

CASA technologies for lower atmospheric observing

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Lower Atmosphere Observing Facility Workshop
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UMass Amherst



University of Oklahoma



Colorado State University



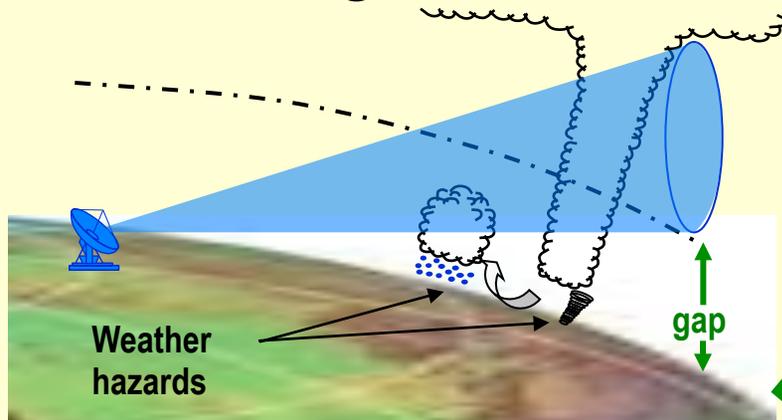
University of
Florida

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CASA Engineering Research Center

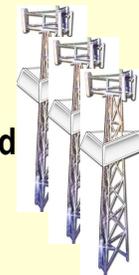
Large S-Band



“Netted X-Band”



Numerous inexpensive, closely-spaced radars



Data

Tasking



Multiple end users

CASA – Basic Ideas

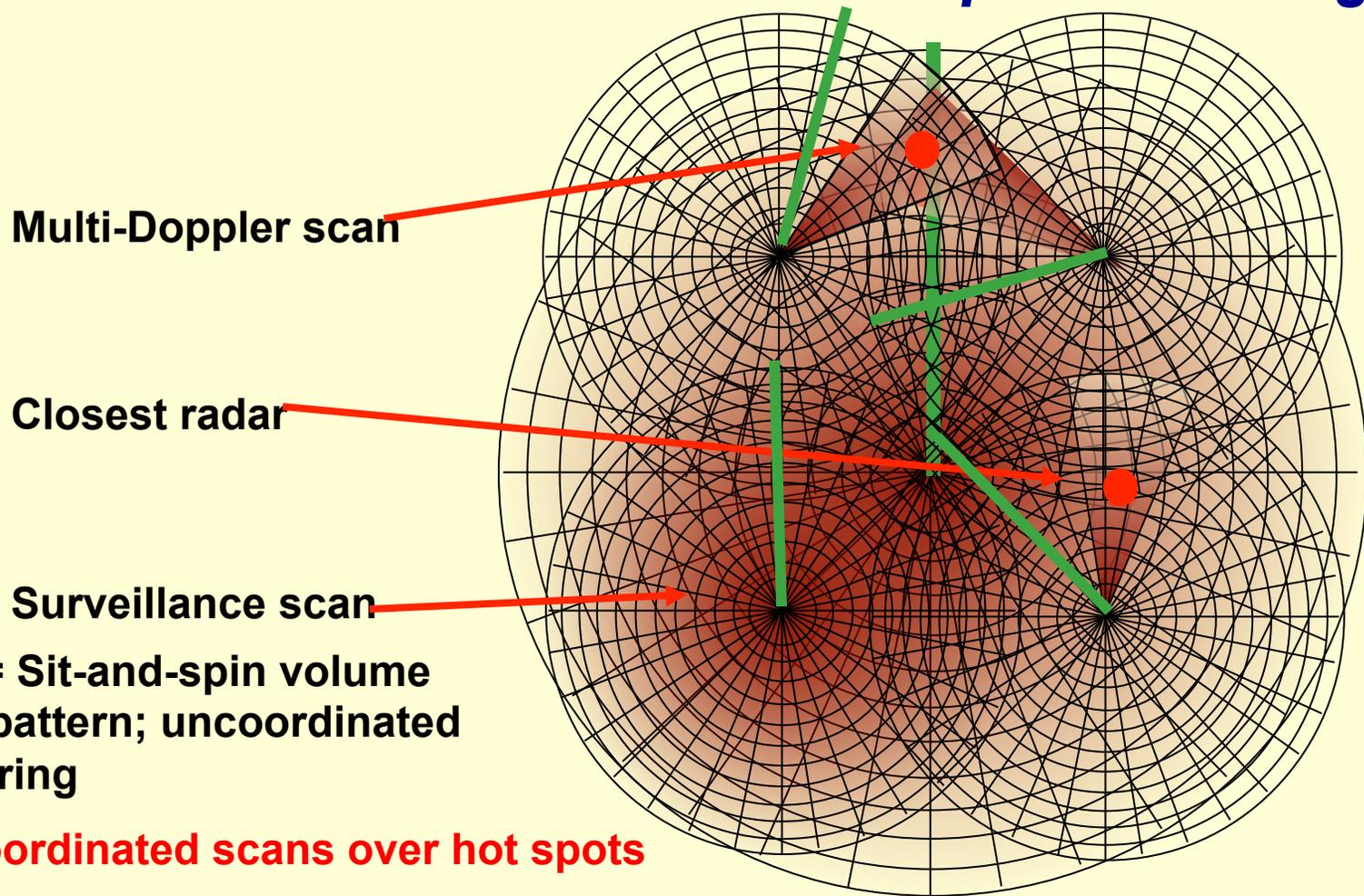
- ❑ Close spacing
 - ❑ 30 km vs. 230+ km
- ❑ Short-wavelength
 - ❑ X-band vs. S-band
- ❑ Small, low-power radars
- ❑ Distributed, collaborative adaptive sensing (DCAS)
- ❑ Low infrastructure
- ❑ Multi-function, multi-user
- ❑ Low life-cycle cost
- ❑ Exportable technology

Key Technologies

- ❖ X-band networks
- ❖ Meteorological Command & Control (MCC)
- ❖ Phased arrays



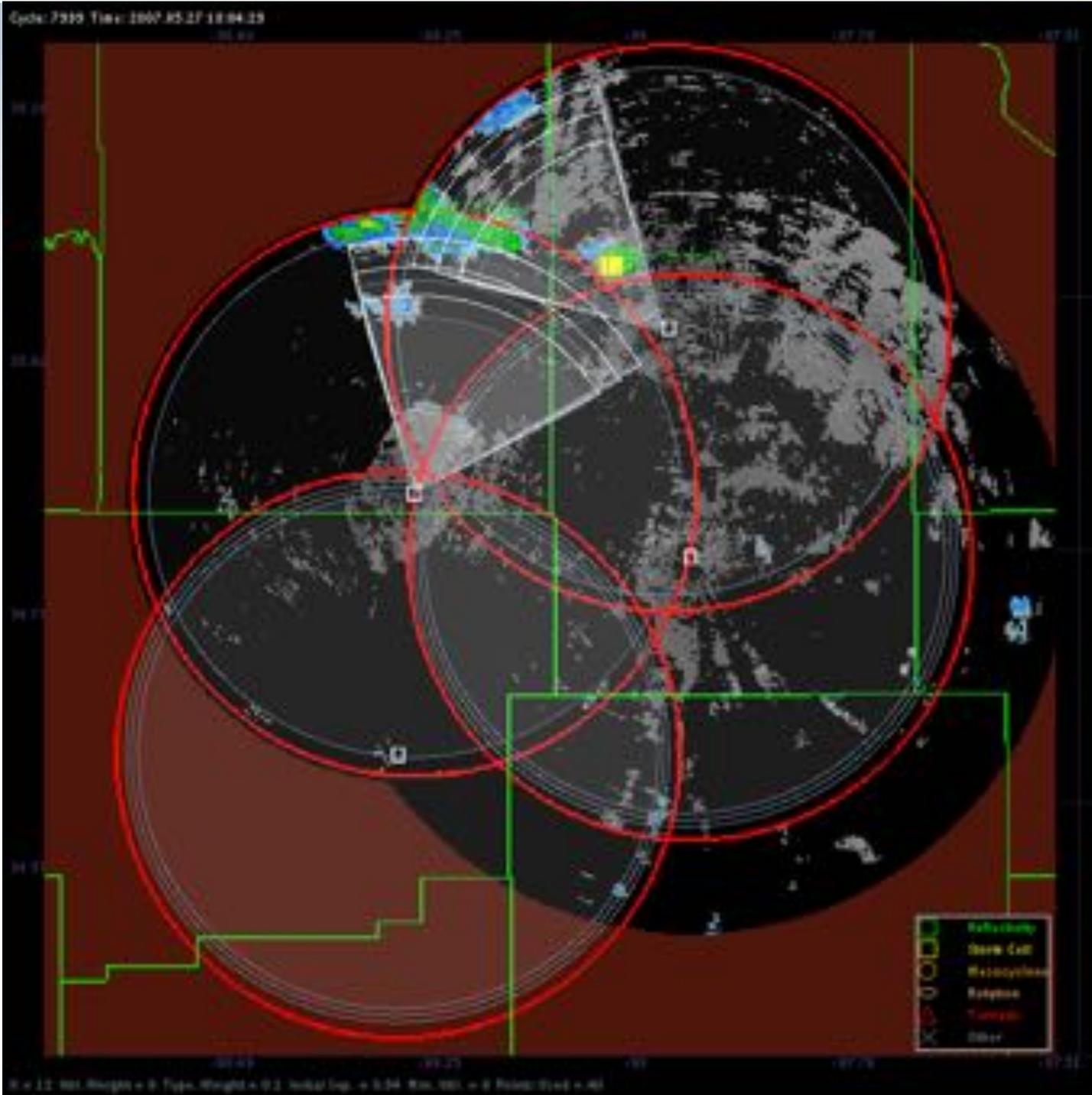
DCAS - Distributed Collaborative Adaptive Sensing



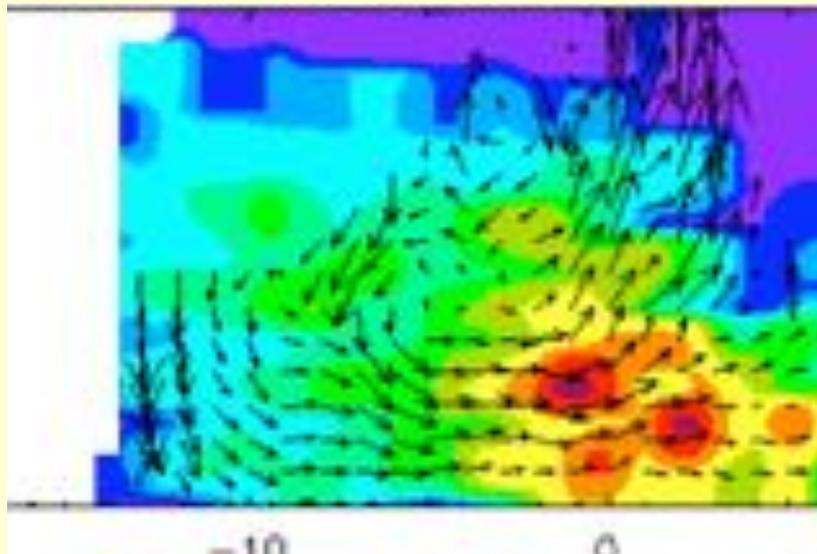
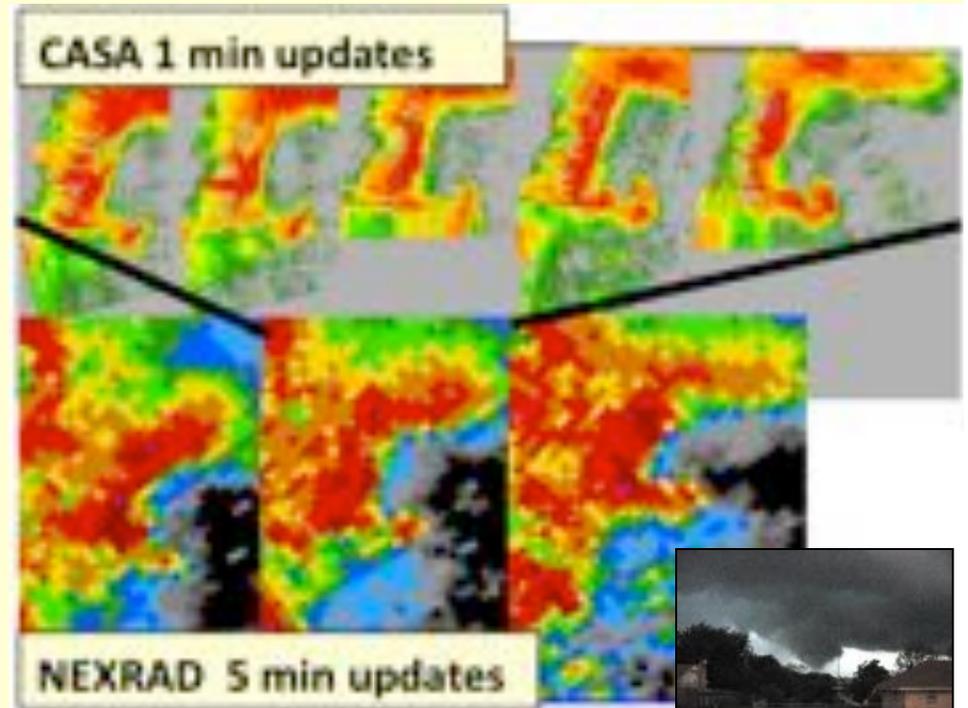
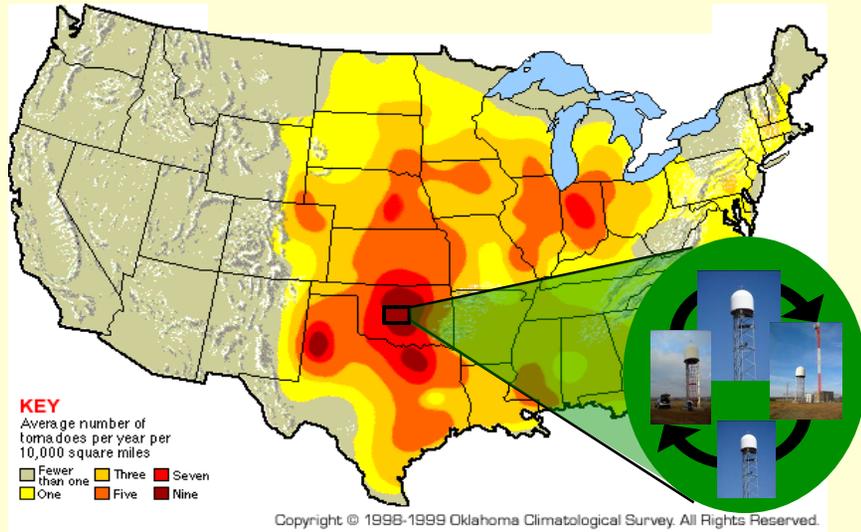
NEXRAD = Sit-and-spin volume coverage pattern; uncoordinated beam steering

DCAS = coordinated scans over hot spots

More rapid, coordinated observing of regions of interest by multiple observing/sampling assets.



CASA's "IP1" 4 Radar X-band Network



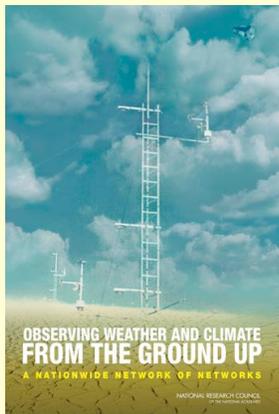
What do people say about CASA?

Forecaster Evaluations – Norman, OK Forecast Office & HWT

- “The resolution and detail of the lower portion of the storm is amazing.”
- “CASA allows you to see much smaller circulations developing over short periods of time which allows you to issue more precise warnings, especially for bow-echo type tornado events.”

Emergency Management :

“The opportunity to use this advanced technology .. probably saved lives. It was literally up to the minute and it made a difference.” - Nick Nazar, City Manager, Newcastle, OK

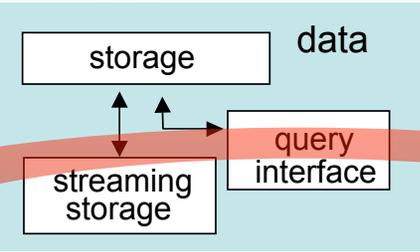
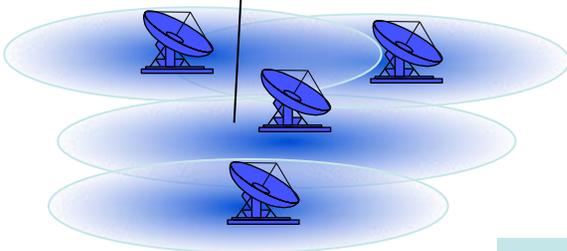


Recommendation: “Emerging technologies for distributed-collaborative-adaptive sensing should be employed by observing networks, especially scanning remote sensors such as radars and lidars.” NRC, 2008

Meteorological Command and Control

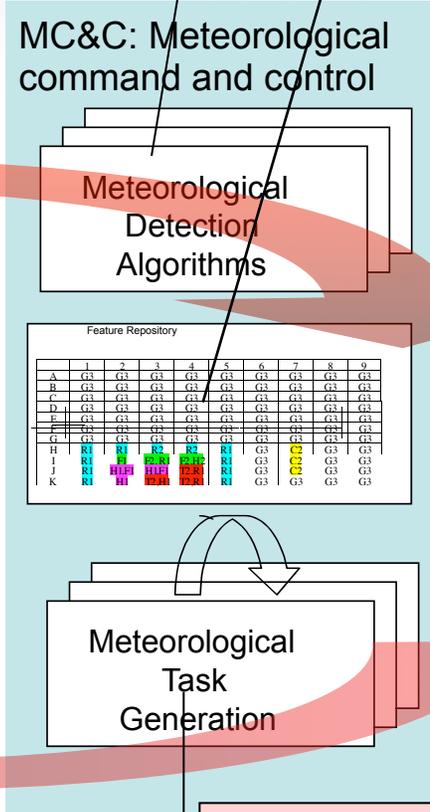
-- manages 360°/20 sec constraint --

1. Radars Scan atmosphere and send data to repository (initially centralized, later distributed)



2. Weather Detection algorithms run on data

3. Detections and other data are "posted" in Feature Repository

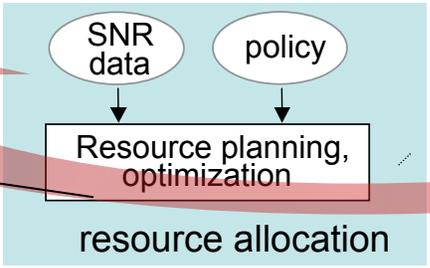


Feature Repository

	1	2	3	4	5	6	7	8	9
A	G3								
B	G3								
C	G3								
D	G3								
E	G3								
F	G3								
G	G3								
H	RI	RI	RI	RI	RI	G3	G3	G3	G3
I	RI	RI	RI	RI	RI	G3	G3	G3	G3
J	RI	RI	RI	RI	RI	G3	G3	G3	G3
K	RI	RI	RI	RI	RI	G3	G3	G3	G3



End users: NWS, emergency response



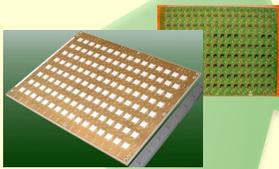
5. Optimal Radar Scans are configured to complete as many tasks as possible while maximizing data utility to users

4. Tasks are generated based on detections and User Rules



X-Band Phased Arrays

Technology Road Map



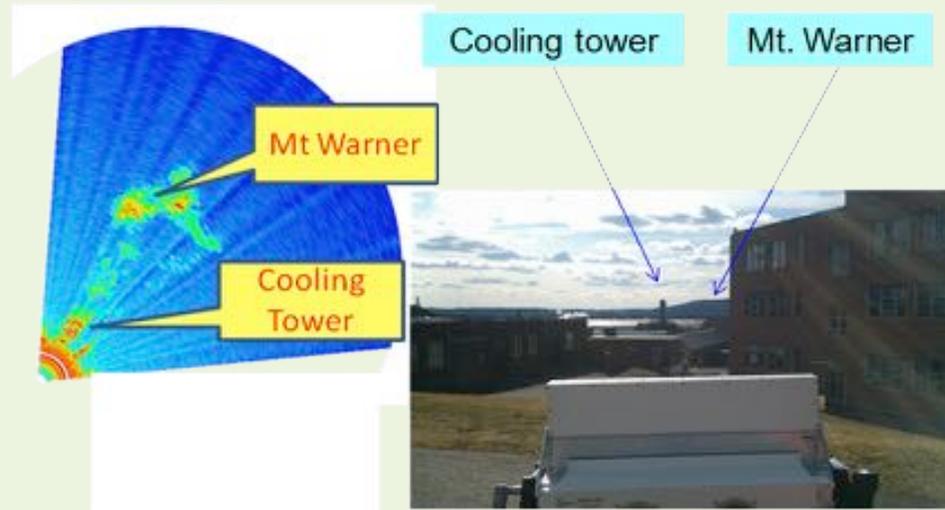
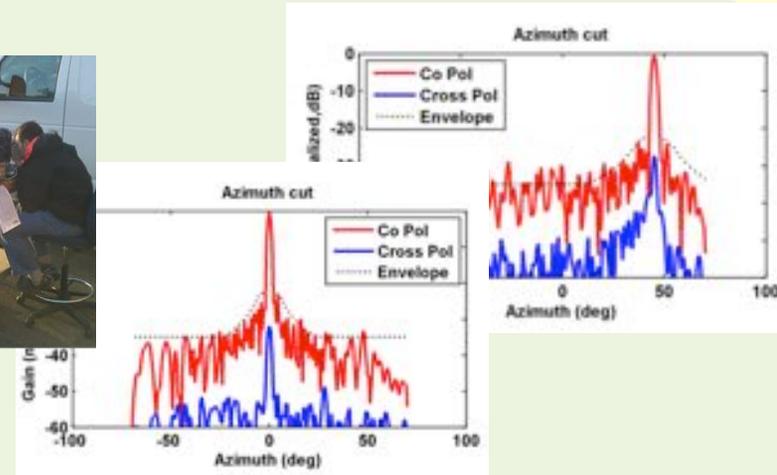
Phase-phase



Phase-tilt (2012)



Mech Scan (2005)



Dual-pol phase-tilt weather radar:
beta product from FirstRF, Boulder, CO

Phase-tilt movies

Summary:

how might CASA impact LOA research endeavors?

1. *Apply DCAS to observing systems:*
 - coordinate the beams/resources of multiple sensors
2. *Deploy phase-tilt radars*
 - now a beta product.
3. *Use the CASA network in Dallas Fort Worth*
 - multi-function system -- can support Atm Research while also doing the hazard warning mission.
4. Other...