What we want:

Targetable

Affordable

Long-Wavelength

Fine-Scale

Fast

Dual-Polarization

Vector-Winds

What we have:

Big Stationary Radars

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

Mobile Radars (X,C,Rapid)

Targetable
Affordable
~~Long-Wavelength~~
Fine-Scale
Fast/Rapid
Dual-Polarization
~~Vector-Winds~~

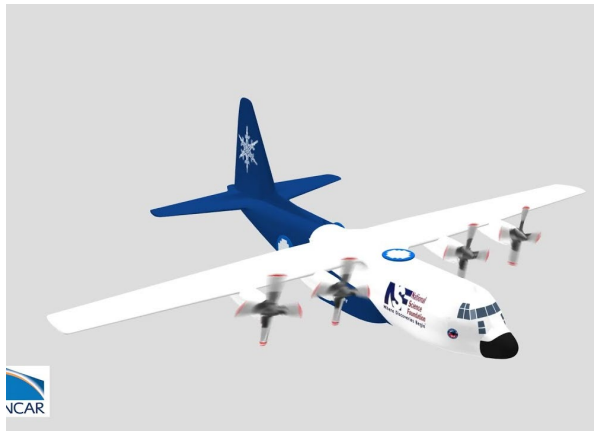



Quickly-Deployable COW

Targetable
Affordable
Medium-Wavelength
Fine-Scale
Fast
Dual-Polarization
~~Vector-Winds~~

APAR (will have)

Targetable
~~Affordable~~
Medium-Wavelength
~~Fine-Scale~~
~~Fast~~
Dual-Polarization
Vector-Winds (slow, pseudo)



To partially address some of these gaps:

We built the COW

It sets up (and tears down) in 2 hours
3 people

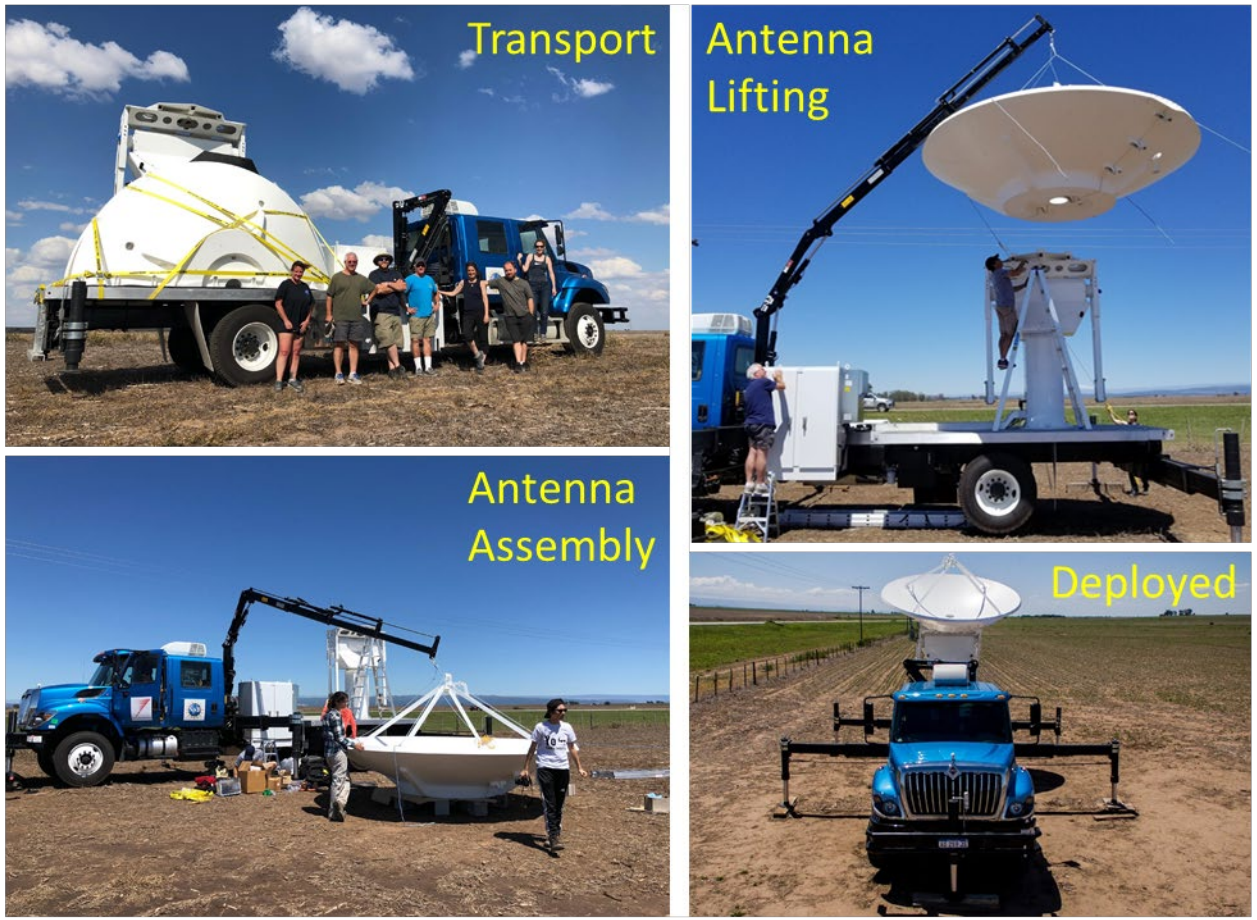


Figure 8. COW assembly. COW as transported, antenna being assembled, antenna lifted onto pedestal, deployed.

COW works great:

1-degree beam
C-band

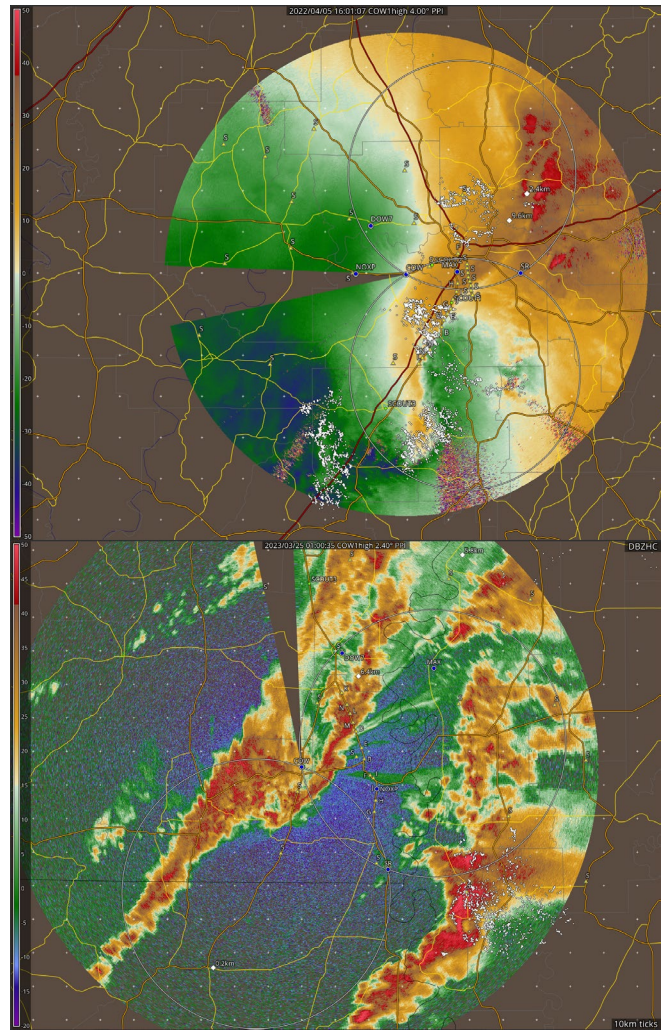
Pretty fast scanning

- **RELAMPAGO (2018)**

---- COVID ----

- **PERILS (2022)**
- **WINTRE-MIX (2023)**
- **PERILS (2023)**
- **CONVECT (proposed 2025)**
- **ICE-CHIP (proposed 2025, 2026)**

PERILS



The Future

S-band On Wheels SOW

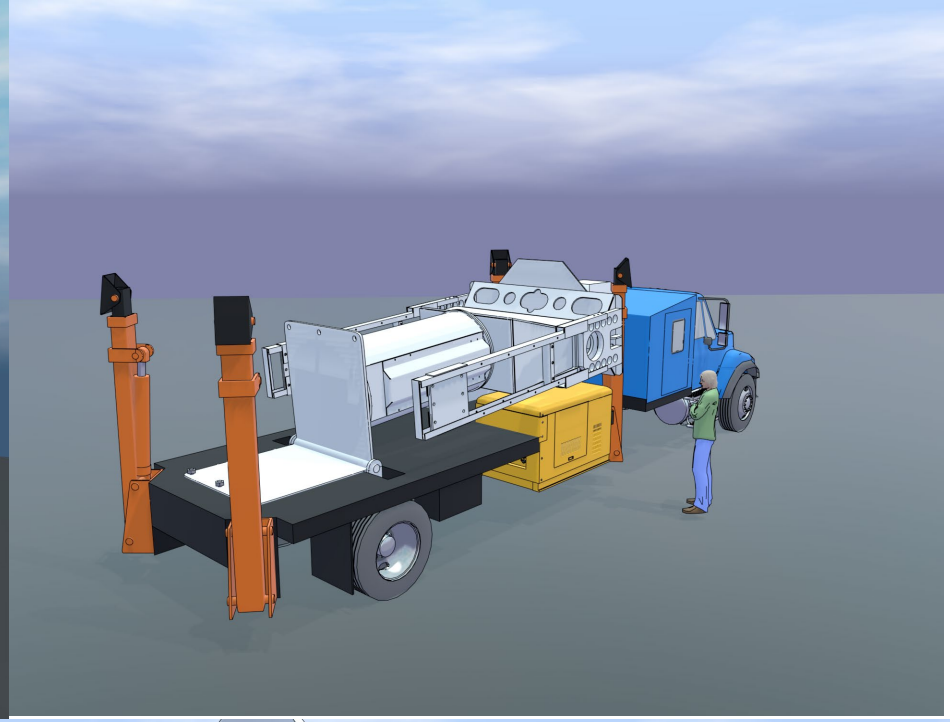
Truck-1 carries antenna
Truck-2 carries pedestal

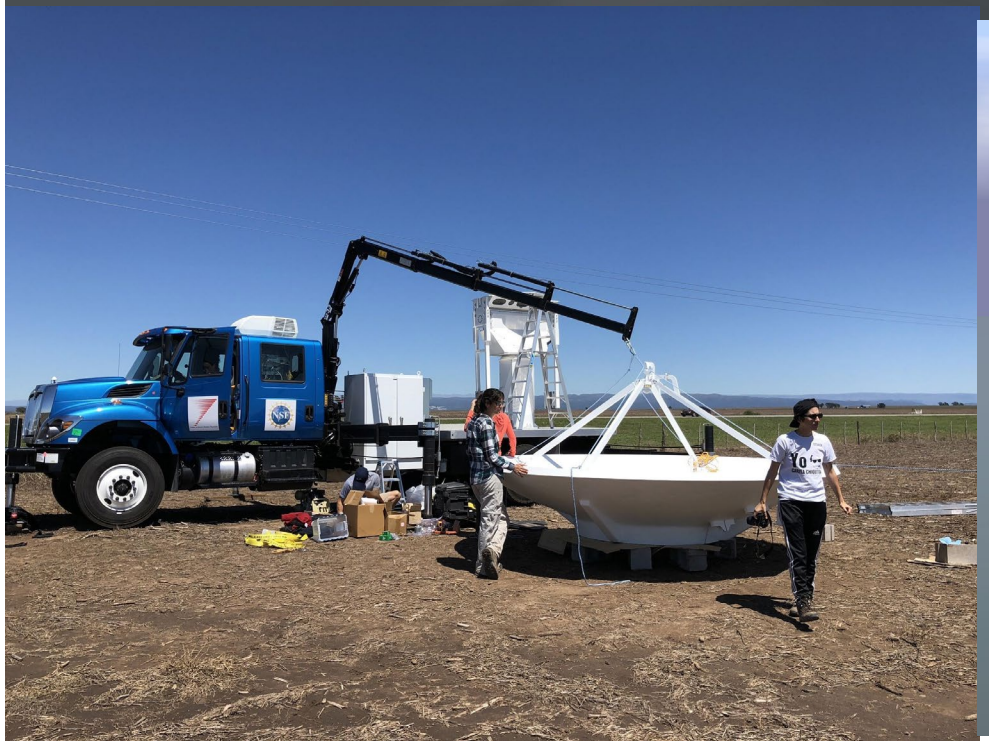
4-6 hours
4 people (1 “skilled”)

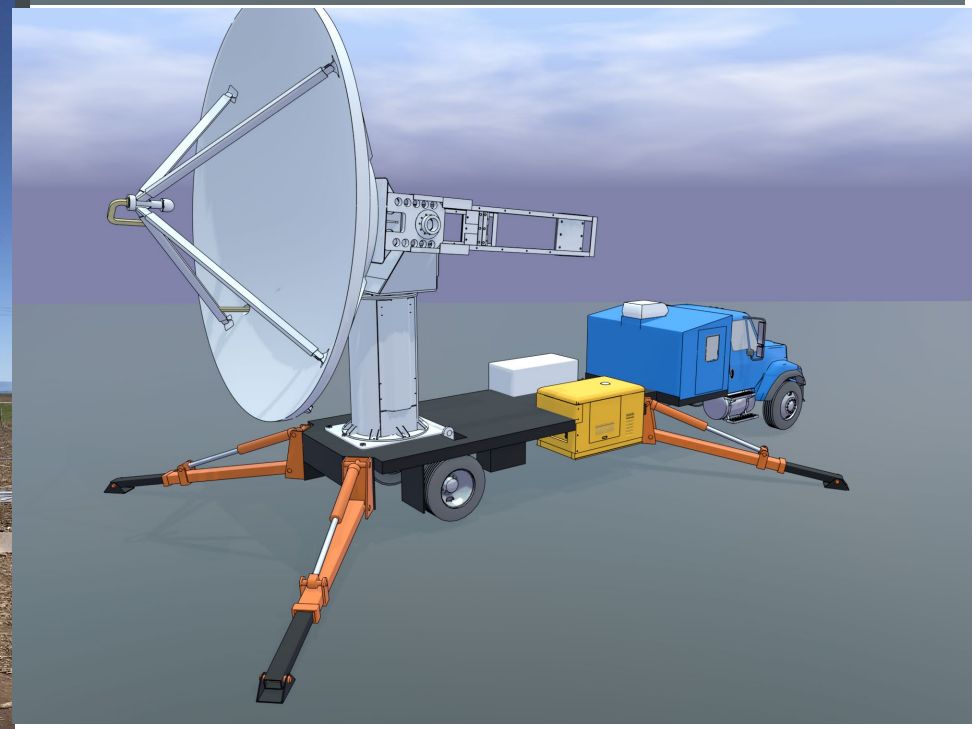
Crew can set up 1 SOW/day

Full SOW-NET setup takes 4 people for 1 week

Zero site prep





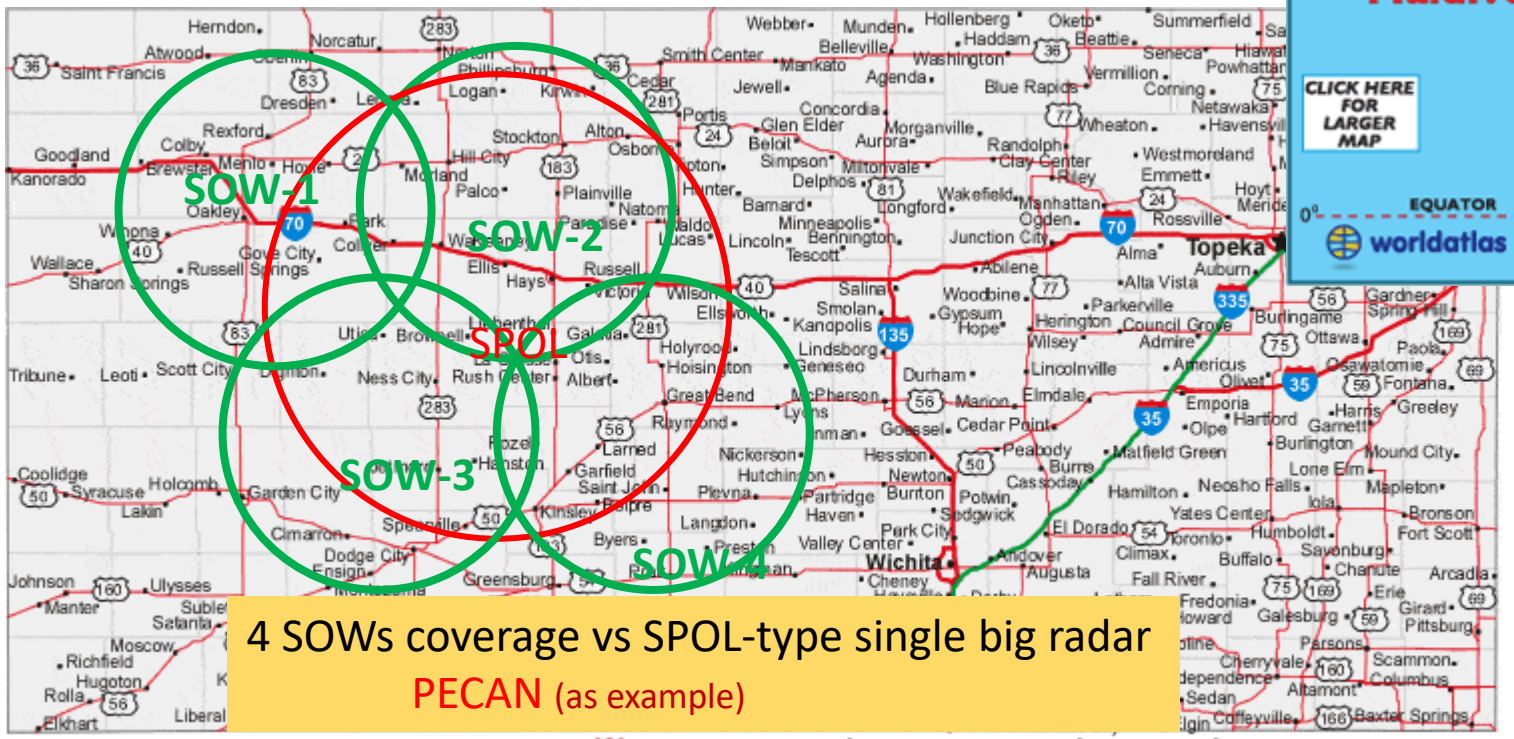


Size/Beamwidth Doesn't Matter -- Resolution at Targets Matters

SOWs *closer* to targets than stationary radar.
Resolution is comparable … or better … throughout domain

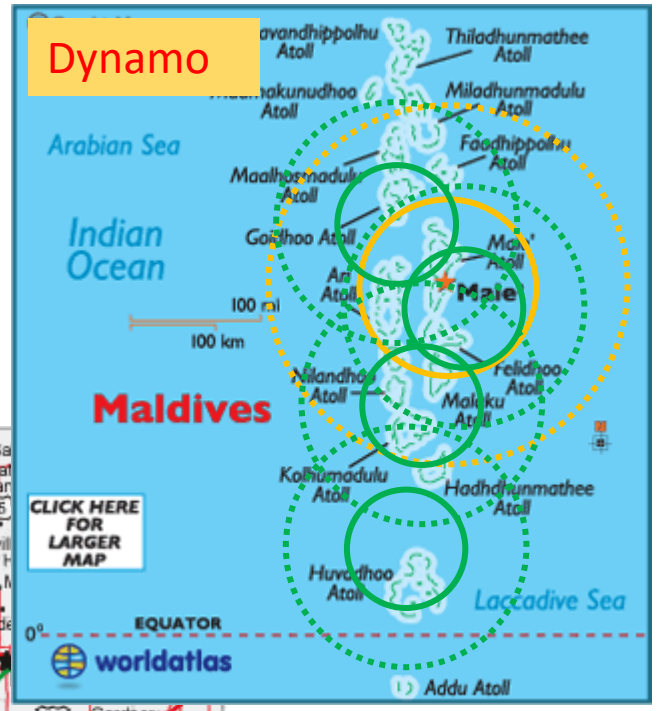
Volumetric resolution 1.5 degrees @ 44 km ~ 1.0 degrees @ 100

Horizontal resolution 1.5 degrees @ 65 km ~ 1.0 degrees @ 100

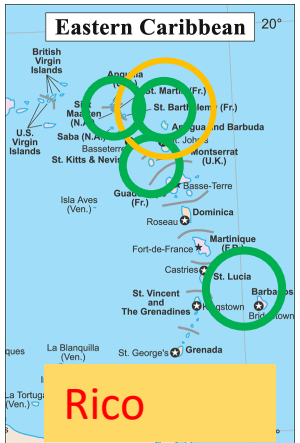


4 SOWs coverage vs SPOL-type single big radar

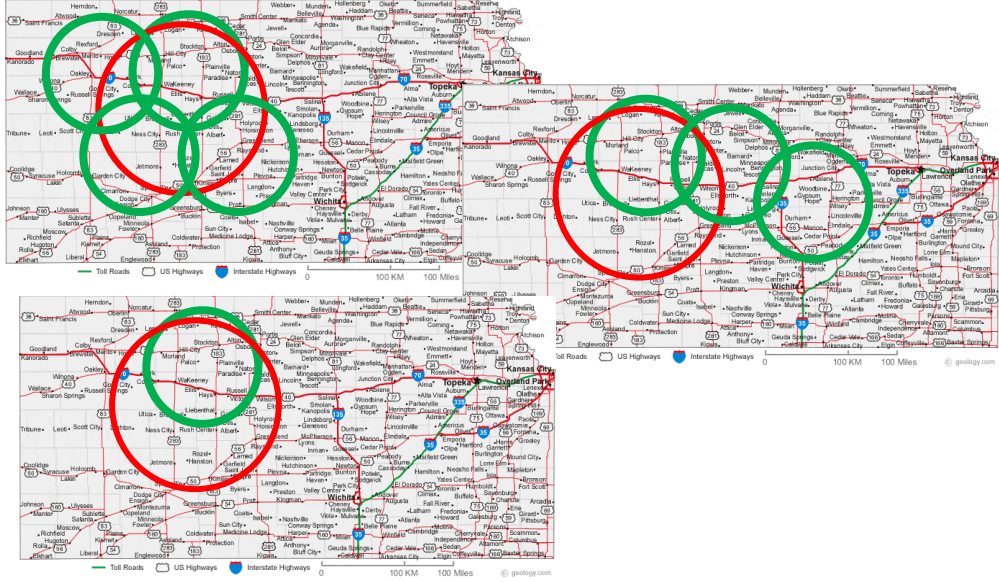
PECAN (as example)



Examples of how 4x SOW could replace 1x big S-Band



Network of 1.5^0 S-Band SOW (or 1^0 C-band COW)



- **More flexible coverage configurations:**
  (triangle, linear, overlapping or spread out)
  (Single S-band radar coverage is rigidly a circle)

- 1, 2, 3, … N could be requested for **small**, medium, and large projects

- **Multiple-Doppler vectors from coordinated scanning network**

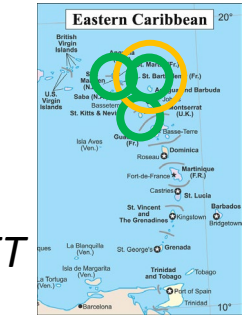
- **~< ½ cost to deploy whole network** compared to big S-band
  - No big pedestal, dish, trailers, site prep, power to maintain **… quicker**

- 1-Day set up and tear down time, each. 1-week for full network. 4 crew total.

- **Same or better scientific capability in nearly all deployments**

  - equal or better spatial resolution
  - 2x scan rates with dual-frequency
  - better sensitivity with 2x 1MW transmitters

  - *but only 2/3 resolution far out to sea (if 1.5 deg S-band. Same resolution if COW-NET*

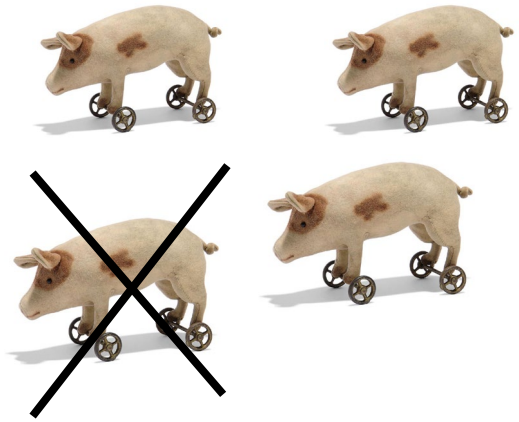


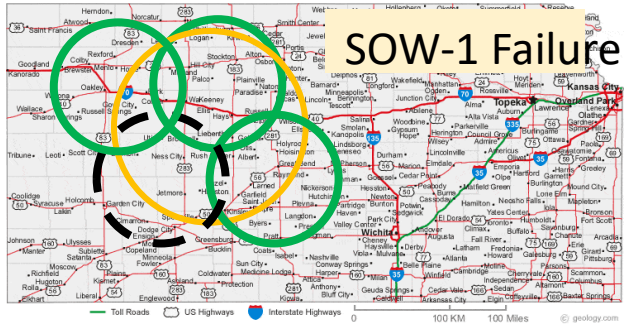
Failure-Tolerant Network

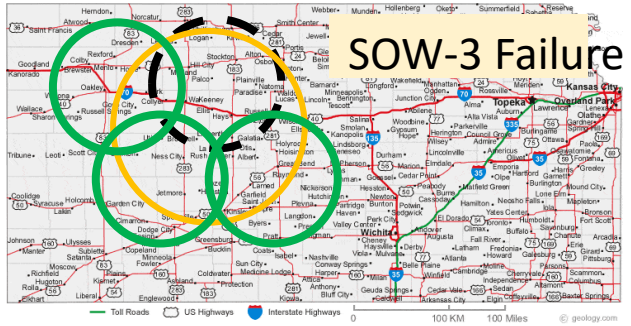
If one radar fails, rest of network is still up and providing dual-Doppler over broad area

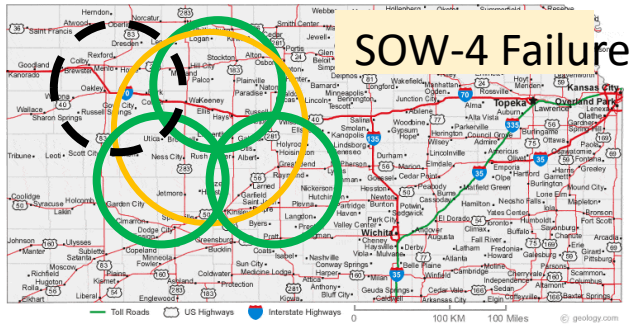
Radars break sometimes.

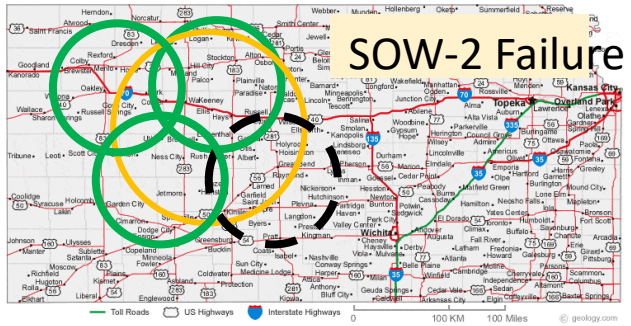
SOW-NET retains much capability even if one breaks



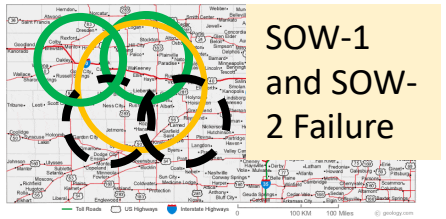








even if 2 fail, there's still coverage

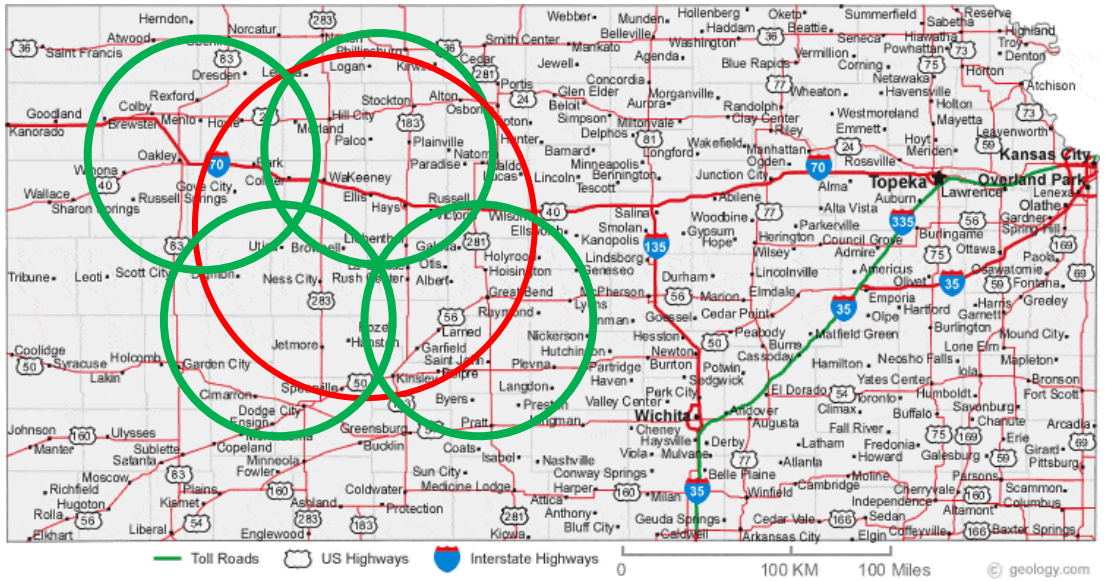


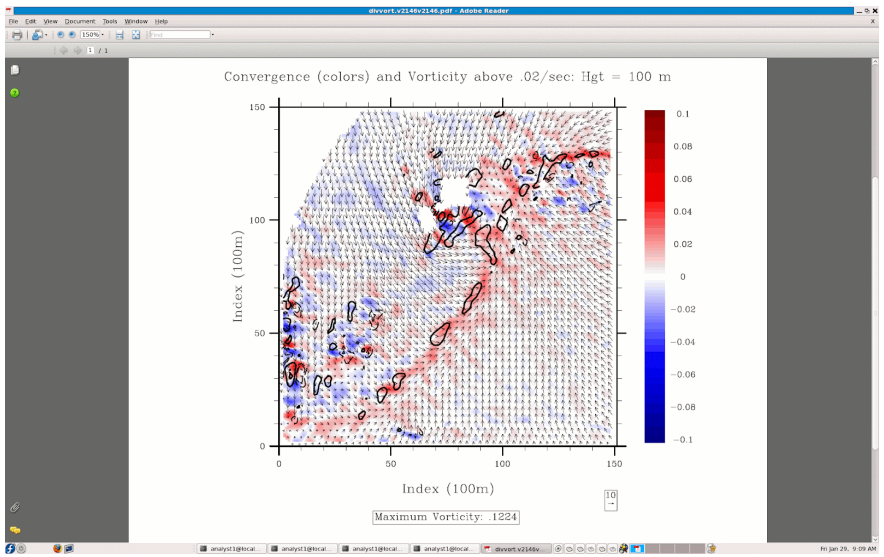
SOW-1 and SOW-2 Failure

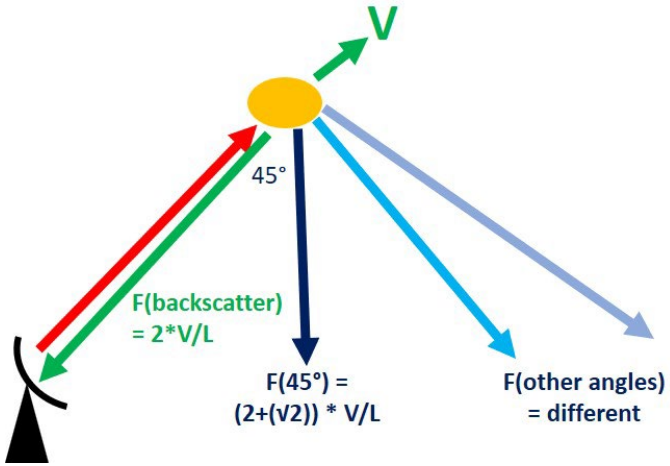
Vector Winds

Inherent to SOW-NET

Look at all those dual-Doppler Lobes !



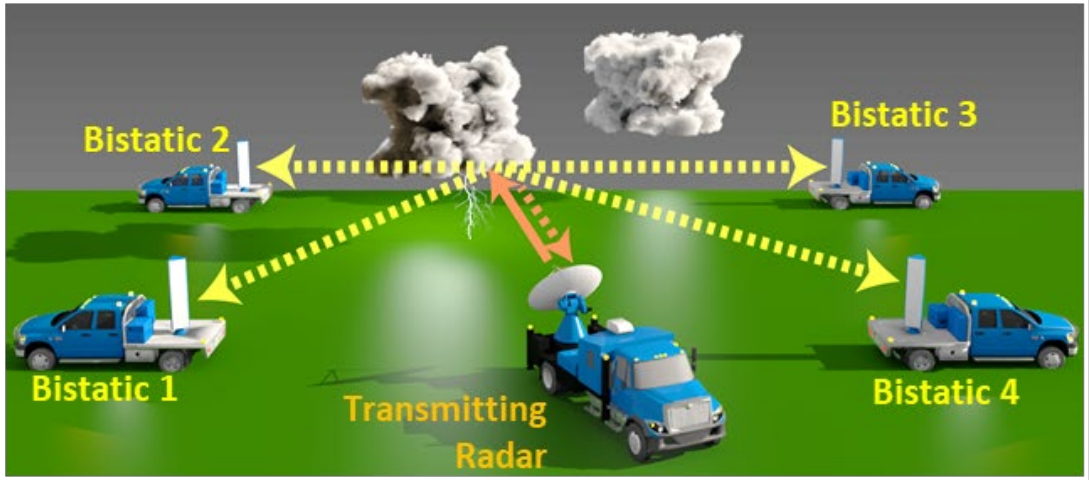


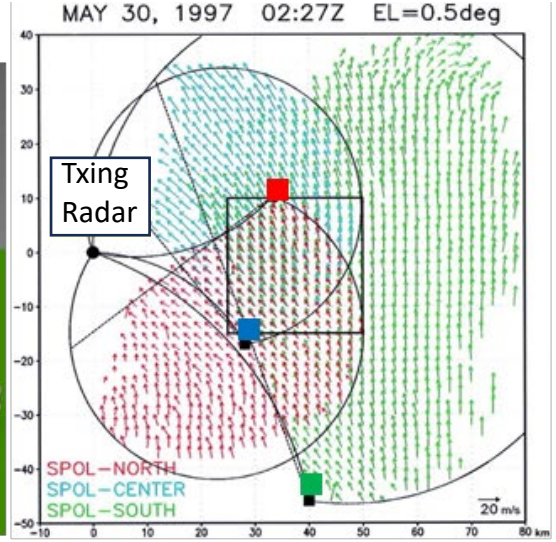


Bistatic Radar Network 101

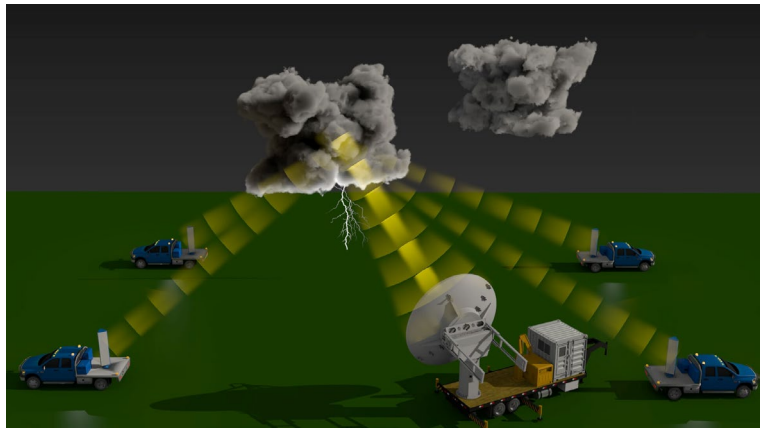
Passive remote receivers
measure Doppler
= Vector Winds

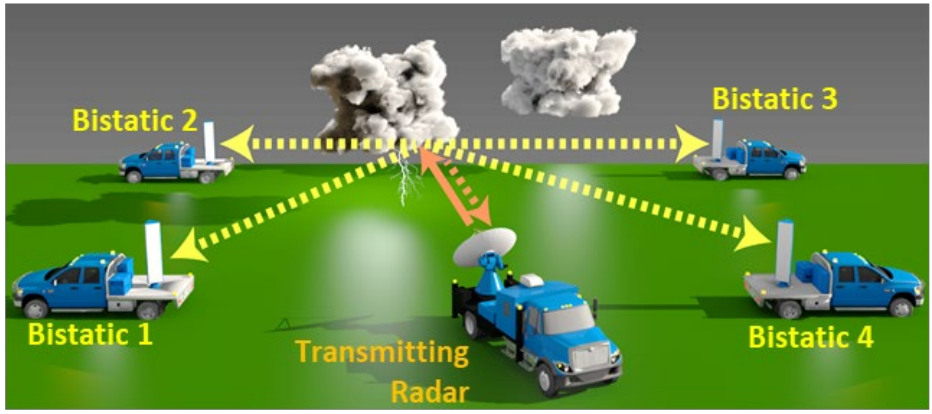
Bistatic Adaptable Radar Network (BARN)





We all want those vectors





The key features of BARN are: (other than too many words)

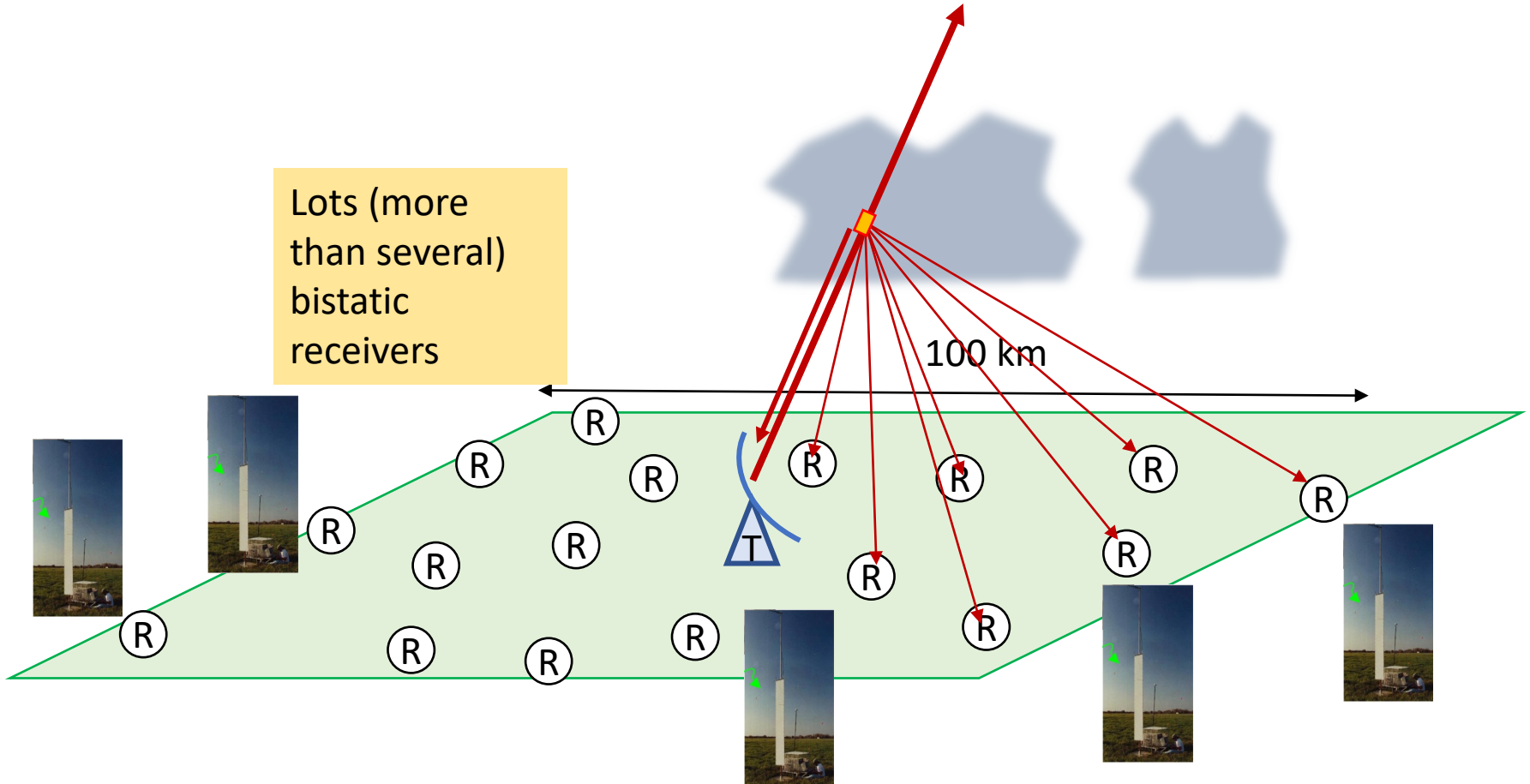
- **Multiple-Doppler vector wind measurements over targeted regions.**
- While **SOWNET** is providing **moderate-resolution** vectors,

  BARN provides finer-scale and/or customized vectors over smaller domains.
- BARN units connect to SOWS, COW, or DOWs.

  Only the receiver front ends and antennas are frequency-specific.
- BARN units stationary or mobile.
- **Stationary BARN units unattended, low power, and logistically similar to deployable weather stations.**
- Highly redundant BARN units provide extreme reliability of multiple-Doppler operations.
- **BARN units are cheap to build and deploy**

Extreme Overdetermination

With >> faster computer power than 1990's bistatic networks,
can use extremely over-determined voting/variational/etc. methods



What the FARM SOW-NET with BARN could provide:

Targetable

Affordable

Long-Wavelength

Fine-Scale

Fast

Dual-Polarization

Vector-Winds