

MWR-05XP RAPID SCANNING X-BAND RADAR



MWR-05XP

- CIRPAS in collaboration with ProSensing Inc. have modified a phased array X-band tactical radar system to add a weather surveillance mode.

Parameter	Value
Transmitted frequency	X-Band (9.37 GHz to 9.99 GHz)
Transmit power	23 kW
PRF	10 kHz (max)
Transmitted pulse width	1 μ s
Antenna type	Mechanically rotated electronically scanned phased array
Azimuth BW	1.8°
Mechanical Azimuth Scan	360°, 30 RPM
Electronic Azimuth Back-Scanning	6° to 8°, depending on elevation angle
Elevation BW	2.0°
Elevation Scan	-18° to 55° relative to the horizon
Range Resolution	150 m



MWR-05XP installation on flatbed truck

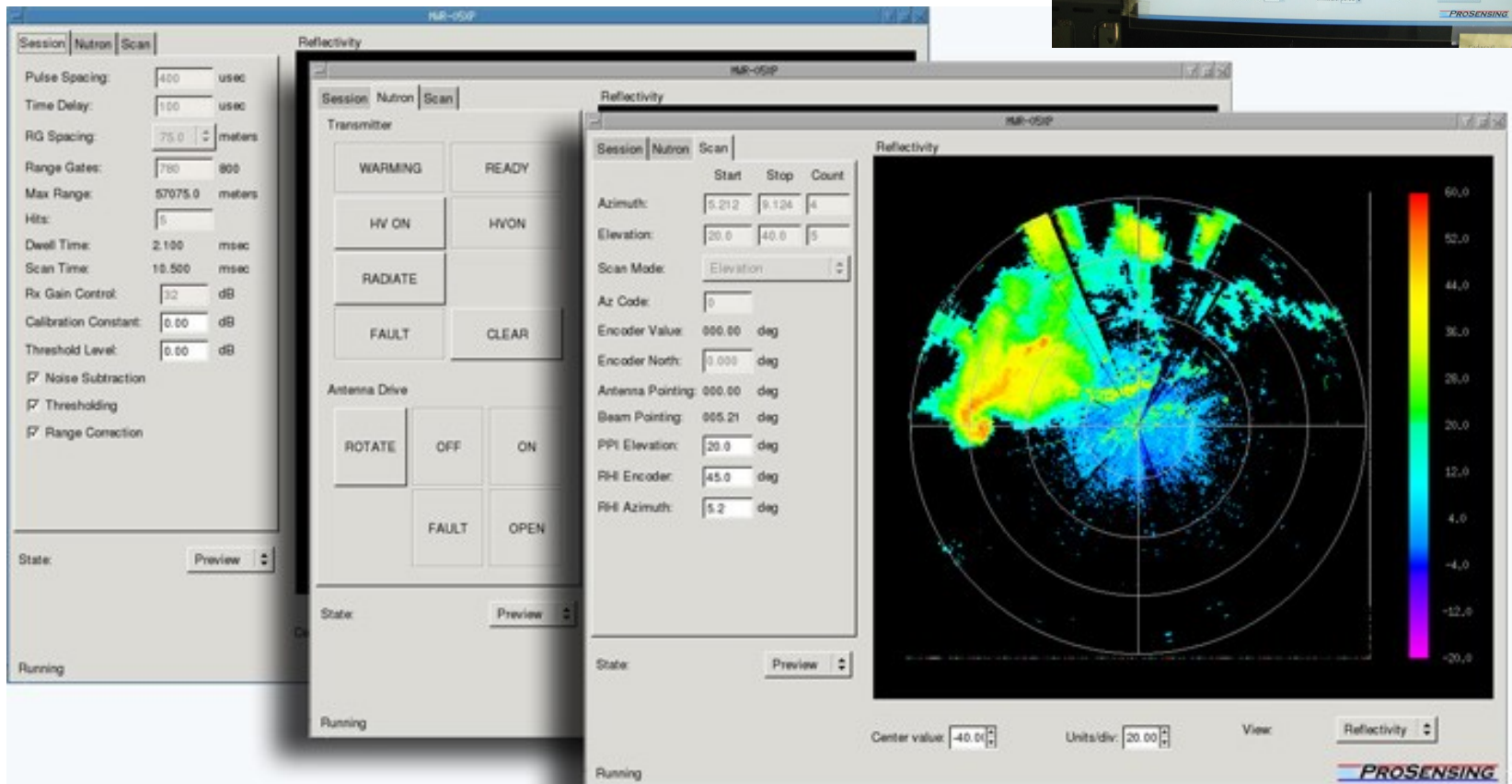
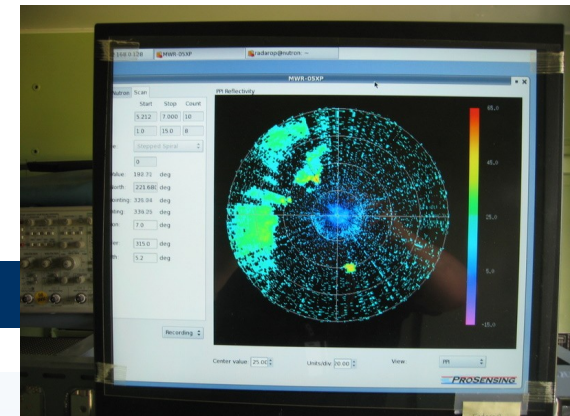
Rapid scanning

- **MWR-05XP** (Mobile Weather Radar, 2005 X-band, Phased Array)
- First mobile electronically scanned phased array weather radar.
- Pulse-to-pulse electronic scanning:
 - Elevation scan: -18° to $+55^{\circ}$
 - Azimuth back scan: 0 to 8°



MWR-05XP can sample a volume:
 0° to 360° in azimuth and
 0° to 20° in elevation
within **20 seconds**
with 0 dBz minimum detectable
reflectivity

Radar Control GUI Software



Real Time PPI and RHI Display of Calibrated Reflectivity and Velocity

Scan Type: STEPPED SPIRAL

PPI Elevation: 3.0 deg

RHI Encoder: 50.0 deg

Encoder Range: 0.01 to 360.00

☒ Noise Subtraction

☒ Thresholding

☒ Range Correction

Threshold Level: 6.0 dB

dBZ Factor: 10.0 dB

Timestamp: Wed May 23 02:01:41 2007

Latitude: 35.68

Longitude: 100.94

PROSENSING

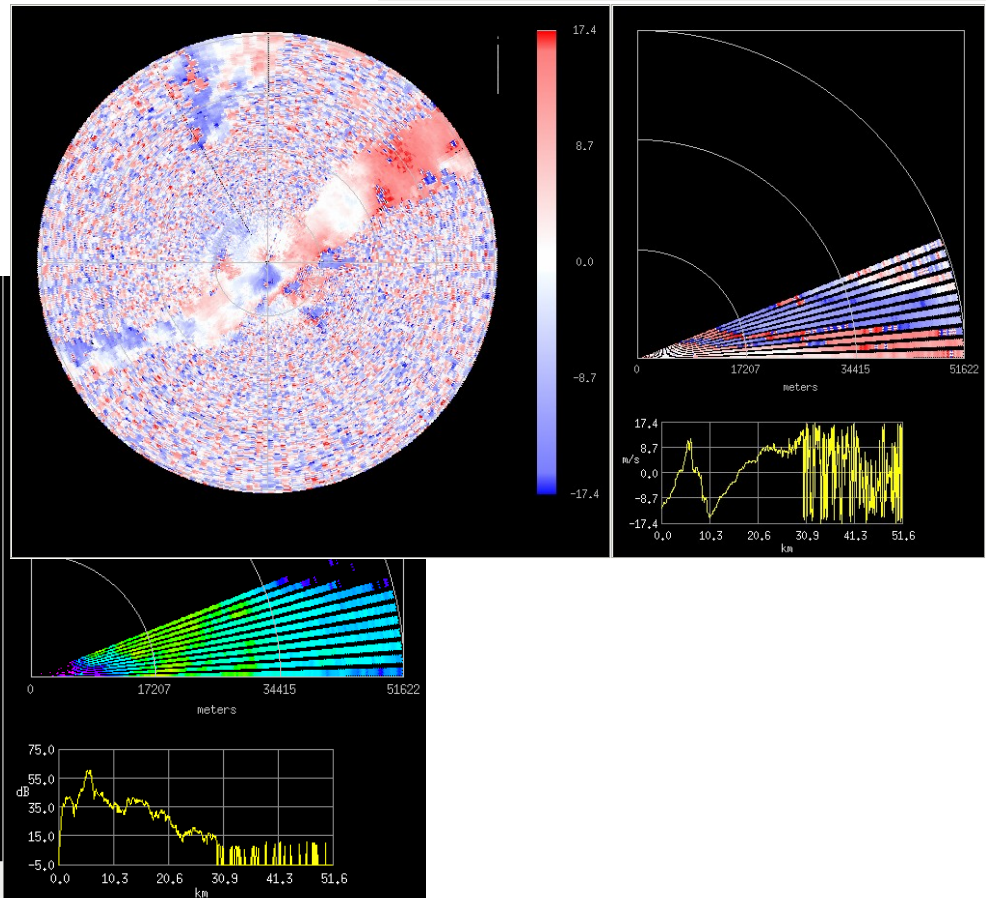
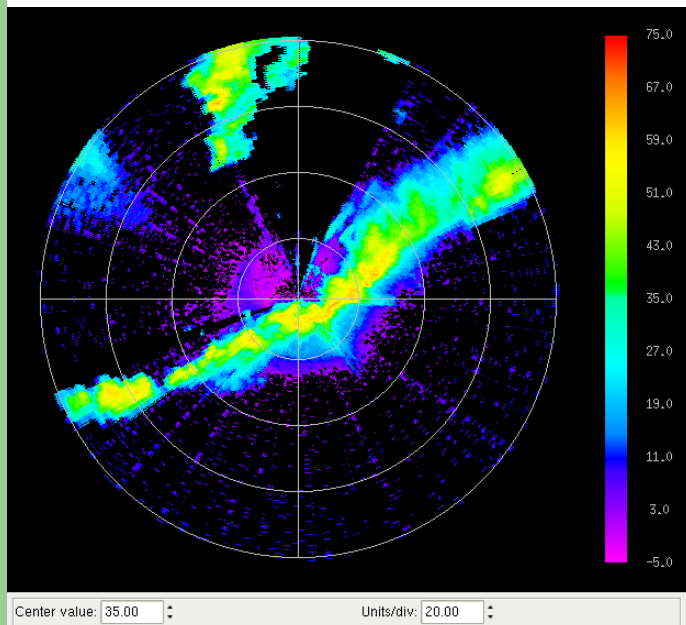
Block: 10105 of 26167

Mode: Still

Skip: 1

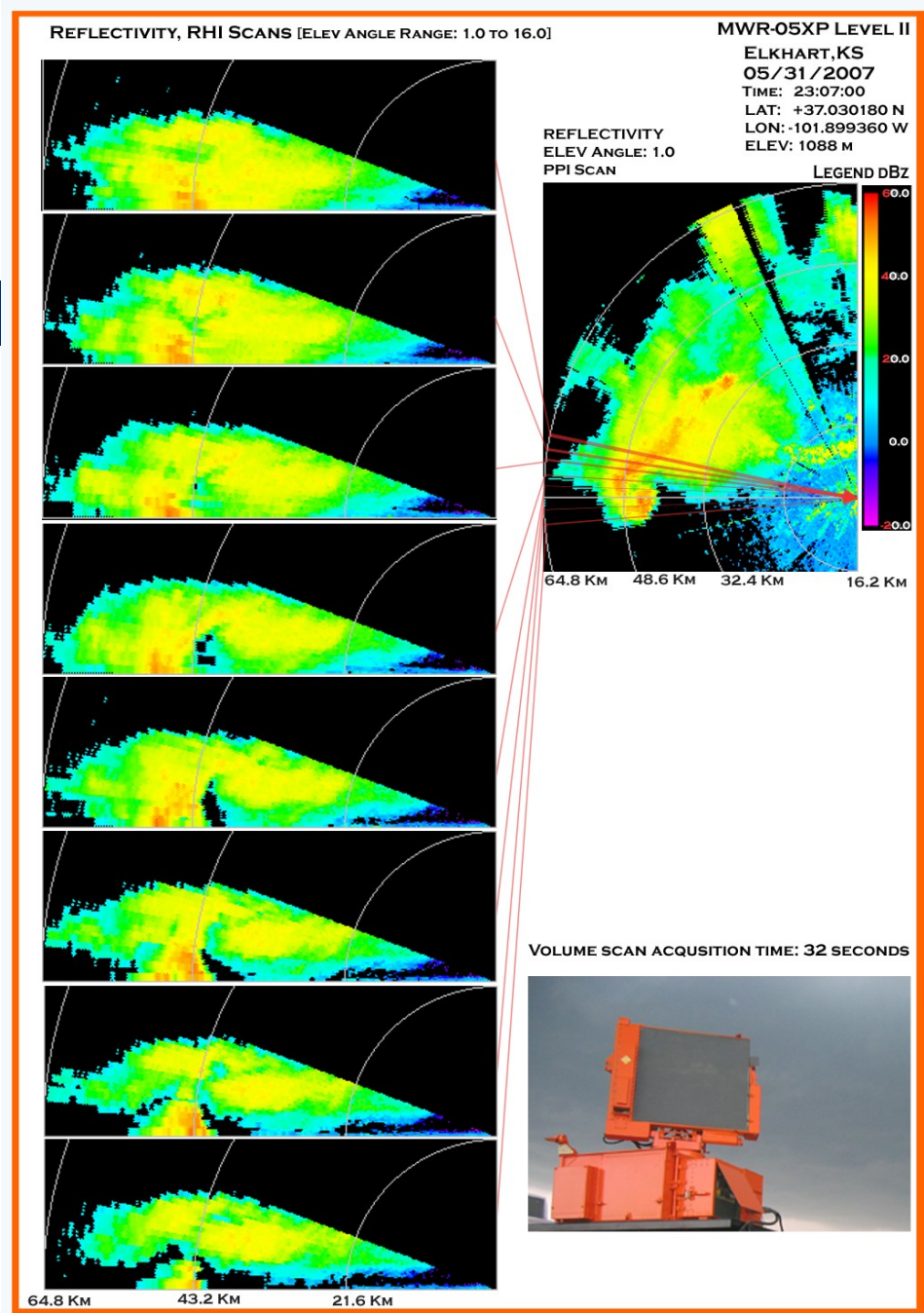
Delay: 1 ms

/arch/MWR-05XP/Y2007/SevereStormData/MWR-05XP-data-2007-05-23-020000-01



Visualization of Rapid Scanning Data

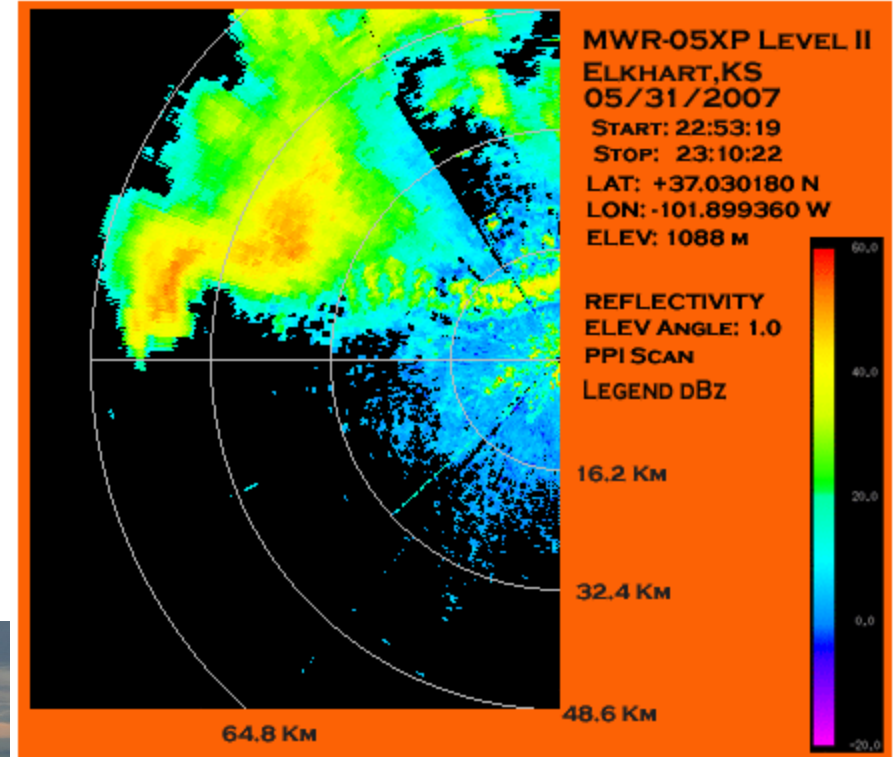
- Rapid volume imaging highlights features that are difficult to detect with conventional weather radar
 - Data gathered in a pre-tornadic mesocyclone shows an upper layer “mantle” structure in the region of the hook echo



2007 Severe Storm Campaign in Southern Great Plains



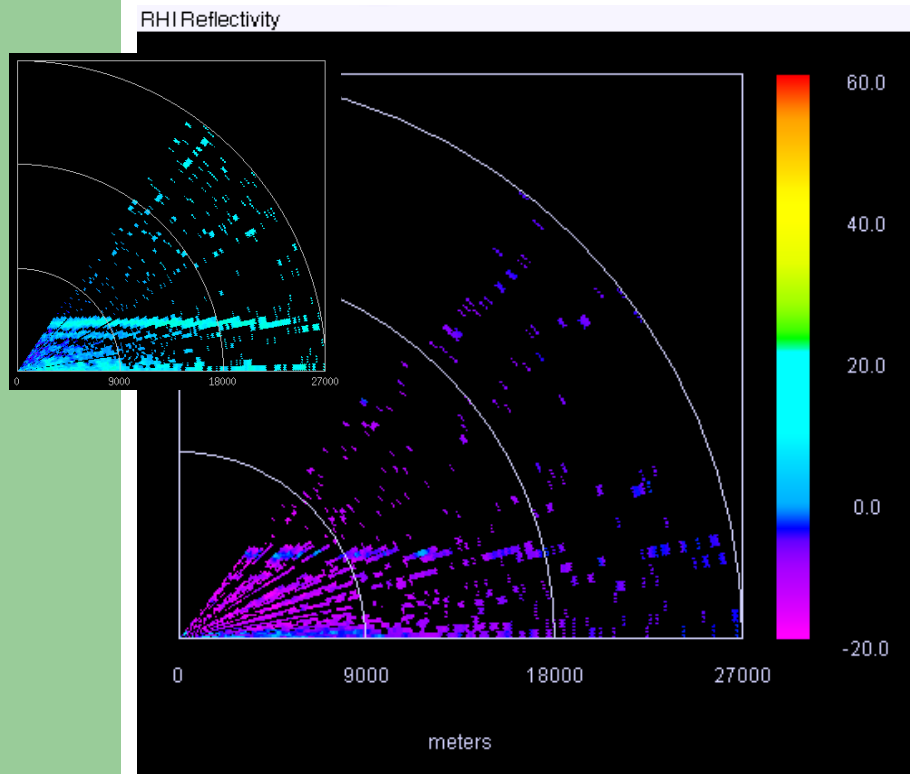
- MWR-05XP was deployed on eleven separate occasions during the 2007 tornado season
 - Two preparatory deployments for testing and calibration
 - nine deployments in severe storm conditions
- Areas covered during the tornado chasing campaign:
 - Northeastern Texas
 - Oklahoma
 - West Kansas
 - Nebraska



PROSENSING



CLASIC 2007



- MWR-05XP located at the ARM program Southern Great Plains site near Ponca City, OK
- Data collection with continuous operation of 8 hours per day for 17 consecutive days
 - Last week of the CLASIC experiment hampered by heavy rain [ARM SGP site evacuated]
- During CLASIC MWR-05XP configured to maximize its sensitivity
 - MWR-05XP imaged drizzle and fog had a lowest value of -10 dBZ
 - Data confirmed by ARM's W-Band cloud radar

Future work - Improvements

- Stepper motor integration
 - Features: sector scanning and variable rotation speed
- Clutter removal filters
 - eliminates signals due to ground targets
- Replacement of narrowband IF filter
 - Improves range resolution from 400 m to 75 m for distributed target (clouds)
- Calibration
 - Absolute calibration with in-scene reflectors
 - sphere tethered on a balloon
 - Active calibration target
 - Rotating reflector
 - Cross-calibration with a NEXRAD radar

