Time & Location: April 2, 2010 at 3:00 PM in HEC 302
Title: The Application of Time to Digital Converters to Small Platform Direction Finding Systems

Integration of electronic support measures (ESM) equipment within UAV’s is limited due to payload size, weight, and power constraints. Current generation direction finding (DF) systems suffer from these confines, so new low-power chip-scale solutions are desirable. Furthermore, DF systems primarily designed with commercial off-the-shelf (COTS) components reduce cost and are particularly attractive.

Passive DF techniques include the comparison of one or more of the following attributes of a signal: amplitude, phase (interferometry), frequency, and/or time difference of arrival (TDOA). Due to size, complexity, and high cost, interferometer DF systems are often not ideal for small platforms. Amplitude comparison systems based on the Watson-Watt method and spatially distributed directional antennas are common, but suffer from limited bandwidth and accuracy, respectively. TDOA is currently implemented when the distances between antennas are large for localization purposes, such as in the case of mobile phone triangulation, but utilizing this technique on a small scale has been limited by the ability to resolve the time differences with high accuracy and precision.

This thesis focused on a feasibility study of an S-band prototype TDOA DF solution using sub-nanosecond resolution time-to-digital converters. By measuring the relative time of arrival of a pulsed RF signal impinging on an antenna array, direction of arrival (DOA) can be ascertained. This technology enables versatile DOA calculation on platforms only several meters in length, and offers many SWAP and cost advantages when compared to current DF technologies.

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Approved for distribution by Dr. Xun Gong, Committee Chair, on March 19, 2010.

The public is welcome to attend.