Project and Instrument Description

As part of the National Science Foundation sponsored project entitled: "Dual Frequency Doppler Observations of Tornadoes", NSF Award: ATM-0000592 to the Univ. of Massachusetts (UMass), 6/01/00 – 5/31/03, UMass developed a mobile X (9410 MHz) radar system. The radar will be used jointly by the University of Massachusetts (UMass) Microwave Remote Sensing Laboratory (MIRSL) and the University of Oklahoma (OU) School of Meteorology (OU NSF Award: ATM-9912097, Howard Bluestein PI) to study the genesis, structure, and decay of tornados. The specific objectives of the current work are to study the formation and fine-scale structure of tornadoes and their parent storms using this X-band radar in combination with a W-band (95.04 GHz, 3-mm wavelength) radar imaging system.

Development this new 3-cm (X-band) radar system was completed in time for the 2001 tornado season. A photo of the new Xpol radar (X-band Polarimeter) is shown in Figure 1 along with UMass graduate student Vidhya Thyagarajan who designed and developed the radar control and data acquisition system.

Figure 1. The UMass X-pol radar system with graduate student Vidhya Thyagarajan - the designer and programmer of the radar control and data acquisition system. The new radar will provide real time, long-range (60km +) images of storm structure to assist navigation during tornado chases.

The UMass X-band mobile radar system consists of a 25 kW MP2 transceiver developed by Raytheon and a dry-air waveguide pressurizer (both mounted in the white box between the antenna positioner and truck cab), a 6' diameter dual-polarized antenna mounted on a refurbished US Army MP61 pedestal, a positioner controller system – developed by UMass undergraduate students, and a PC based data acquisition system containing an FPGA (Field Programmable Gate Array) digital I/O and processor card and a dual-channel high speed A/D and data buffer interface. This coherent radar system is designed to measure Doppler velocities and with the use of a dual-polarized antenna, two-channel waveguide rotary joint and two-channel high-speed data acquisition system will enable this radar to measure polarimetric quantities such as differential phase shift, *Kdp*, and differential reflectivity, *Zdr*, once suitable modifications are made to the RF-electronics section of the radar next year. The X-band radar planned to be deployed in a single-channel, non-Doppler mode during the spring 2001 tornado season to test the system and gather initial measurements of reflectivity to complement the polarimetric W-band imagery. The system now has long-range measurement capability and the ability to map the structure of parent storms in real-time