



# Transition

**SBIR Topic Number:**

AF98-295

**Title:**

Advanced Short, Mid, and Long Wavelength Infrared Detector Material

**Contract Number:**

F 4060-99-C-0011

**Company Name:**

Fermionics Corporation, Simi Valley, CA

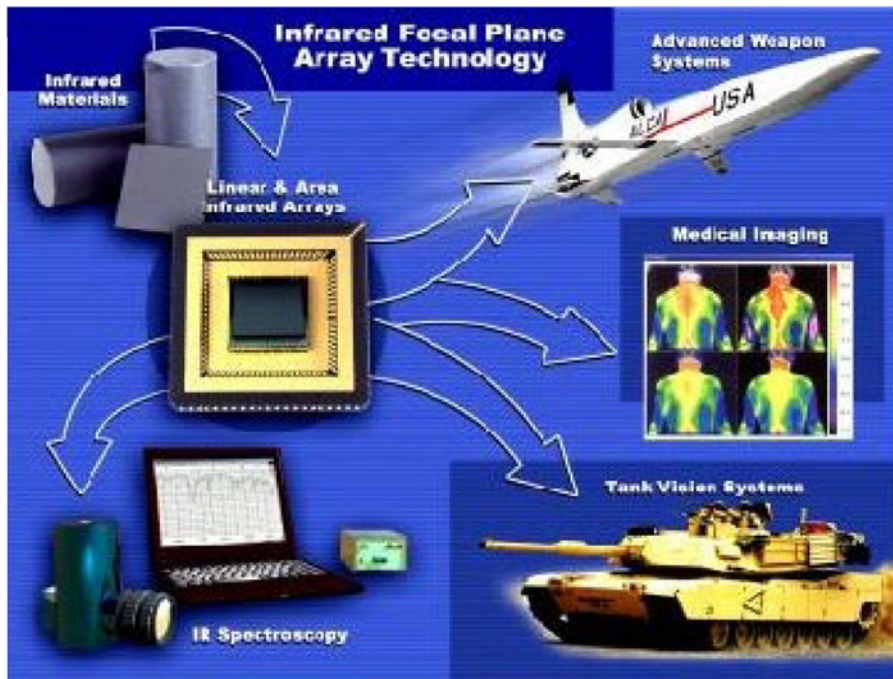
**Technical Project Office:**

Arnold Engineering Development Center

**Transition Office:**

Arnold Engineering Development Center

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.



## Major Improvements Developed for High Performance Infrared Focal Plane Arrays

- High performance infrared Focal Plane Arrays (FPA) are vital for advanced Air Force weapon systems
- Over the past three years SBIR supported R&D has helped drastically improve the quality of the semi-conductors involved
- After two decades of R&D efforts, the production yield of fabricating infrared FPAs remained unacceptably low
- New linear long wave arrays are currently used in tanks for command control, in smart bombs for identification, and in advanced missiles for searching and tracking

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## Air Force Requirements

High performance infrared Focal Plane Arrays (FPA) are vital for advanced Air Force weapon systems such as the Space Based Infrared System (SBIRS) and for laboratory testing using spectroscopic analysis. The Air Force sought FPAs fabricated using high quality mercury-cadmium-telluride (HgCdTe) semiconductors. After two decades of R&D efforts, the production yield of fabricating these HgCdTe infrared FPAs remains unacceptably low. As a result, the cost of an FPA is high and the delivery lead-time is too lengthy.

## SBIR Technology

Working with the Air Force under a Small Business Innovation Research (SBIR) Program Phase II, Fermionics scientists designed a program to address the material issues in order to improve the yield of producing the HgCdTe FPAs. Based on experimental data and theoretical predictions, a number of defects in the HgCdTe existing semiconductors were discovered. Company scientists then engineered a series of processes to minimize the densities of these defects. As a result, the quality of the semiconductor improved drastically. In three years, short wave, mid-wave, and long-wave HgCdTe linear arrays and two-dimensional focal plane arrays in the 320x256 format have been successfully produced. At the conclusion of the contract, two cameras in different wavelength bands were delivered to the Air Force.



## Air Force Transition Payoff

Technical Project Officer, Ron Bishel states, "High operability HgCdTe focal plane arrays are needed to extend the wavelength range of infrared imaging systems such as infrared cameras. These focal plane arrays have various uses within the Air Force, and in particular at AEDC, such as infrared signature measurements of threats, verification of infrared suppression technologies in military aircraft, and near ambient thermal imagery for leak detection. Ultimately, we expect to incorporate a long wavelength FPA in a hyperspectral imagery system now being developed at AEDC. This device will further Air Force capabilities to accurately acquire background subtracted infrared images of threats which is presently very difficult and time consuming."

## Company Benefit

The technology developed under this program found immediate military and civilian applications. In the military arena, the new linear long-wave HgCdTe arrays are currently used in tanks for command control, in smart bombs for identification, and in advanced missiles for searching and tracking. In the civilian application arena, the mid-wave HgCdTe detectors are used for medical imaging and the 320x256 short-wave arrays are finding their applications in paper automation machines. The combined company revenue resulting from this technology already exceeds half a million dollars. In addition to the infrared applications, the improvement in CdZnTe, a sister material of HgCdTe, allows Fermionics to enter the gamma ray detector field. The total amount of government R&D contract awards to date on the gamma ray detector is near one million dollars and the amount of pending proposals to the U.S. government is over three million dollars.



Imaging picture taken by a 320x256, 9.7  $\mu\text{m}$ , heterojunction, LWIR HgCdTe camera showing repair areas.



U.S. AIR FORCE

# SBIR

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