Abstract The conventional approach to GMTI uses narrowband signals and a short coherent processing interval (CPI). In this talk, we examine some of the fundamental theoretical issues involved in GMTI with wideband signals and long CPIs (WL-GMTI). The possibility of wideband, long CPI GMTI has received some attention in recent years, and there are a number of potential benefits:

1) Improved minimum detectable velocity (MDV).
2) Detection of targets with zero radial velocity (but non-zero tangential velocity).
3) Better fit with dual-use SAR/GMTI architectures.
4) Less demanding array requirements (shorter and/or sparser arrays).
5) Greater robustness to clutter internal motion.

The most convenient framework for WL-GMTI is a “post-SAR” architecture, where each spatial channel is pre-processed with synthetic aperture radar (SAR) image processing. The post-SAR architecture is the natural generalization of post-Doppler STAP to the wideband, long-CPI case.

Exact steering vectors in the post-SAR framework are computed analytically for constant-velocity targets, assuming a calibrated array. The steering vectors can be used with algorithms such as the GLRT or AMF to perform adaptive detection on the post-SAR data. We also derive a simple, exact expression for SINR loss when the covariance is known exactly. The loss is a two-dimensional function of both target velocity components, indicating the capability to detect both radial and non-radial target motion.

The final section of this talk examines WL-GMTI performance bounds based on optimal Bayesian detection. In particular, we study how detection performance varies as a function of the number of pixels that the moving target "smears" over in the SAR image. There is a surprising improvement in detection performance when the clutter has strong non-Gaussian tails. In at least some cases, it appears that much of the performance can be achieved with a simple sub-optimal detector.