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FOR IMMEDIATE RELEASE
Nov. 12, 2007

Plasma antennas can magically vanish

New antennas made from plasma, rather than metal, have the advantages of being stealthy, reconfigurable, and resistant to jamming.

ORLANDO, Florida, Nov. 12, 2007 – Scientists from industry and academia have carried out new theory and experiments on "plasma antennas," which use ionized gas instead of metal to transmit and receive signals. The results demonstrate the novel features and useful advantages of such antennas.

A conventional antenna made out of metal will radiate electromagnetic radio waves when a high-frequency voltage is applied to it. A plasma antenna, on the other hand, consists of a sealed glass or ceramic tube containing a gas. When a radio-frequency voltage is coupled to the tube, the gas inside is ionized to produce a plasma. The high density of electrons in the plasma makes it a very good conductor of electricity, just like a metal. Unlike a metal antenna, however, once the voltage that creates the plasma is turned off, the plasma reverts to a neutral gas and the antenna disappears.

Therefore, the basic advantage of a plasma antenna over a metal antenna is that when the plasma antenna is de-energized, it ceases to exist electrically. Because it cannot backscatter incoming radar signals, it is stealthy with regards to radar when turned off. Also, because operating plasma antennas can transmit and receive through a de-energized plasma antenna, it could be possible for large stacked antennas with improved range and precision to replace numerous small antennas, thus decreasing clutter, weight, and interference. Furthermore, plasma antennas have a high frequency cut-off that can be adjusted electrically. Thus, a plasma antenna can be transmitting and receiving signals while intense incoming high-frequency signals pass freely through it without interacting, which reduces the effect of jamming.

Basic prototype for a plasma antenna
(on display in the Booze-Allen exhibition hall in McLean, Virginia)

The new theory and experiments were carried out by Haleakala R&D, Inc., and the University of Tennessee on unique plasma antennas that are stealthy, reconfigurable, and jamming-resistant. The plasma antennas are remarkably simple and rugged. Laboratory prototypes have been developed of various kinds of plasma antennas that have counterparts in metal antennas but with the added advantage of being reconfigurable. These plasma antennas operate over a frequency range from hundreds of MHz to several GHz. Currently under development is the prototype for a "smart" plasma antenna that can utilize the physical properties of plasma to steer the antenna beam 360 degrees without phased arrays and without phase shifters. It can scan a region and then find and lock onto transmitting antennas. This prototype will be completed at the end of November 2008.

Funds for this research are provided by US Air Force contract FA9453-06-C-0068.

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Abstract: BO5.00004

Plasma Antenna Shielding

Contributed Oral Session BO5: Processing, Plasma Antennas, and Electric Propulsion
9:30 AM–12:18 PM, Monday, November 12, 2007
Rosen Centre Hotel - Salon 11/12