What we want:

Targetable, Affordable, Long-Wavelength, Fine-Scale, Fast, Dual-Polarization, Vector-Winds

What we have:

S-Band on Wheels

1996 Research S-Band Proof

One big super high-capacity radar

Extremely valuable tool for ~25 years

Expensive to deploy < $1M

Expensive to maintain < $500/yr

Single point of failure

Long set-up time (so not so targetable)

S-Band on Wheels Network SOW

Size Matters for Adaptability and Cost

1.5-degree S-band antenna

5.5 m in antenna

6 dual-polar, dual-frequency radars in a S-band multiple-Doppler network

More Failure-Tolerant Network

1. COW failure, rest of network is still up and providing dual-Doppler over broad areas

2. SOW failure

3. SOW failure

4. SOW failure

5. 1-day set up and tear down time, each

6. Some or better scientific capability in nearby deployments

Even if 2 fail, there’s still coverage

More Size Matters

Set up similar to COW

1 Day Each

Bistatic Adaptable Radar Network (BARN)

Using DOW / COW / SOW network

Most of what used to be “hard” about bistatics is now easy

• Faster computers

• Full time series recording

• 10-20 receiver networks feasible, extremely overdetermined solutions to vector wind field

BARN: Bistatic Array of Radars and Mesonets

Highly redundant BARN units provide extreme reliability of multiple-Doppler operations.

• BARN units will be configured with different SOWS, COW, or DOWs. Only the receiver front ends and antennas are frequency-specific.

• BARN units will be stationary, deployed for the duration of a project, or mobile.

• Stationary BARN units will be unattended, low power, and logistically similar to deployable weather stations.

The key features of BARN are:

• BARN enables multiple-Doppler vector wind measurements over targeted regions.

• While SOWNET is providing moderate-resolution multiple-Doppler measurements, BARN provides finer-scale and/or customized measurements over smaller domains.

• BARN units will be configured with different SOWS, COW, or DOWs. Only the receiver front ends and antennas are frequency-specific.

• BARN units will be stationary, deployed for the duration of a project, or mobile.

• Stationary BARN units will be unattended, low power, and logistically similar to deployable weather stations.

• Highly redundant BARN units provide extreme reliability of multiple-Doppler operations.

• BARN units are < 1/10 the cost of scanning transmitting radars.

• BARN receiving antennas will be designed with different characteristics. These will include previously-used low-gain systems optimized to sample broad areas of precipitation, but unable to observe clear-air non-precipitating regions. Medium-gain systems, perhaps slowly scanning or switching, which can obtain vector wind measurement in the non-precipitating boundary layer will be designed. Different configurations will be optimized for different observational needs.

Schematic of an S-band transmitting bistatic radar transmitter network. Radiation is backscattered towards the transmitting radar (T), and obliquely scattered towards several or more bistatic receivers (R). The vertical receiver is using high-power bistatic receiving antennas focusing with moderate gain at higher and lower elevations, or at different dual-Doppler lobes.

Bistatic receiving antennas can be optimally located and/or pointed to enhance coverage of high-value areas (e.g., airports, focusing topography, lackland or large land boundaries, even, if receivers are mobile, convergence lines, fronts, and other atmospheric boundaries).