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A Summary of Recent Activities on the Airborne Phased-Array Radar (APAR) Development

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The NCAR Earth Observing Laboratory (EOL) is currently developing a novel Airborne Phased Array Radar (APAR) to be 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 is composed of approximately 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 advanced radar data assimilation schemes and high-resolution numerical modeling, will be able to address the key science questions needed to improve understanding and predictability high-impact weather events.
Over the past year NCAR/EOL has received funding from the National Oceanic and Atmospheric Administration (NOAA) Office of Weather and Air Quality to conduct critical development activities that will further advance the APAR design and reduce overall risk to the APAR development. First, two APAR Trade Studies were conducted with industry partners to examine the technical specifications versus cost tradeoffs in building the AESAs. The results of these Trade Studies are being integrated into the technical specifications and design of the APAR system.

Second, EOL completed build out of an 8X8 LRU prototype and conducted characterization and initial calibration of the LRU. Additionally, a fully functioning radar back end to control the LRU has been developed and is currently being tested. The LRU will allow for the development of a preliminary set of waveforms, development of APAR software architecture, allow for verification of beam forming as well as other radar control functions and improve the overall APAR design.

Third, EOL conducted ground and flight vibration testing of the NSF/NCAR C-130. These tests documented the inherent modal characteristics of the platform as well as the vibration of the NSF/NCAR C-130 while in flight. The ground test data was included in a modeling and simulation effort that will provide critical insight into how the NSF/NCAR C-130 modal frequencies will impact APAR performance. The results of these tests will be integrated into the APAR design and technical requirements.

Finally, the APAR Team has developed an APAR Observing Simulator Prototype (AOS). The AOS consists of three high resolution Weather Research and Forecasting model simulations of high impact weather events that APAR will observe. The NSF/NCAR C-130 (with APAR) was then “flown through” the simulations to produce synthetic radar output. The results of the AOS will allow the APAR Team to develop optimal flight patterns and scan strategies for APAR. Finally, these results can be used to examine the forecast improvement of assimilating APAR data into numerical weather prediction models.

The current talk will provide updated results from each of the aforementioned activities and describe their impact on the overall APAR development. Finally, a description of the next steps in the APAR development will be presented.