Airborne Phased Array Radar (APAR): The Next Generation of Airborne Polarimetric Doppler Weather Radar

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This paper presents a configuration of a novel, airborne phased array radar motivated by major advances in cellular technology, component miniaturization, and radar antenna simulation software. This has paved the way for a next-generation radar being designed by NCAR/EOL to be installed on the NSF/NCAR C-130 aircraft. The APAR system will consist of four removable C-band active electronically scanned arrays (AESA) strategically placed on the fuselage of the aircraft. Each AESA measures approximately 1.5 x 1.5 m and is composed of 2368 active radiating elements arranged in a total of 37 line replaceable units (LRU). Each LRU is composed of 64 radiating elements that are the building block of the APAR system.

Polarimetric measurements are not available from current airborne tail Doppler radars. However, APAR, with dual-Doppler and dual polarization diversity at a lesser attenuating C-band wavelength, will further advance the understanding of the microphysical processes within a variety of precipitation systems. Such unprecedented observations, in conjunction with the advanced radar data assimilation schema, will be able to address the key science questions to improve understanding and predictability of significant weather.

The development now underway is expected to take ~5 years. It adopts a phased approach as an active risk assessment and mitigation strategy. At the present time, both the National Science Foundation and the National Oceanic and Atmospheric Administration are funding the APAR project for risk reduction activities. The APAR Team is actively seeking partners in industry and in the university community. An APAR science and engineering advisory panel has been organized.

The authors will review the overall design and current progress of APAR and outline ambitious future development work needed to bring this exceptional tool into full operation.

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