casa

Revolutionizing our ability to observe, understand, predict, and respond to hazardous weather events

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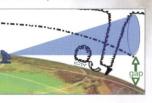**Engineering Research Center for**
Collaborative Adaptive Sensing of the Atmosphere

The Challenge: Sensing Gaps

Because of the Earth's curvature, current radars cannot observe the lower atmosphere. In fact, 72% of the atmosphere below 1km does not have radar coverage in the United States, even though most severe weather forms at these low altitudes.

The CASA Solution

By filling these sensing gaps with densely spaced networks of low-power, X-band radars, the CASA solution provides:

- Low-level coverage to 250m above ground level
- Rapid updates as fast as 20 seconds
- High spatial resolution averaging 250m
- Overlapping radar coverage for better views of wind fields (vector winds)
- Collaborative adaptive radar control optimizes sector, surveillance and multi-Doppler scans to deliver the best data to users
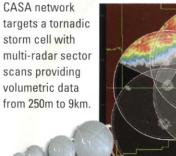
CASA network, southwest Oklahoma

CASA radar networks operate as an integrated system, delivering information optimized for user decision-making. The system software analyzes incoming meteorological data and reconfigures network scanning patterns in response to changing weather and diverse user needs every 60 seconds.
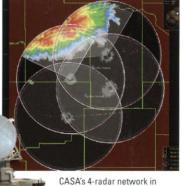
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User-Driven System Design
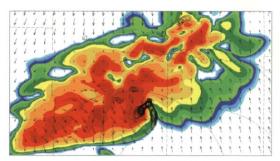
Observe ☐

Understand ☐

Predict ☐

Respond ☐

First generation dual-pol, Doppler radars with novel real-time signal processing features including dual-PRF, second trip echo suppression, velocity unfolding, clutter filtering, and attenuation correction.
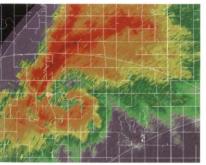
CASA network targets a tornadic storm cell with multi-radar sector scans providing volumetric data from 250m to 9km.

CASA's 4-radar network in Oklahoma, showing overlapping 40km range coverage.

Using CASA low-level wind data, the Advanced Regional Prediction System (ARPS) forecasts an area of rotation (vorticity) in advance of an EF2 tornado, paving the way toward "warn-on-forecast."

Frequent, high resolution, low altitude radar observations provide geographically specific detections that can map weather hazards with street level precision. CASA radars also feed analysis and assimilation systems for hazardous weather forecasts and nowcasts ranging from minutes to hours. Ongoing user feedback on weather products and scanning strategies is incorporated into CASA's iterative research and design process.
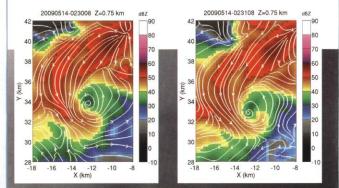
CASA high resolution view of tornado hook echo over the town of Gracemont, Oklahoma.

An emergency manager evaluates CASA data.

CASA is a multi-sector partnership among academia, industry and government that is creating a new paradigm for weather observation based on low cost, densely spaced networks of X-band radars for improved warning and response.

High resolution view of a tornado in progress with wind direction (multi-Doppler wind) and storm intensity (reflectivity) captured in CASA's Oklahoma test bed.

End-to-End Test Bed

CASA operates prototype test beds in Massachusetts, Oklahoma, and Puerto Rico to research and validate the CASA concept. The Oklahoma test bed is a network of four agile, adaptive X-band radars that disseminates data in real time to National Weather Service forecasters and local emergency managers for evaluation and feedback.

A Multi-Sector Partnership

CASA is a consortium of academic, government, and industry partners, including:

Academic Partners

University of Massachusetts Amherst (lead organization)
University of Oklahoma
Colorado State University
University of Puerto Rico Mayaguez
University of Delaware
University of Virginia
McGill University
Indiana University of Pennsylvania
University of Colorado at Colorado Springs

Government and Industry Partners

NOAA/National Weather Service, OSHRE/OneNet, Raytheon Company, Vaisala, Inc., EWR WeatherRadar, WeatherNews, Inc., ITT Corporation, Environment Canada, KWTV NEWS 9, Japan National Research Institute for Earth Science and Disaster Prevention (NIED)

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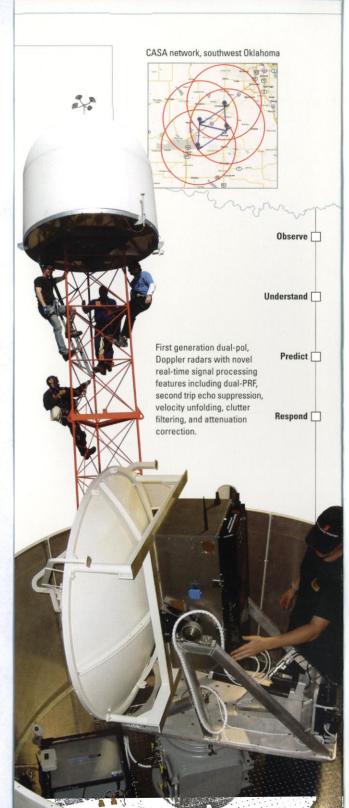webmaster@casa.umass.edu

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CASA network, southwest Oklahoma

Observe ☐

Understand ☐

First generation dual-pol,
Doppler radars with novel
real-time signal processing
features including dual-PRF,
second trip echo suppression,
velocity unfolding, clutter
filtering, and attenuation
correction.

Predict ☐

Respond ☐

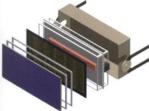## Educating the Next Generation

CASA is educating the next generation of
system-savvy engineers, meteorologists, social
and computer scientists.

Collaborate with CASA

We invite universities, government organizations
and industry to discuss using our data archives,
test beds, and technology for research and
development.

Projects may include: determining capabilities of
networks of small radars for winter weather,
flooding, or non-weather targets; new
implementations of adaptive scanning strategies
and radar network control; product development
for weather sensitive industries such as utilities,
transportation, or broadcast media; research in
weather information and human behavior;
exploration of innovative radar deployment
strategies leading to federal, state, local, or private
use of CASA radars; or sponsored research on
technology development.

On the Horizon...
e-scan radars

*A new generation of solid
state X-band radars are in
development. Pictured left:
1 x .5m low-power, low-cost
e-scan panel (phase-tilt).
Contact CASA to learn more.*