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The Next Generation of Airborne Polarimetric Doppler Weather Radar: NCAR/EOL Airborne Phased Array Radar (APAR) Development

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The National Center for Atmospheric Research (NCAR) Earth observing Laboratory (EOL) is entering the third year of preliminary system design studies, engineering prototype testing and project management plan preparation for the development of a novel Airborne Phased Array Radar (APAR). This system being designed by NCAR/EOL will be installed and operated 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 1.9 m and is composed of ∼3000 active radiating elements arranged in an array of line replaceable units (LRU) to simplify maintenance. APAR will provide unprecedented observations, and 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 and high-impact weather

APAR, operating at C-band, allows the measurement of 3-D kinematics of the more intense portions of storms (e.g. thunderstorm dynamics and tornadic development, tropical cyclone rainband structure and evolution) with less attenuation compared with current airborne Doppler radar systems. 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. The radar is sensitive enough to provide high resolution measurements of winter storm dynamics and microphysics.

The planned APAR development that would bring the system to operational readiness for research community use aboard the C-130 is expected to take ∼8 years once major funding support is realized. The authors will review the overall APAR design and provide new details of the system based on our Technical Requirements Document, airflow studies and antenna aperture simulations We will further outline the next steps needed to bring this exceptional tool into full operation.