# Mobile Doppler Radar: A new tool to investigate tornadic storms

*by Erik Rasmussen, VORTEX Director and Field Coordinator*

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After the end of the first Verifications of the Origins of Rotation in Tornadoes EXperiment (VORTEX) in June of last year, Jerry Straka (University of Oklahoma School of Meteorology; VORTEX assistant director) and I discussed our successes and failures, and whether or not we were collecting the kind of data required to really understand important events in severe storms. It was obvious that the mobile mesonet system, a group of cars instrumented with high-quality weather observing equipment, could give us new insights into the pressure, temperature, and humidity fields near the ground. These fields give rise to the forces that cause air to accelerate and rotate, and knowledge of them would be an important new element in our understanding. However, we also realized that many of the hypotheses of the VORTEX experiment required a detailed view of the three-dimensional airflow in small regions of the target storms. It is quite possible that a lot of the events in the life cycle of a supercell storm may be caused by forces above the ground where we are nearly incapable of measuring temperature, pressure, and humidity directly, except along very isolated trajectories where our rawinsondes, borne by weather balloons, have risen. At the very least, we needed high-resolution observations of the airflow near and above the ground: if one can document the evolution of this airflow in three dimensions, the approximate forces causing the airflow to change can be deduced.

After VORTEX-94, it was apparent that we faced a serious problem that could prevent us from adequately evaluating any of our tornadogenesis hypotheses. We simply were not able to sufficiently resolve and document the motion of the air within the small region of the storm that potentially can give rise to a tornado: the mesocyclone. It was unlikely that a WSR-88D would ever be near enough to one of our target mesocyclones to provide the data we needed. Even the airborne research Doppler radars (on the NOAA P-3 and NCAR Electra) were only providing data every 300 meters or so and failed to resolve the vitally-important variations in wind immediately adjacent to the ground. Data from these aircraft will provide important new knowledge about the structure and evolution of airflow features that range in size from the mesocyclone up to the entire storm. But we needed information about wind variation in features ranging in size from tornadoes up to mesocyclones (100 m up to about 10,000 m).


It was this problem that motivated us to develop a research Doppler radar that was fully mobile. We envisioned a system that could be driven right up to the storm or mesocyclone, parked, and obtain volume scans of high-resolution Doppler velocity data.

Joshua Wurman had spent several years at NCAR developing innovative Doppler radar technology. In the fall of 1994 he joined the faculty at the OU School of Meteorology as an Assistant Professor. Teaming with him, we laid the groundwork for the development of the "Doppler-On-Wheels." With the support of NSSL, a significant amount of development funds were provided to VORTEX. This funding paved the way for the collaborative