Advanced Adaptive UWB-OFDM Radar Imaging Sensor Network for Reconnaissance and Location

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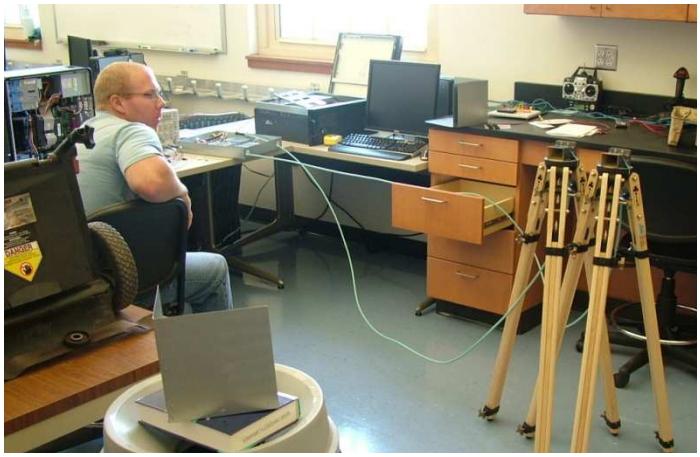

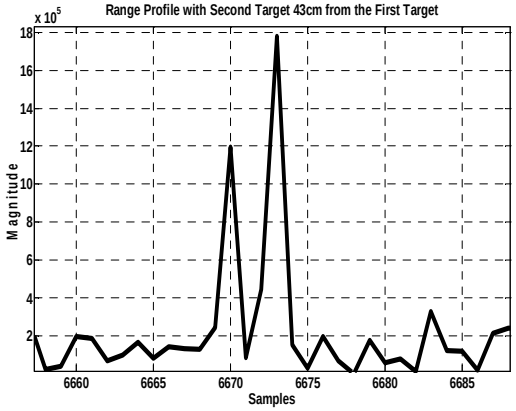

Experimental high-resolution range imaging with the dual-use UWB-OFDM system. Left: Lab setup for single-target range profile extraction. Right: Two-target resolution test – each time sample between the peaks corresponds to 1 nanosecond interval, or 0.15 m distance, thus resulting in target separation estimation of 0.45 m (the actual distance between the two targets was 0.43 m).

The concept of a dual-use (radar/communication), high-resolution all-weather radar imaging sensor is addressed in this Project via utilizing UWB orthogonal frequency division multiplexing (OFDM) system architecture and wave-forming method. The system is built as a short-range, high-resolution radar and communication unit for possible implementation in airborne sensor networks. UWB OFDM is analyzed and contrasted with the existing wideband radar concepts to explore the benefits pertaining to: Wavefront reconstruction SAR imaging with real-time processing potential; ECCM potential via pulse diversity; In-band coexistence with narrowband services, such as GPS, allowing for common analog front-end (AFE) between several on-board systems via adaptive spectral shaping. The researched framework of UWB OFDM signal and system design will be extremely applicable to multi-platform sensor network scenarios, as it will allow for real-time battlefield image data collection and exchange among friendly platforms while providing significant anti-jamming capabilities. One potential extension of this work is reliable image-based navigation in multi-platform environment when GPS service is unavailable.

References: D. Garmatyuk, J. Schuerger, "Conceptual design of a dual-use radar/communication system based on OFDM," *Proceedings of 2008 Military Communications Conference (MILCOM'08)*, November 2008, pp. 1-7.

D. Garmatyuk, Y. Jade Morton, and X. Mao, ""On coexistence of in-band UWB-OFDM and GPS signals: Tracking performance analysis," *Proceedings of 2008 IEEE/ION Position, Location and Navigation Symposium (PLANS'08)*, May 2008, pp. 196-202.