



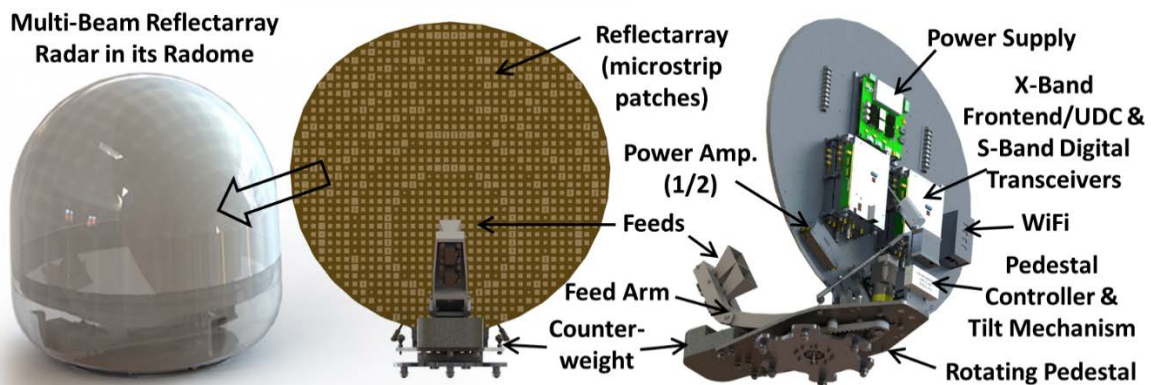
Reflectarray-Based Weather Radar

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Project Narrative

The OU Advanced Radar Research Center (ARRC) wishes to perform intermittent field testing of a multi-beam X-band reflectarray antenna and transceiver that will cut costs in next-generation low-cost weather radar by providing a simple, effective means to achieve multiple simultaneous EL angle observations. This reduces the radar volume scan timeline while striking the balance between hardware component counts/weight and performance. Additionally, a low-cost, open, scalable, and accessible radar platform would provide a solution for many applications. The prototype system design vision is shown below.



Notional System Specifications

System	
Deployment	Transportable, one-man deployment set up
Operating Frequency	9410 - 9450 MHz
Pulse Width	1 to 100 us (15 us nominal)
Range Resolution	Down to 30 m with pulse compression for each channel
Pulse Repetition Frequency	100 to 2000 Hz
Maximum Velocity	15 m/s without velocity unfolding (high PRF)
Sensitivity	Better than 30 dBZ @ 30 km (can detect light rain)
Data Output	Z, V, W

Antenna / Pedestal	
Antenna Type	0.6-m microstrip patch reflectarray, with two feeds, two mechanical EL tilt positions
Polarization	Horizontal

Gain	32 dBi (lower, at 0.5° or 3.0° when tilted), 31 dBi (upper, at 6.5° or 9.0° when tilted)
3-dB Beamwidth	3.9° nominal (lower), 4.2° nominal (upper)
Return Loss	1.5:1
RF Input	2 x SMA
Scanning Speed	Up to 12 RPM (72°s^{-1}), volume coverage at ~6 RPM (every 10-12 seconds)

RF Transmitter	
Type	Solid State
Peak Power (Per Polarization)	150 W
Duty Cycle	Up to 10%

RF Transceiver	
Type	Up/downconversion from X to S band; digital transceiver from S band to I/Q
Minimum Discernible Signal	-101 dBm

Digital Transceiver / Signal Processor	
Baseband Receive Output	12-bit ADC with digital down conversion (15 Msps out; two sub-bands)
Baseband Transmit Input	12-bit DAC with digital up conversion (15 Msps in; two sub-bands)
Maximum Number of Range Gates	1024 (@ 30m resolution)
Minimum Processed Gate Spacing	10m