HMD device tracks the direction of gaze of the wearer, providing data that are used to select, for display, the portion of the mosaic image corresponding to the direction of gaze.

The basic functionality of the system has been demonstrated by mounting the cameras on the roof of a van and steering the van by use of the images presented on the HMD device.

This work was done by Amarnath Banerjee of Texas A&M University for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809. MSC-23777-1

Spacesuit Data Display and Management System

John H. Glenn Research Center, Cleveland, Ohio

A prototype embedded avionics system has been designed for the next generation of NASA extra-vehicular-activity (EVA) spacesuits. The system performs biomedical and other sensor monitoring, image capture, data display, and data transmission. An existing NASA Phase I and II award winning design for an embedded computing system (ZIN vMetrics – BioWATCH) has been modified.

The unit has a reliable, compact form factor with flexible packaging options. These innovations are significant, because current state-of-the-art EVA spacesuits do not provide capability for data displays or embedded data acquisition and management. The Phase 1 effort achieved Technology Readiness Level 4 (high fidelity breadboard demonstration). The breadboard uses a commercial-grade field-programmable gate array (FPGA) with embedded processor core that can be upgraded to a space-rated device for future revisions.

This work was done by David G. Hall, Aaron Sells, and Hemal Shah of ZIN Technologies, Inc. for Glenn Research Center.

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18399-1.

IEEE 1394 Hub With Fault Containment

Lyndon B. Johnson Space Center, Houston, Texas

This innovation is designed to prevent a single end system communication node from negatively influencing the whole system's behavior so that the network system can still operate if an end node is faulty. Placing a hub (star) in the middle of the system prevents propagation of critical control information that other end systems would react to, like block reset messages.

This work was done by Michael Paulitsch, Brendan Hall, and Kevin R. Driscoll of Honeywell, Inc. for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809.

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act {42 U.S.C. 2457(f)} to Honeywell, Inc. Inquiries concerning licenses for its commercial development should be addressed to:

Honeywell, Inc.
P.O. Box 52199
Phoenix, AZ 85072

Refer to MSC-24459-1, volume and number of this NASA Tech Briefs *issue, and the page number.*

Compact, Miniature MMIC Receiver Modules for an MMIC Array Spectrograph

MMIC multi-chip modules can be used in astrophysics telescopes, automotive radar, and communication links.

NASA's Jet Propulsion Laboratory, Pasadena, California

A single-pixel prototype of a W-band detector module with a digital back-end was developed to serve as a building block for large focal-plane arrays of monolithic millimeter-wave integrated circuit (MMIC) detectors. The module uses low-noise amplifiers, diode-based mixers, and a WR10 waveguide input with a coaxial local oscillator. State-of-the-art InP HEMT (high electron mobility transistor) MMIC amplifiers at the front end provide approximately 40 dB of gain. The measured noise temperature of the module, at an ambient temperature of 300 K, was found to be as low as 450 K at 95 GHz.

The modules will be used to develop multiple instruments for astrophysics radio telescopes, both on the ground and in space. The prototype is being used by Stanford University to characterize noise performance at cryogenic temperatures. The goal is to achieve a 30–50 K noise temperature around 90 GHz when cooled to a 20 K ambient temperature. Further developments include characterization of the IF in-phase (I) and quadrature (Q) signals as a function of frequency to check amplitude and phase; replacing the InP low-noise amplifiers with state-of-the-art 35-nm-gate-length NGC low-noise amplifiers; interfacing the front-end module with a digital back-end spectrometer; and developing a scheme for local oscillator and IF distribution in a future array.

While this MMIC is being developed for use in radio astronomy, it has the potential for use in other industries. Applications include automotive radar (both transmitters and receivers), communication links, radar systems for collision avoidance, production monitors, ground-penetrating sensors, and wireless personal networks.

This work was done by Pekka P. Kangaslahti, Todd C. Gaier, Joelle T. Cooperrider, Lorene A. Samoska, Mary M. Soria, Ian J. O'Dwyer, Sander Weinreb, Brian Custodero, and Heather Owen of Caltech; Keith Grainge of Cambridge University; Judy M. Lau and Sarah Church of Stanford University; and Richard Lai and Xiaobing Mei of Northrop Grumman Corp. for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-46522

Waveguide Transition for Submillimeter-Wave MMICs

NASA's Jet Propulsion Laboratory, Pasadena, California

An integrated waveguide-to-MMIC (monolithic microwave integrated circuit) chip operating in the 300-GHz range is designed to operate well on high-permittivity semiconductor substrates typical for an MMIC amplifier, and allows a wider MMIC substrate to be used, enabling integration with larger MMICs (power amplifiers). The waveguide-to-CBCPW (conductor-backed coplanar waveguide) transition topology is based on an integrated dipole placed in the E-plane of the waveguide module. It demonstrates low loss and good impedance matching. Measurement and simulation demonstrate that the loss of the transition and waveguide loss is less than 1-dB over a 340-to-380-GHz bandwidth.

A transition is inserted along the propagation direction of the waveguide. This transition uses a planar dipole aligned with the maximum E-field of the TE10 waveguide mode as an interface between the waveguide and the MMIC. Mode conversion between the coplanar striplines (CPS) that feed the dipole and the CBCPW transmission line is accomplished using a simple air-bridge structure. The bottom side ground plane is truncated at the same reference as the top-side ground plane, leaving the end of the MMIC suspended in air.

This work was done by Kevin M. Leong, William R. Deal, Vesna Radisic, Xiaobing Mei, Jansen Uyeda, and Richard Lai of Northrop Grumman Corporation, and Lorene A. Samoska, King Man Fung, and Todd C. Gaier of Caltech for NASA's Jet Propulsion Laboratory. The work was sponsored under the DARPA SWIFT program and the contributors would like to acknowledge the support of Dr. Mark Rosker (DARPA) and Dr. H. Alfred Hung (Army Research Laboratory). Further information is contained in a TSP (see page 1). NPO-46237

Magnetic-Field-Tunable Superconducting Rectifier

This device would be useful in superconducting circuit applications.

Goddard Space Flight Center, Greenbelt, Maryland

Superconducting electronic components have been developed that provide current rectification that is tunable by design and with an externally applied magnetic field to the circuit component. The superconducting material used in the device is relatively free of pinning sites with its critical current determined by a geometric energy barrier to vortex entry. The ability of the vortices to move freely inside the device means this innovation does not suffer from magnetic hysteresis effects changing the state of the superconductor.

The invention requires a superconductor geometry with opposite edges along the direction of current flow. In order for the critical current asymmetry effect to occur, the device must have different vortex nucleation conditions at opposite edges. Alternative embodiments producing the necessary conditions include edges being held at different temperatures, at different local magnetic fields, with different current-injection geometries, and structural differences between opposite edges causing changes in the size of the geometric energy barrier. An edge fabricated with indentations of the order of the coherence length will significantly lower the geometric energy barrier to vortex entry, meaning vortex passage across the device at lower currents causing resistive dissipation.

The existing prototype is a two-terminal device consisting of a thin-film superconducting strip operating at a temperature below its superconducting transition temperature (T_c). Opposite ends of the strip are connected to electrical leads made of a higher T_c superconductor. The thin-film lithographic process provides an easy means to alter edge-structures, current-injection geometries, and magnetic-field conditions at the edges. The edge-field conditions can be altered by using local field(s) generated from dedicated higher T_c leads or even using the device's own higher T_c superconducting leads.

This work was done by John E. Sadleir of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15643-1