We propose to develop a multichannel radar to provide small unmanned aerial vehicles (UAVs) with knowledge regarding the relative position and velocities of nearby objects (both mobile and fixed) that may pose a collision risk. With this knowledge, the UAV's on-board flight director may alter course to avoid collisions and thus reduce its potential hazards to society. By increasing the safety of autonomous UAV operations, various commercial and industrial flight services may become economically viable.

A low-power, lightweight, frequency-modulated, continuous-wave (FMCW) radar will be developed and flight tested to assess performance. To validate the concept under Phase I of the NASA LEARN program, a proof-of-concept radar (not miniaturized) will be evaluated onboard a manned Cessna aircraft using a small UAV (its ground-based pilot coordinating maneuvers with the Cessna pilot) to emulate an airborne obstacle. The radar will incorporate recently-released, programmable, radar-ready integrated circuits from Analog Devices (developed in support of the automotive collision-avoidance market) so that later (under Phase II) the radar can be significantly miniaturized and fully automated to fly aboard a 50-lb. UAV.

The radar will detect targets with radar cross sections as small as one square meter (characteristic of a parachuting human or a small aircraft) at ranges up to 1 nautical mile. Accurate real-time range and radial velocity estimates will be derived for detected objects via digital signal processing. An array of low-gain receive antennas will enable determination of the object's azimuth and elevation position relative to the UAV by comparing the signals received phases (i.e., no antenna scanning required).

The successful completion this radar development will offer several benefits to the UAV community. 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 UAVs into the National Airspace System (NAS). The NextGen concept of airspace operations (to be operational in the 2025 time frame) will involve self-separation concepts for manned and unmanned aircraft that the proposed radar could support, both for inter-aircraft and aircraft-terrain spacings. When integrated with a flight