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Overview of the Airborne Phased Array Radar Observing Simulator

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The proposed airborne phased array radar (APAR) system consists of four removable, dual-polarized, C-band AESAs (Active Electronic Scanning Array) strategically located on the fuselage of the NSF/NCAR C-130. Conceptually, the radar system is divided into the front-end, the backend, and aircraft-specific section with the front-end primarily consisting of AESAs and the signal processor is in the backend. The aircraft specific section includes a power system and a GPS antenna.

As part of the risk reduction of the APAR development, the APAR Observing Simulator (AOS) system has been developed to provide simulated APAR data collection sampled from a C-130 flying by/through realistic numerical weather simulations of high-impact weather events. Given that APAR is designed to extend beyond capabilities of the existing airborne tail Doppler radars (e.g., NOAA TDRs and the retired NSF/NCAR ELDORA), a verification of signal processing software and algorithms is needed before the radar is physically built to ensure that the signal processing software infrastructure can handle high data rates and complicated, multiplex scanning that will be part of normal APAR operations. Furthermore, several algorithms that will need to ingest large amounts of APAR data at very high rates are under development, including dual-Doppler wind synthesis, radar reflectivity attenuation correction, rain rate estimation, and hydrometeor classification. These algorithms need to be tested and verified before the implementation.

The AOS will also serve as a planning tool for future Principal Investigators (PIs) who will use it to design and test different flight and scanning strategies based on simulated storms to yield the best scientific outcomes before their field deployment takes place. This will enable better understanding of trade-offs among various sampling regimes/strategies during the planning and enhance future field programs' efficiency and effectiveness.