

AFRL RESEARCH TOPIC CALL FOR FY13

1. **Research Title:** Compressive Sensing Technique development for EW Receiver Application
2. **Individual Sponsor:**
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3. **Academic Area/Field and Education Level:** Electrical Engineering and Computer Science / Signal Processing (MS or Ph.D. level)
4. **Objectives:** Explore the feasibility of the compressive sensing (CS) technique for electronic warfare (EW) Receiver applications. Primary focus is on the realization of the random-modulated pre-integrator (RMPI) CS technique. Identify and resolve the implementation issues to achieve real-time or near real-time EW receiver operation.
5. **Description:** The proposed project will enable the realization of the CS technique for EW receiver applications. Due to the sparse nature of a signal of interest (SOI) over a wide instantaneous bandwidth, CS techniques can process wideband data with an order of magnitude less samples compared to traditional Nyquist sampling. The advantage of CS thus includes low data rate and large effective number of bits (ENOB). Various algorithms have been developed to restore the signal at the Nyquist rate samples with the CS data sets. However, the algorithm often involves large matrix operations and sequential iterations to reach an asymptotic solution. The disadvantage of CS is thus the heavy computation load. Alternative parameter estimation algorithms that do not require full reconstruction have also been proposed, but still require more processing than operating directly on Nyquist sample data. With technology advancement of computational hardware, including high performance FPGAs and GPUs, the realization of CS for EW applications needs to be assessed. To conduct this research, the performer needs to have a background in signal processing and the understanding of basic CS theory with random modulated signals and its full wave restoration and parameter estimation algorithms. The research is thus to identify and resolve the issues involved in the hardware implementation, and eventually achieve a CS-based EW receiver operation. The performance of a CS-based EW receiver is evaluated in two ways: 1) via a theoretical analysis of the expected performance with emphasis on sensitivity and multiple signal dynamic range, and 2) via hardware design verification that compares the performance of CS-based EW receiver against the theoretical analysis.
6. **Research Classification/Restrictions:** This research is FOUO and has ITAR restrictions.
7. **Eligible Research Institutions:** Place an X in all that apply.

Universities (DAGSI)

AFIT (only)

USAFA

8. **Interest in Summer USAFA Cadet (Avg Cost for USAF Cadet for 33 days was \$5000):**
NO