

Research

HIGHLIGHTS

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New Transistor Technology Doubles Performance Levels of Solid State Devices

ELIMINATES NEED FOR SUPPLEMENTAL ENVIRONMENTAL COOLING ON AIRCRAFT

A University of California (Santa Barbara) professor has produced an electronic device which doubles microwave power performance output compared to previously published results. The device is known as a modulation-doped field effect transistor (MODFET).

The demonstration of this device and collateral theoretical modeling indicate that solid state devices may potentially produce microwave power output levels rivaling those of vacuum tubes. This long-sought transition from vacuum tubes to solid state devices would mean:

- greater lifetimes for such Air Force applications as radar and electronic countermeasure systems;
- significant reductions in cost; and,
- improved reliability.

With AFOSR support, Prof. Umesh Mishra and his research team have explored electronic devices fabricated from a new class of semiconductor materials — gallium nitride (GaN) and related materials. While long recognized as promising for electronic and optoelectronic uses, GaN is a technically challenging material that only recently has had notable progress. Building on the progress from teams at Santa Barbara and elsewhere, Prof. Mishra has succeeded in producing new record levels of performance for the MODFET.

It also appears that the MODFET is capable of operation under uncooled conditions. This would mean that such devices would not require supplemental environmental cooling on an aircraft or on a space platform, resulting in a savings of weight, power consumption, and improved system reliability.

These research accomplishments are being transitioned to UCSB's industrial partners at Hughes Research Laboratory for potential insertion in a variety of Air Force and DoD electronic systems.

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Professor Mishra



USAF Airmen with
ALQ-184 ECM pod at
Hill Air Force Base, Utah

Photo: Raytheon Company