

# 2.5-D Miniature Microwave and Millimeter-Wave Circuits

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*Faculty Candidate Seminar*  
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## Abstract:

A major frontier of current electromagnetics research is the application of new fabrication capabilities to the implementation of classical microwave devices, as well as the enabling of the design of novel, heretofore unrealizable devices. One promising circuit topology is the air-filled rectangular coaxial transmission line created using microfabrication techniques. These transmission lines have the advantages over traditional planar transmission lines in that they are non dispersive, possess high isolation, are amenable to dense integration and sharp turn radii, are low loss for their cross section, and are much smaller than rectangular or circular metallic waveguides for a given frequency. In a multi-layer configuration, vias and crossovers with excellent broadband performance are quite naturally fabricated. Millimeter-wave designs on both the component and subsystem levels are of interest.

In collaboration with Rohm and Haas Electronic Materials, we have developed a fabrication process capable of building rectangular coaxial components. Air-filled, copper rectangular coax lines and devices with cross sections between 125um by 300um and 630um by 700um have been fabricated. My research focus is to design usable, high-quality millimeter-wave components which demonstrate the merits of this technology. Components operating in Ka-band have been designed, fabricated, and tested. Designs operating in the V- and W-band are currently being fabricated, and the presently used topologies could conceivably be operated at frequencies into the hundreds of GHz. This talk will identify some of the interesting advances, present results from this work, and indicate a few of the future challenges to be solved to bring this technology to maturity.

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**Bio:** Kenneth J. Vanhille received the B.S. degree in electrical engineering from Utah State University, Logan, in 2002, the M.S.E.E. degree from the University of Colorado at Boulder, in 2005, and is currently working towards the Ph.D. degree at the University of Colorado at Boulder with an expected graduation date of May 2007. From 2000 to 2003, he was with the Space Dynamics Laboratory, Logan, UT, where he designed space science instrumentation for sounding rocket campaigns. He was a member of the 2002 National Aeronautics and Space Administration (NASA) Academy, Goddard Space Flight Center, Greenbelt, MD. His professional experience also includes internships with The Aerospace Corporation, El Segundo, CA (2001), the Ball Aerospace and Technologies Corporation, Boulder, CO (2003), and the First RF Corporation, Boulder, CO (2003–2004). His current research interests include millimeter-wave components, broadband packaging of optoelectronics and antenna design.