FY 2004 President's Request

Tornado/Severe Storm Research: Phased Array Radar

Addresses

NOAA Mission Goal #3

Serve society's needs for weather and water information

What is requested?

NOAA requests an increase of 2 FTE and $1,001,000 to develop new technologies for forecasting and detecting tornadoes and other forms of severe weather and to disseminate this information to emergency managers, the media, and the general public for appropriate action. This initiative consists primarily of construction, operations, infrastructure, and research support for a phased-array radar test-bed at the National Severe Storms Laboratory in Norman, OK. The formation of a National Weather Radar Testbed will provide the meteorological research community with the first dedicated phased-array radar facility to collect real-time data 24 hours a day, 7 days a week. Installation of this new radar begins in April, 2003.

Why do we need it?

Phased-array technology is a leading candidate to improve lead times for severe weather, including tornadoes, flash floods, large hail, violent winds and heavy snow and ice storms. If proven cost effective, phased-array technology could be infused into future upgrades of the national network of WSR-88D (NEXRAD) radars.

Early tests of the phased-array radar system show that the technology has the potential to vastly improve upon the capabilities of the national NEXRAD radar network for all weather radar applications. Using multiple beams and frequencies, phased array radar reduces the scan time of weather from five or six minutes for NEXRAD radar to less than one minute, producing fast updates of weather data. The National Weather Radar Testbed will allow the NSSL and other meteorologists to determine if phased-array radar will become one of the next significant technological advancements to improve our nation's weather services.

What will we do?

Researchers will soon begin re-engineering the SPY-1 radar, developed by Lockheed Martin in support of tactical operations aboard Navy ships, to support weather detection. Significant work is required to adapt current military technology to civilian use for weather applications. This process has proven successful before, when NSSL researchers took surplus military Doppler radar components and developed what became the WSR-88D radar or NEXRAD. The deployment of a system of 120 NEXRAD radars across the

Phased-Array Radar At-a-Glance

What: $1.0 M increase

Why: New technology to help forecasters provide earlier warnings for tornadoes and severe weather

United States was a cornerstone of the modernization of the National Weather Service. Most importantly, it has helped forecasters provide better forecasts and warnings, saving countless lives.

The phased-array radar project will begin a new era in NSSL's leadership in the research and development of future generations of weather radar. However, the NSSL is not working alone. All aspects of this initiative will be carried out in a partnership among several Federal, private, state, and academic partners, including NOAA's Forecast Systems Laboratory and National Weather Service, U.S. Navy, Federal Aviation Administration, Lockheed Martin, and The University of Oklahoma.

Research problems to be addressed include determining what scan strategies are required to provide the greatest improvements for severe weather detection; how to adapt displays and algorithms to process the three-dimensional data; and how to present the data to the forecaster in the fastest and most concise way. Simultaneously, NOAA will collaborate with the FAA in using the PAR for both weather and aircraft tracking applications.

What are the benefits?

The goal of phased-array radar technology is to help forecasters provide earlier warnings for tornadoes and other types of severe and hazardous weather. Phased array radar's faster scan rates can reduce the time it takes to make a complete scan of the atmosphere from five or six minutes to less than one minute. Coupled with artificial intelligence based decision support systems, tornado warning lead times could be doubled from 11 to 22 minutes. Other technology being developed at the NSSL will extend lead times even further.

In addition, the new system will be able to scan the atmosphere with more detail at lower elevations than current radar allows. It will also be able to re-scan areas of severe weather very quickly, potentially increasing forecasters' warning lead times as storms rapidly transition to severe modes.

The new technology will gather storm information not currently available, such as rapid changes in wind fields. Researchers and forecasters can then improve conceptual storm models and use that knowledge to evaluate and improve storm-scale computer models. Phased-array technology will increase fundamental understanding of storm evolution, in turn leading to improved computer models, more accurate forecasts, and earlier warnings. Not only will phased array technology significantly improve severe weather detection and forecasting, but it will simultaneously track non-cooperative aircraft in three dimensions, possibly detect certain kinds of chemical and biological airborne releases, and provide rapid updates of winds to track and forecast the path of these releases.

For more information:

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Phased-Array Radar

Tornado/Severe Storm Research

Partners in the development of phased-array:

NOAA Budget FY 2004 Change

Office of Oceanic and Atmospheric Research
Weather and Air Quality Research
Other Partnership Programs
Tornado/ Severe Storm Research

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$1.0M