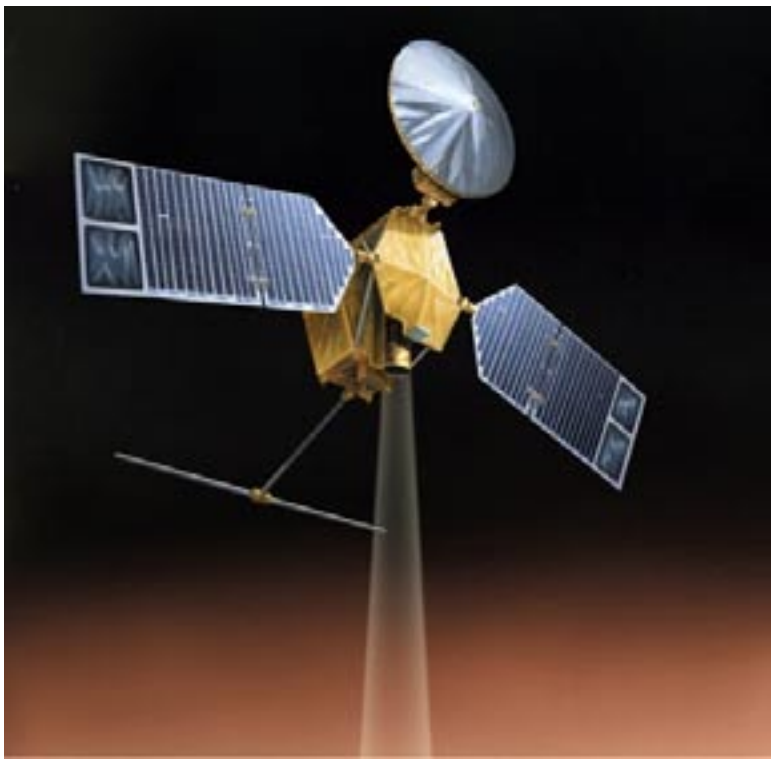
Title:
Temporarily and Spatially Resolved Spectrograph for 15-300 KEV X-rays

Contract Number:
F40600-00-C-0011

Company Name:
Alameda Applied Sciences Corporation, San Leandro, CA

Technical Project Office:
Arnold Engineering Development Center (AEDC)

Transition Office:
AEDC



High Speed Camera Used For Testing Satellite Spacecraft Components Against Nuclear Radiation Effects

- **Air Force satellites are routinely tested with high intensity x-rays prior to launch in order to insure reliability and survivability.**
- **Air Force SBIR supported development of a robust, very high-speed pixilated camera for imaging high intensity x-rays.**
- **Testing procedures must verify x-ray dose and energy are within specifications while insuring the machine's operations are monitored with real-time diagnostics.**

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Air Force Requirements

To ensure the reliability and survivability of Air Force satellites, spacecraft components and structures are routinely tested using high intensity x-rays. These tests are carried out by large, sophisticated, extremely fast pulsed x-ray machines. One of the critical requirements of the testing procedure is to verify that the x-ray dose and energy are within specified guidelines. In addition, the complexity and speed of the x-ray machines demands that real-time diagnostics are in place to monitor operations. The requirements of such diagnostics are severe, since they must survive the harsh x-ray environment and have the ability to take accurate, quantitative data at an extremely rapid rate.

SBIR Technology

Working with the Air Force under the Small Business Innovation Research (SBIR) Program, Alameda Applied Sciences Corporation (AASC) designed and constructed a robust, very high-speed pixilated camera for imaging high intensity x-rays. The principal of operation of the camera is quite simple. Small natural diamond pixels about 1 mm in size are used to detect the x-rays. Electrical leads are connected to each of the diamond pixels. Under normal conditions, diamond is an excellent insulator so no current flows through the electrical leads. However, under x-ray irradiation diamond becomes conductive and a current flows. The amount of current flowing is proportional to the x-ray intensity, so accurate calibrated measurements can be made. The big advantage of this approach is that diamond is extremely resistant to x-ray damage, even at high intensities, and thus the camera gives reliable, reproducible results year after year. In addition, diamond has a very simple and predictable response to x-rays and responds much faster than other materials and thus is much more accurate. The response of the diamond camera has proven so fast that movies of the x-ray event can be made, giving a frame by frame snapshot of the exposure. This information is vital for monitoring the operation of the x-ray source and for determining the response of the spacecraft components to the x-ray radiation.

A promising crossover application for this technology is to use the diamond camera for medical imaging and for accurate dose measurement in cancer treatment. Currently, silicon based detectors are used which have a lower damage threshold and a more complex response to x-rays than that of diamond and thus are not as stable or accurate. AASC has made commercial sales of diamond radiation detectors for medical applications and is currently working to expand this market.

Air Force Transition Payoff

A camera was delivered to the Air Force under this SBIR. The technology developed under this SBIR found immediate military application. The 96-pixel diamond camera is currently being used at Arnold Engineering Development Center to measure x-ray doses during testing of Air Force and other military satellite components and to diagnose and monitor the operation of the x-ray machine. These tests will ensure that military satellites and other spacecraft are robust, surviving the harsh space environment, and can remain operable even during severe countermeasures by unfriendly forces.

U.S. AIR FORCE

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