FY23 DAGSI Research Topic

1. Research Title: Optimal Signal Design for Joint Radar and Communication System

2. **Individual Sponsor:**

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3. Academic Area/Field and Education Level

Electrical Engineering (MS or PhD level)

4. Objectives:

This project will focus on the following objectives: (i) Develop a robust scheme of radar scatter-based communication to be implemented simultaneously and jointly with radar sensing. (ii) Optimize the resultant waveforms with respect to their radar performance. (iii) Implement and test the solution via mathematical modeling.

5. Description:

Research investigations in radar-communication (radarcom) signal and system co-design are currently motivated by the three goals: (a) Achieving reductions in SWaP (size/weight/power) characteristics of on-board RF devices; (b) Enhancing the potential for spectrum sharing among multiple platforms and functionalities; and (c) Improving the security of data communications in congested/adverse environments. Existing approaches for radarcom are subdivided into two broad categories: a). Radar-Communication Coexistence, and b). Dual-Functional Radar-Communication system design. Although the above-mentioned solutions do enable combinations of sensing and communications in some scenarios, there is still need for a more robust and universal approach. RF tag-based communications via radar beam utilization require tag pre-placement in the area, which may not be feasible in many applications. Also, the tag-based solutions only make one-way communications possible, whereas a goal of two-way communications is more desirable. Another challenge in radar-communication co-design is that the requirements to radar and communication signals may not always be the same, and in some cases, they can even be conflicting. Hence it is required to select a modulation scheme which will allow the desirable performance of both functionalities. A coding method of orthogonal frequency division multiplexing (OFDM) is a viable candidate due to its excellent spectral efficiency and flexibility, as well as the relative ease of generation and processing. The flexibility with which OFDM sub-carrier coefficients can be selected affords adjustments of the resultant signal's characteristics.

6. Research Classification/Restrictions: Unclassified

7. Eligible Research Institutions: DAGSI approved universities and institutions

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