Multichannel Sense-and-Avoid Radar for Small UAVs

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Purpose

The purpose of this effort is to develop and demonstrate a multichannel radar to provide small unmanned aerial vehicles (UAVs) with situation-awareness regarding the relative position and velocities of nearby objects (both mobile and fixed) that may pose a collision risk. Phase I objectives include development, testing, and flight evaluation of a proof-of-concept multichannel radar brassboard on a Cessna-172 aircraft (owned and operated by the Kansas University Aerospace Engineering department) for performance evaluation.

Background

Unmanned aircraft systems (UAS) may enable many valuable future commercial and industrial services; however their lack of situation awareness poses unacceptable societal hazards such as airborne collisions with mobile and fixed structures. Although air traffic may rely on established transponder-based collision-avoidance systems, UAS avoidance of non-cooperative objects (e.g., balloons, parachutists, towers, etc.) will require supplemental sensors.
A multichannel frequency-modulated, continuous-wave (FMCW) radar will be used to detect nearby objects and determine their positions relative to the UAV. Accurate real-time range, azimuth and elevation bearing, as well as radial velocity estimates will be derived for detected objects via digital signal processing. The proposed airborne radar represents a technology “building block” for assessing the capabilities and limitations of this class of sense-and-avoid radar across a range of airspace environments, a critical step for integration of UAS into the National Airspace System (NAS).