Engineering Research Center for
Collaborative Adaptive
Sensing of the Atmosphere
casa

Convergent Research: Lessons from the Collaborative Adaptive Sensing of the Atmosphere (CASA) Engineering Research Center

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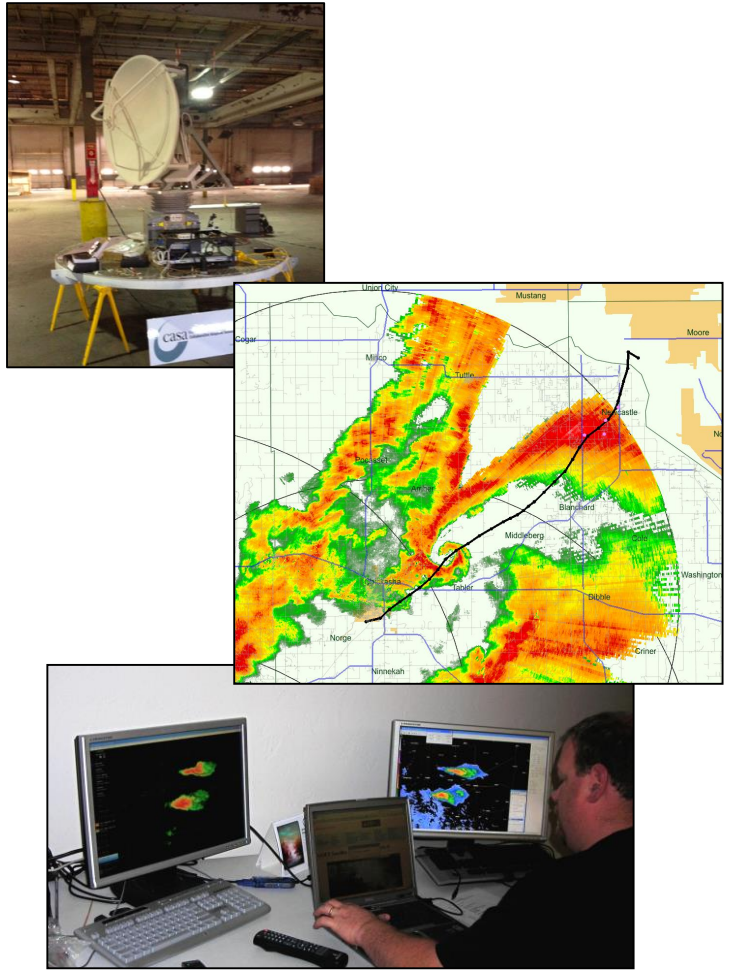
CASA – NSF Engineering Research Center

CASA ERC

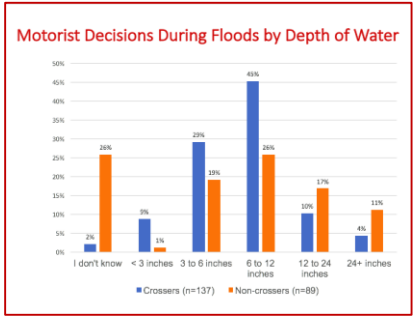
- Started as an NSF Engineering Research Center in 2003
- UMass, Colorado State U, U of Oklahoma, U. Colorado Colorado Springs, UDel + Industry & Government Partners
- Test beds in Oklahoma, Puerto Rico … and now North Central Texas
- Self-sustaining, post-NSF funding



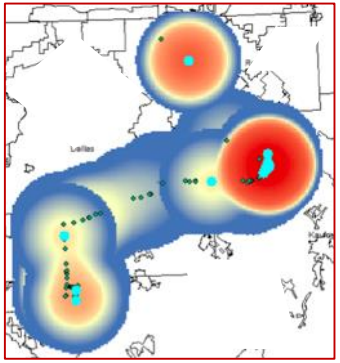
End-to-end weather systems from radars to response

Brenda Philips, Co-Director, CASA DFW Living Lab

- Severe weather warning systems: floods, tornados, thunderstorms
- Sociotechnical systems research: integrating natural, technical, & human dimensions of warning systems
- Research in real-world contexts: Living Labs, test beds; co-creation with stakeholders; partnerships
- Multidisciplinary research grants: CityWarn (NSF), NextGen Warning Systems (NSF), NWS, Raytheon, City of Ft. Worth



Public Perception & Response to Hazards

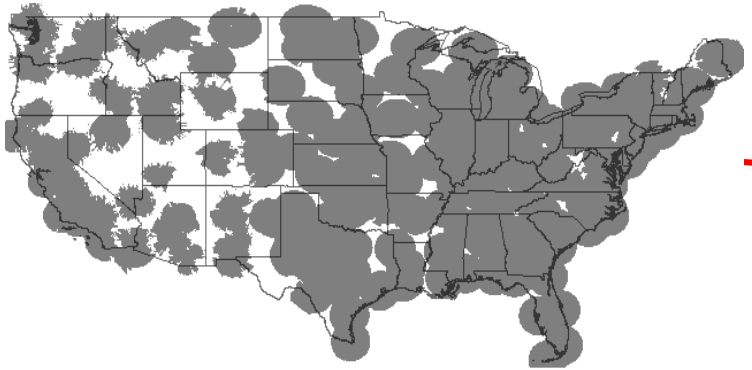


Individual Mobility Patterns & Warning

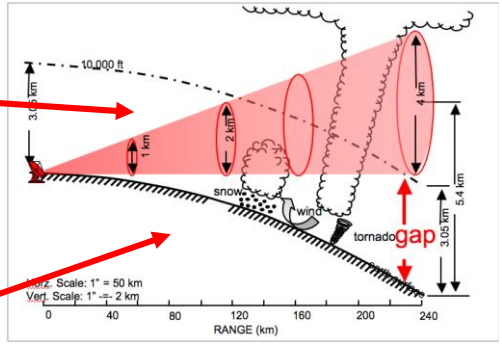
EM and Stormwater Mgrs Meeting in Texas

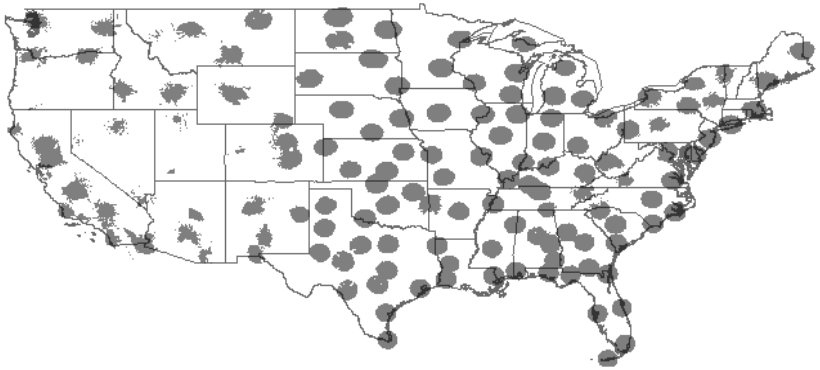
Motivation

Onset of CASA

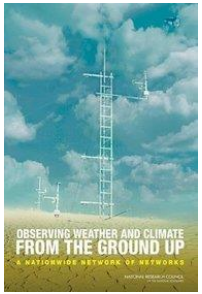


NEXRAD coverage at 3 km (10,000 ft).

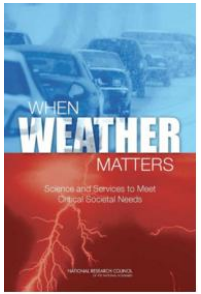




NEXRAD coverage at 1 km (~3200 ft) AGL.

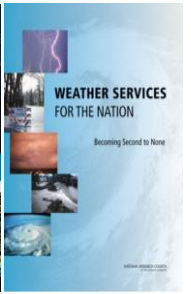


2009



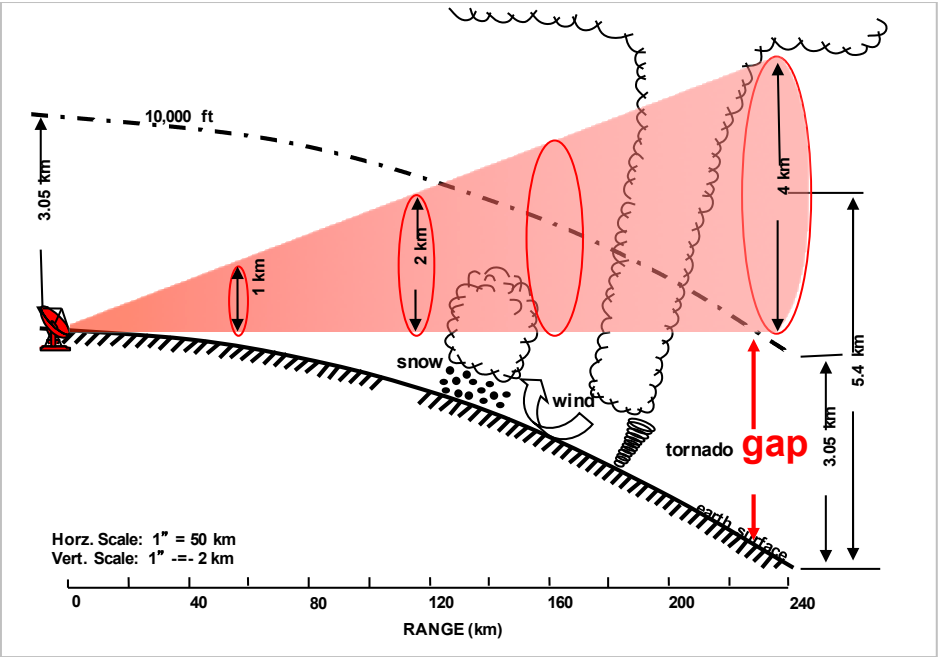
2010

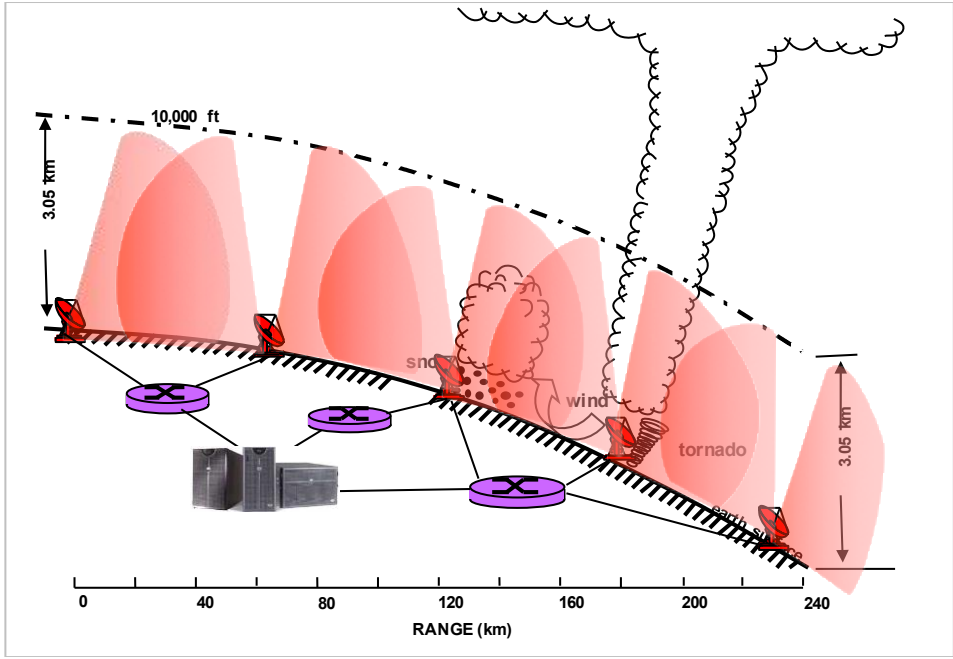
2012



2012

NEXRAD versus CASA





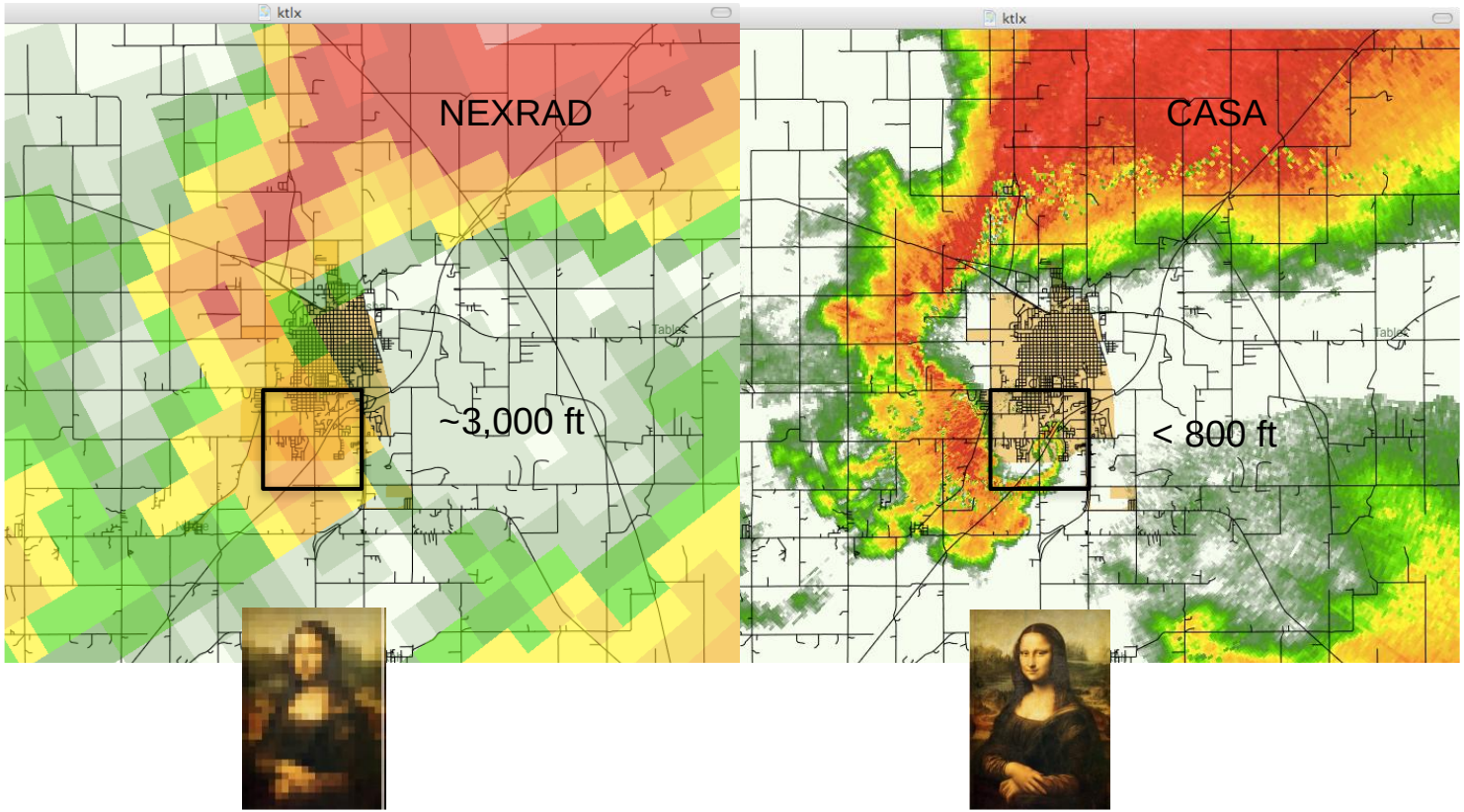
Next Generation Warning System

- People make decisions about hazardous weather, such as thunderstorms, tornados and floods
- Over 80% of the US population is concentrated in cities
- 80% of the Gross Domestic Product in the United States is produced in metropolitan areas
- Cities are even more vulnerable to extreme weather events

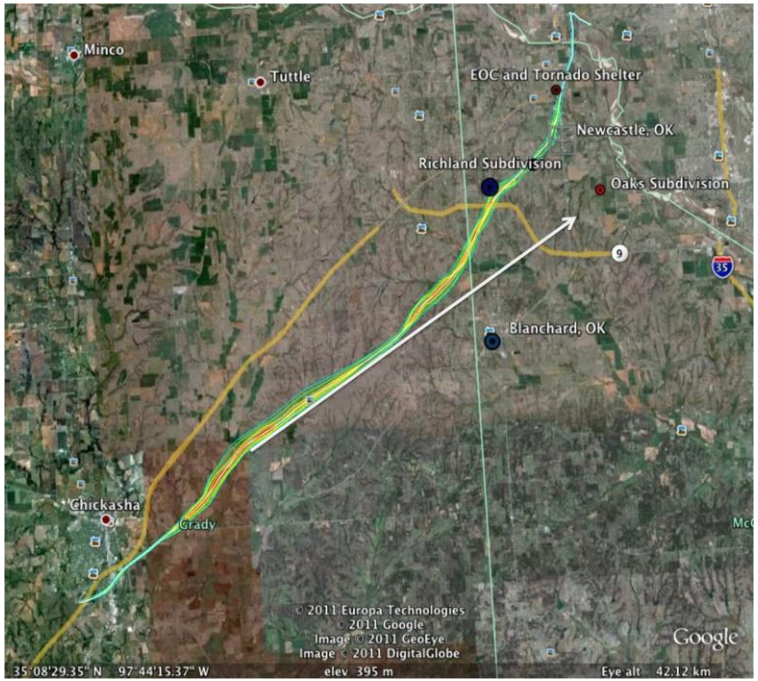
Hazard Warning System

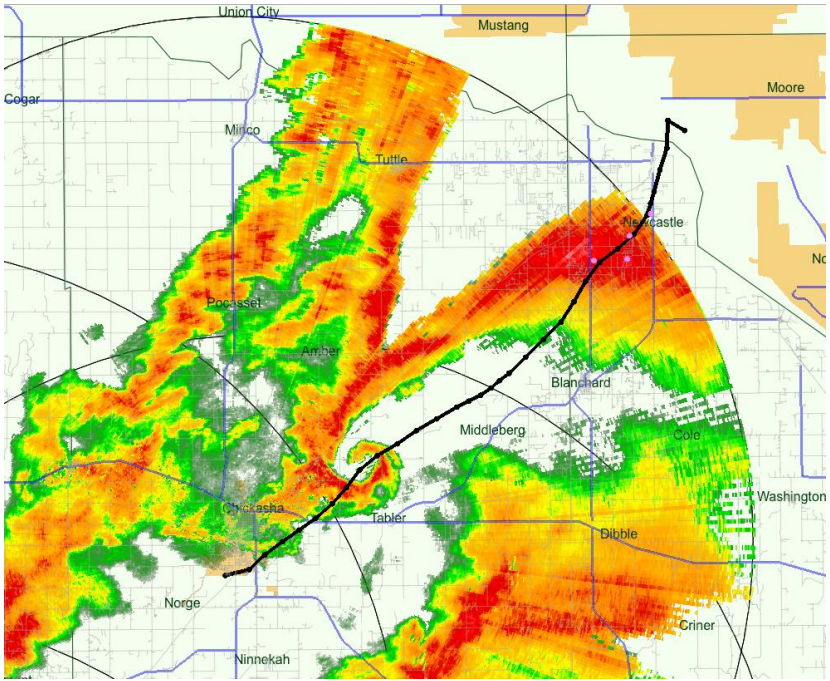
- Effective hazardous weather warning systems are critical
- Hazard warning systems are service systems that aim to minimize deaths, injuries, property loss, infrastructure destruction, and service or business disruption
- Include sensors, forecasts, networking and communications, public safety personnel and decision-makers, warning information, and those who receive and respond to the warnings

Example



Example


Minco
Tuttle
EOC and Tornado Shelter
Newcastle, OK
Richland Subdivision
Oaks Subdivision
9
35
Blanchard, OK
Chickasha
Grady
© 2011 Europa Technologies
© 2011 Google
Image © 2011 GeoEye
Image © 2011 DigitalGlobe
Google
35° 08'29.35" N 97° 44'15.37" W
elev 395 m
Eye alt 42.12 km

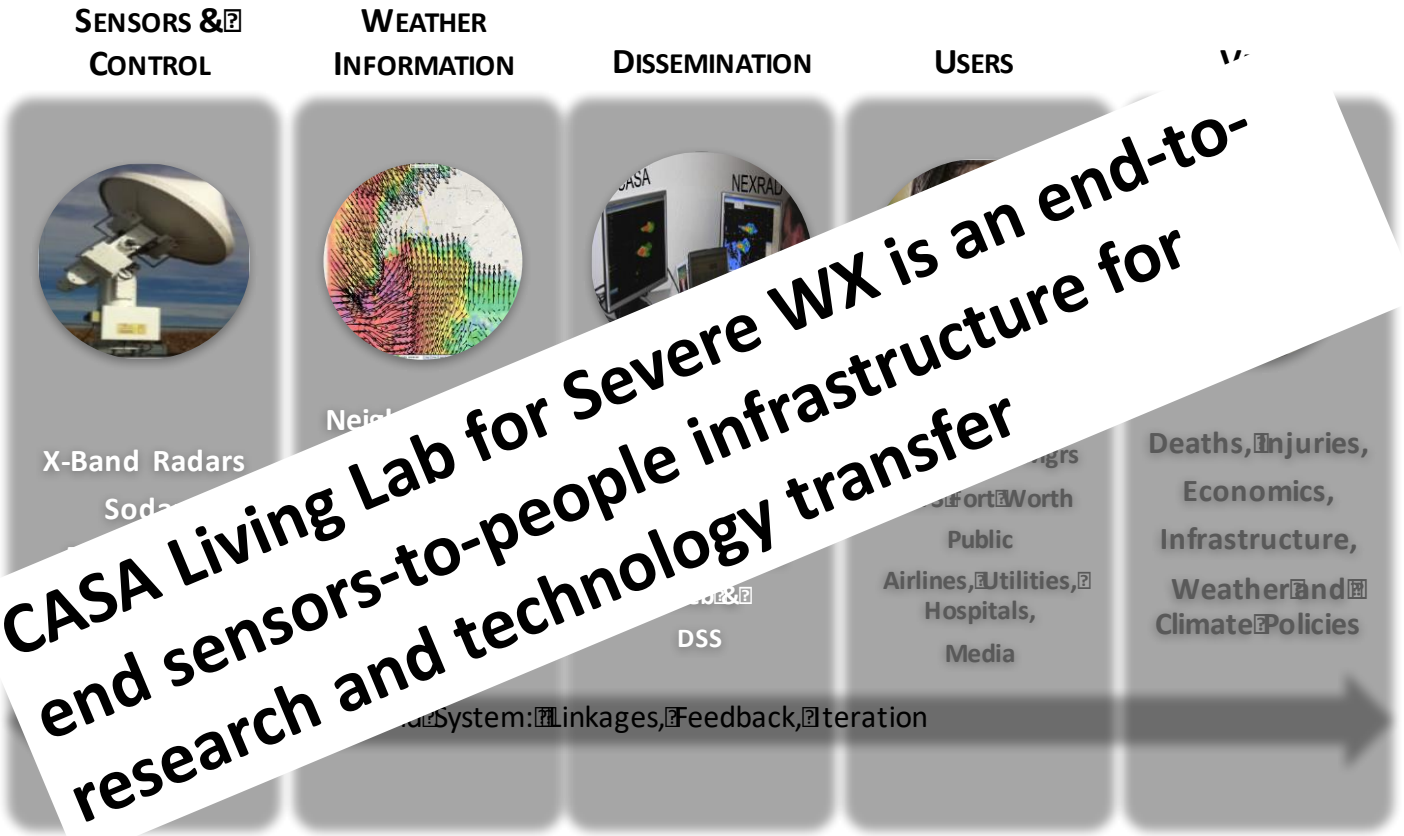

Union City
Mustang
Cogar
Moore
Minco
Tuttle
Newcastle
Pocasset
Amber
Blanchard
Middleberg
Cole
Washington
Chickasha
Tabler
Dibble
Norge
Criner
Ninnekah

CASA DFW Living Lab

CASA DFW Living Lab

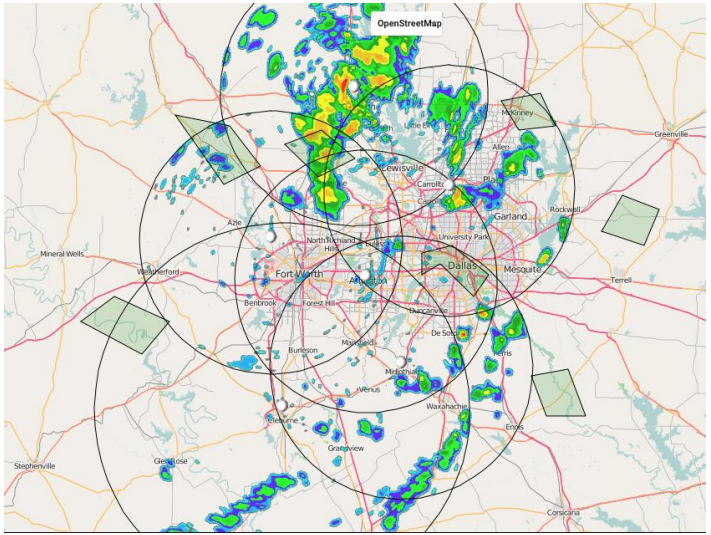
- Sensors-to-People Severe Weather Warning System
- Centered around X-band CASA radars & other sensors
- Demonstrates benefits of high resolution, lower atmosphere sensing: Urban, gaps, users
- Multidisciplinary research in live environment (physical, technical, social sciences)
- Co-Creation with users through a public private partnership

Flexible Infrastructure for Research and Tech. Transfer



CASA DFW Living Lab: Concept of Operations

- 7 node network, Doppler, dual polarization radar + other sensors
- Operates year round
- Real-time single & merged radar data
- CASA products available for real-time operational use with low latency for emergency management & NWS
- 1500+ users: ~750 local public safety users from 50 NTX cities and counties, ~1000 App holders
- Data archive and ability to regenerate data



CASA network covers approximately 32,000 sq. km. radar range is 40 – 60km. Overlapping coverage helps to address X-band attenuation

CASA DFW Living Lab: Private Public Partnership

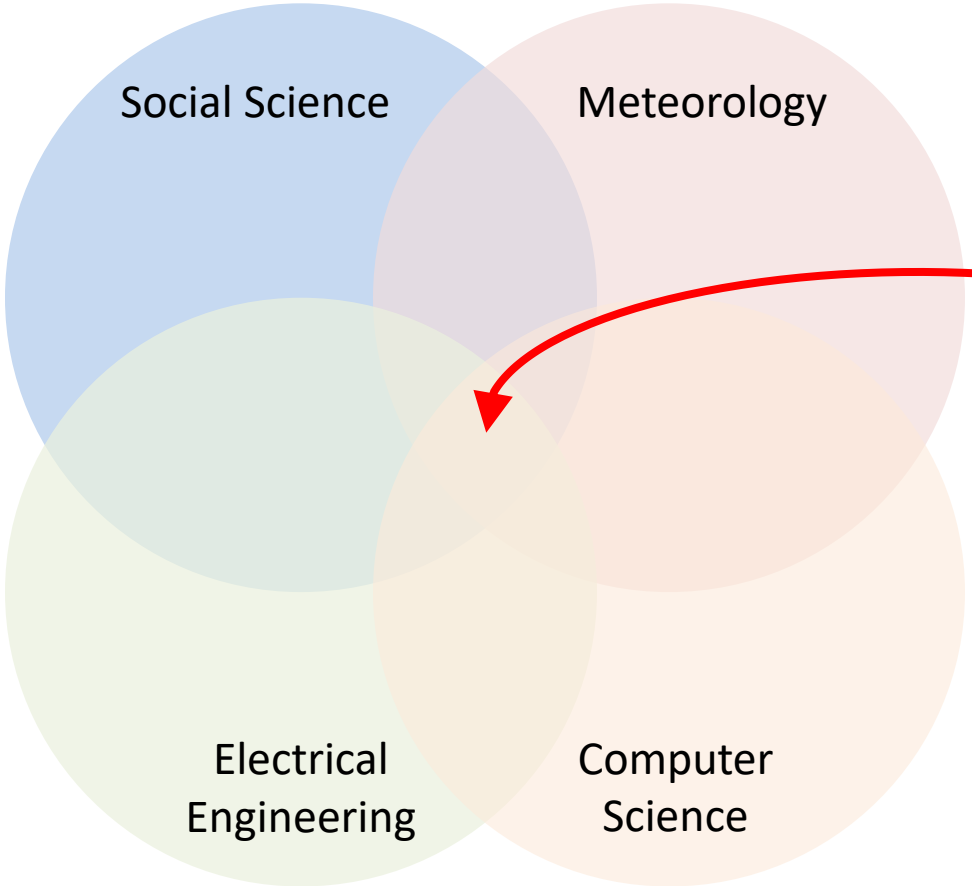
University of North Texas | *Johnson County* | *City of Addison*

- North Central Texas Council of Governments coordinates local efforts through 5-year agreement with CASA. In second renewal period.
- Local Exec Committee of EMs, media, NWS sets local policy
- A membership fee to local towns and cities supports radar operations. ~$1 million in fees to date.

Community sponsored installations
UT Arlington, UNT, Cities of Addison and Midlothian

Convergent Research

Research Areas



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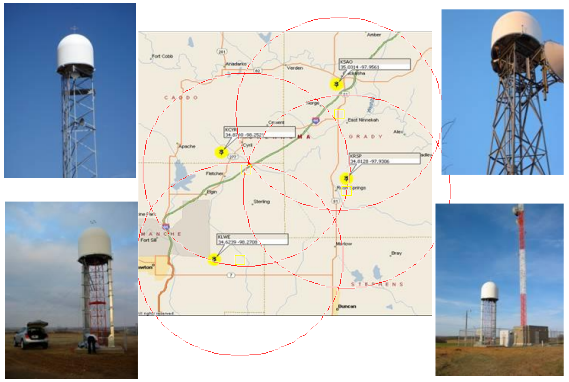
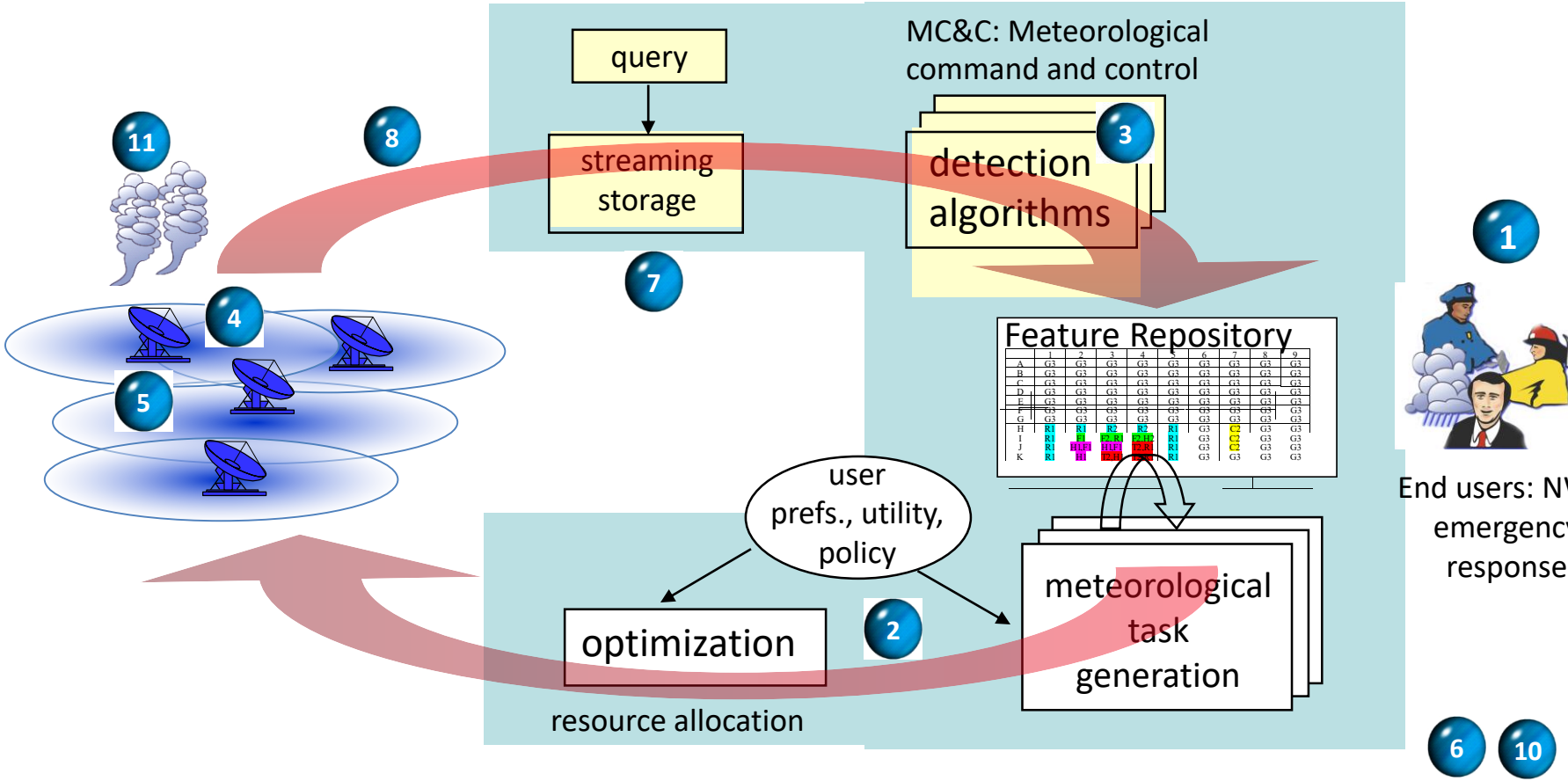
Make Convergence Happen

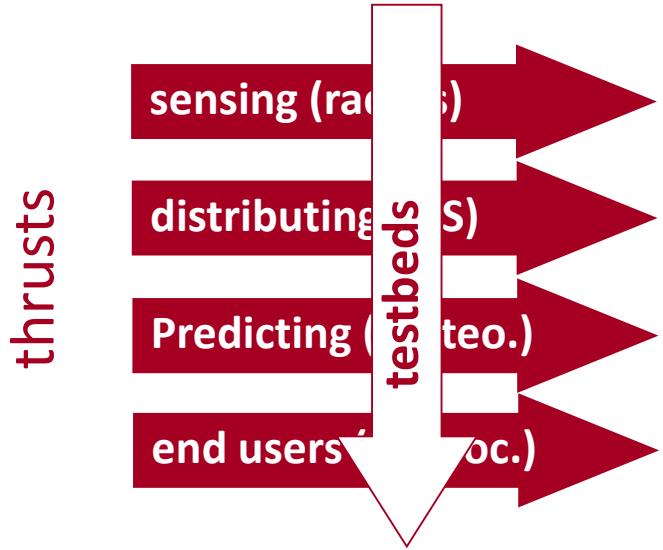
- End-to-end testbeds
- Community building
- Organizational structure
- Systems Engineering
- Make convergence the ”new normal” for students



End-to-End Testbeds



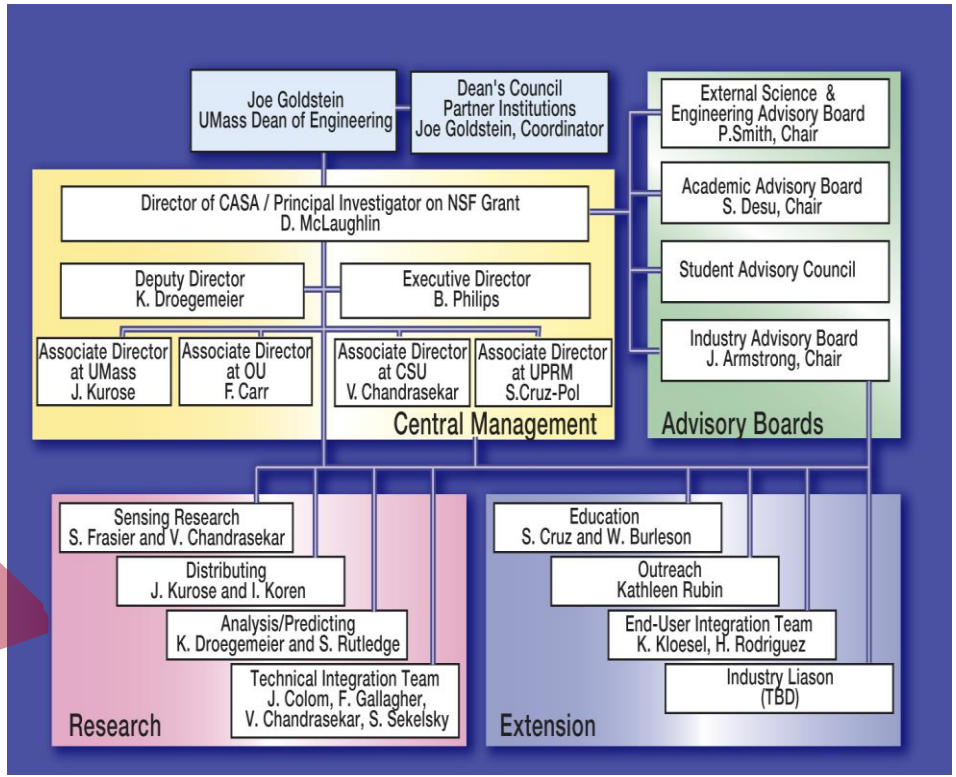
Community Building



- What role do students play?
- Include your stakeholders
- Break silos, promote interaction

Organizational Structure

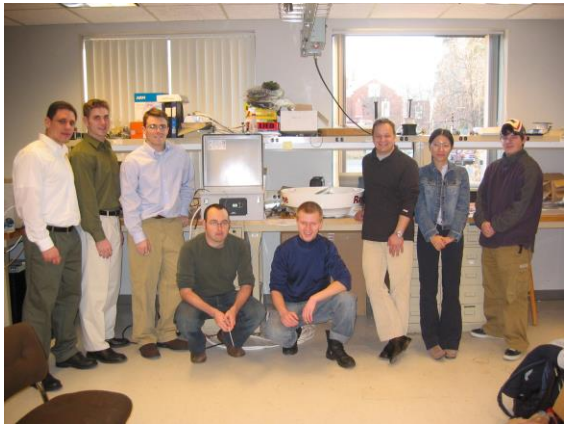
Thrusts - where the heavy research/technical lifting get done



Slide courtesy of Jim Kurose, UMass Amherst

“New Normal” for Students

- Your center will educate the next generation of engineers/scientists
- Make convergence the ”new normal” for the students
- In CASA students had their own testbed



Convergence Issue

Achieving Convergence is Hard!!

- Systems Engineering
- Changing Culture

Example

- “naturally”: group-sensitive utility for each feature (tornado, wind shear, hail core) scanned
- … and the survey says…..

User feedback:

- NWS: want “mental movie” scanning “areas of interest” at regular intervals
- feature-based too “jumpy”
- need context: scan areas around features (storm cell)
- dynamic data requests

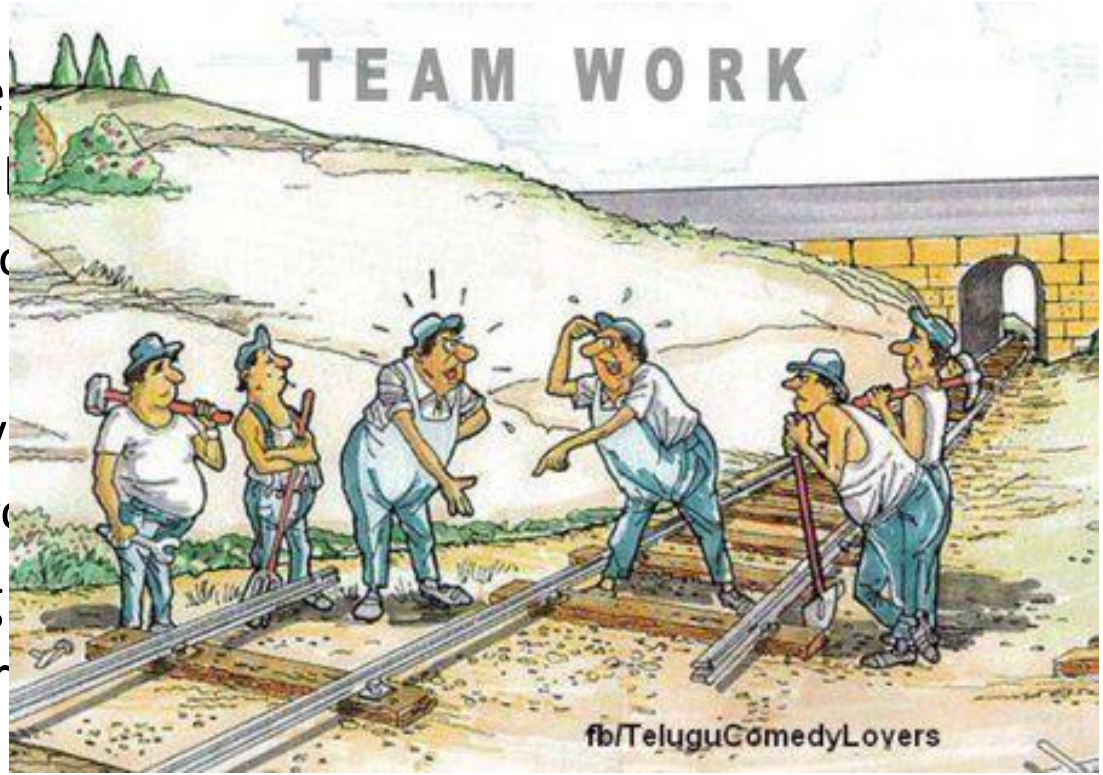
Example

- *interval-based preferences:* “do X every Y time units”

Rules	Rule trigger	Sector Selection	Elevations	# radars	Contig.	Sampling interval
NWS						
N1	time	360	lowest	1	Yes	1 / min
N2	storm	task size	full volume	1	Yes	1 / 2.5 min
EMs						
E1	time	360		1	Yes	1 / min
E2	reflectivity over AOI	task size		1	Yes	1 / min
E3	Velocity over AOI	task size	lowest	2+	Yes	1/ 2.5 min

Changing Culture

- Graduate
  - Break si
  - Offer cr
- Faculty
  - Incentiv
  - Pick ”pr
- Changing
  administr



Conclusion

- Achieving convergence is hard
- What mechanisms to put in place to achieve convergence?
- If every team member understands need for convergence in can be fun and highly rewarding
- Make it part of the culture of your ERC!

Media Pilot: NBCDFW Using CASA Radar Data 5/3/18