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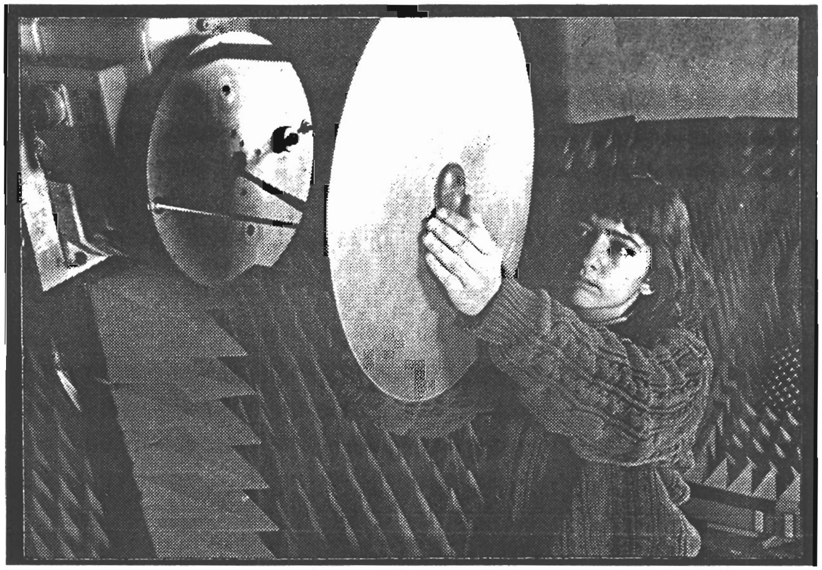
ENGINEERS DEVELOP A NEW CLASS OF MICROSTRIP ANTENNA WHICH OFFERS BROAD BANDWIDTH, LOW COST & HIGH EFFICIENCY

Engineers at the Georgia Tech Research Institute (GTRI) have developed a new class of microstrip antenna that combines the broad-band performance typical of spiral and sinuous antennas with the surface mount capabilities, efficiency and low cost of microstrip antennas.

The new antenna design was developed through a research program supported by the U.S. Air Force's Wright Research & Development Center at Wright-Patterson Air Force Base. A paper describing the antenna will be published in the March 1991 issue of IEEE Transactions on Antennas and Propagation.

Though designed for military use, the new antenna could have widespread application to the commercial communications industry, its inventors say. And because it can be manufactured using conventional printed circuit board technology, it could help lower the cost of manufacturing communications equipment.



Amy Jacoby places experimental antenna onto positioner for testing in Georgia Tech's compact range. (Color Slide/B&W Photo Available)

"What we did was to combine two different antenna technologies: the broad-band spiral technology and the microstrip technology," explained Victor K. Tripp, a senior research engineer at Georgia Tech and a co-inventor of the antenna. "We put them together and got the best of both worlds."

While most microstrip antennas offer a bandwidth of just 10 percent, the GTRI design offers bandwidths as high as 500 to 600 percent.

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Though not as broad-banded as many cavity-backed spiral antennas, the new GTRI design offers significant efficiency advantages -- in addition to its simplicity of manufacture and ability to be "pasted" onto vehicles anywhere an antenna is needed, explained Johnson J.H. Wang, principal research engineer and the other co-inventor.

The antenna could even be conformably placed on the roof of an automobile or the helmets of military personnel to help global positioning system (GPS) satellites track their location, said Wang. Examples of some other uses include navigation, cellular telephones, identification, satellite communications, inter and intra-building communications and the tracking of ground shipments.

The antenna could help global positioning system satellites track vehicles and personnel. Other uses might include navigation, cellular telephones, identification systems, satellite communications, inter and intra-building communications.

Because of its broad-band capabilities, the GTRI antenna could serve several different devices operating on the same vehicle.

"There are applications where you might want to combine three or four functions that are at different frequencies," Tripp noted. "Instead of having three or four different antennas, you could use the same antenna -- one with a broad enough bandwidth to cover all functions. This is what we call an integrated or shared aperture approach."

Though advanced in its design, the antenna would be manufactured using conventional etching techniques common to printed circuit board manufacturers. Because it would use existing manufacturing technology, Tripp believes the antenna could be mass-produced at a low cost.

The design has so far been tested on six different substrate materials. The designers know it works best on materials with low dielectric constants; its performance on other substrates is less promising but is still being investigated. The designers believe the antenna would not be readily suitable for high-gain applications.

Because it can be etched from thin conducting materials like copper, the new antenna is easily conformed to curved surfaces. That should make it especially useful for placement onto aircraft or other vehicles.

"This antenna can be pasted onto any surface you would like," explained Wang. "We can make it conformable to a vehicle's surface, which means we do not have to cut into the vehicle's skin."

Engineers have attempted to combine properties of the spiral and microstrip antennas for more than 10 years. Tripp and Wang say the secret to their success lies in the understanding of the spiral modes and the strategic placement of lossy material.

Conventional spiral antennas rely on a "brute force" approach using electrically "lossy" material placed in the back of a cavity. The "lossy" material permits a wide bandwidth, but decreases the efficiency of the antenna to less than 50 percent, complicates its manufacture and increases the thickness of the antenna.

The new microstrip antenna uses small amounts of the "lossy" materials placed in strategic locations. Though the material reduces efficiency to a level less than that of most microstrip antennas, the efficiency remains well above the spiral devices, Wang explained.

This project was supported under contract from the U.S. Air Force, Wright Research & Development Center, Wright-Patterson Air Force Base. The project monitor is Robert L. Davis.

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