

# Preliminary Insights into Operational Benefits of Phased Array Radar

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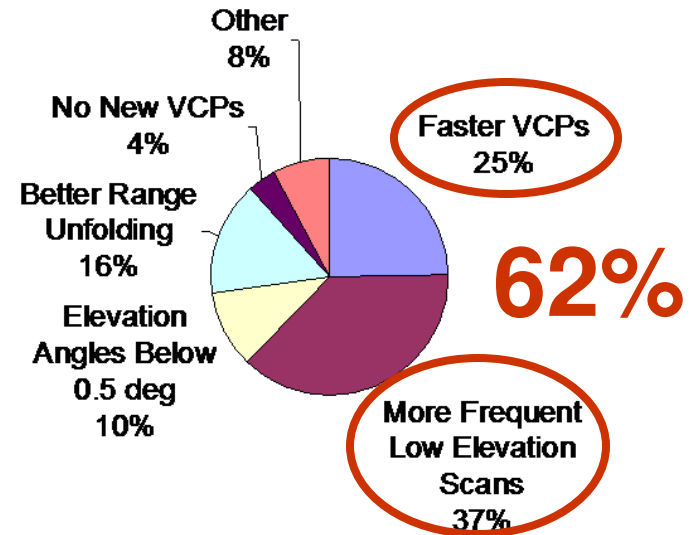
# Why Research PAR Capabilities?

1) Current technology is 20-years old



2) Stakeholder needs (N=80)

*Which type of scanning improvement do you consider most important?*



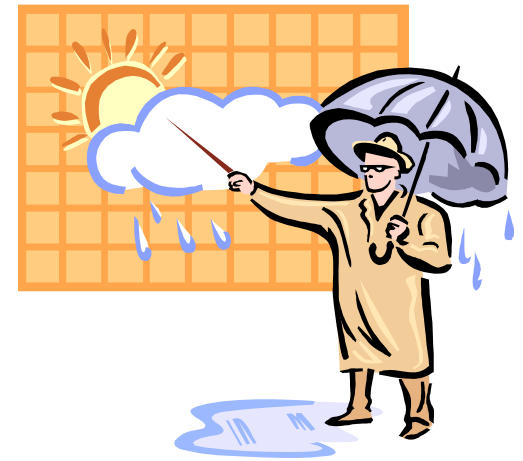
# Identifying Strengths & Limitations of Current Radar Systems

## Purpose

Understand stakeholder needs in order to assess suitability of PAR as a useful weather radar technology

Who: NWS and Broadcast Meteorologists

Methodology: Use the critical incident technique to interview radar users.



# Critical Incident Technique helped pilot recruitment during WW II





# Identifying Strengths & Limitations of Current Radar Systems

## Purpose

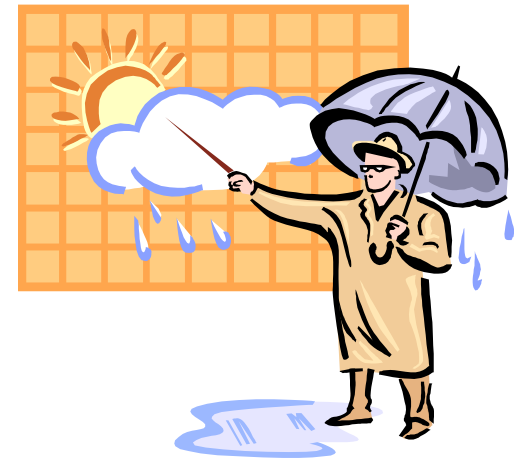
Understand stakeholder needs in order to assess suitability of PAR as a useful weather radar technology

**Who:** NWS and Broadcast Meteorologists

**Methodology:** Use the critical incident technique to interview radar users.

**Critical incident technique:** Ask participant to recall critical incidents which illustrate strengths and limitations of radar.

**Collaborators:** Daphne LaDue and Jennifer Newman

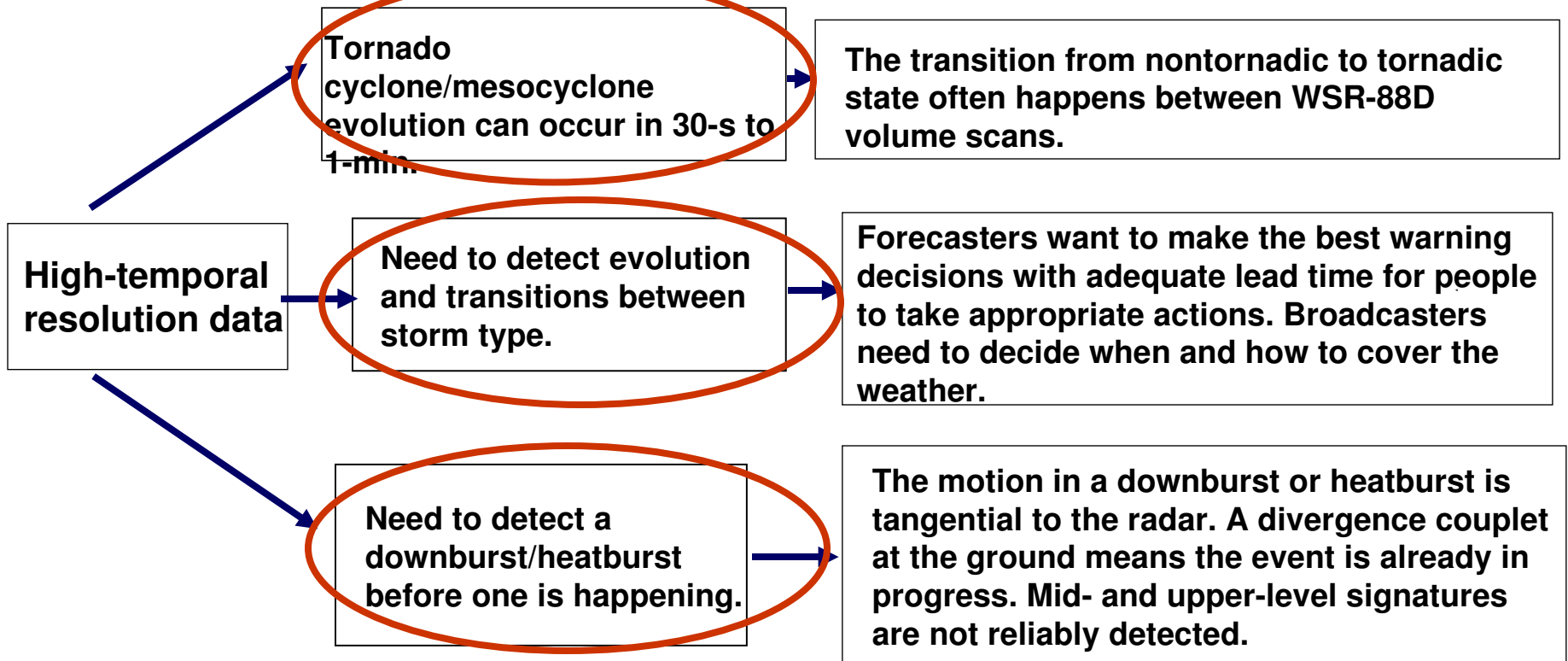


# Identifying Strengths & Limitations of Current Radar Systems

## USER NEED

## PROBLEM


## WHY



# Objective

***Determine how to best capitalize on PAR capabilities to address 21st century forecast and warning needs***



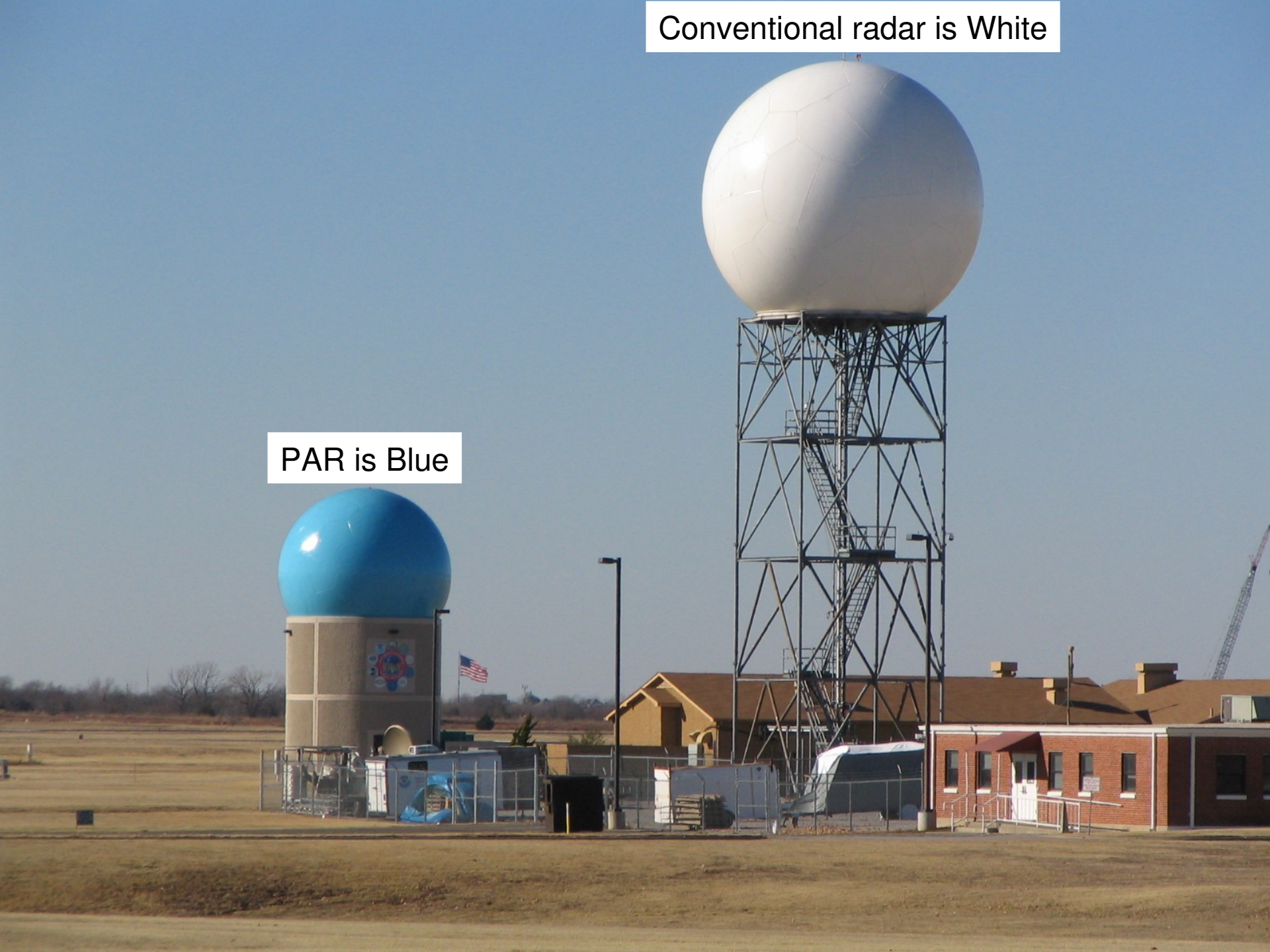


*What is the difference between  
the  
WSR-88D and Phased Array  
Radar?*



Conventional radar is White

PAR is Blue



# Weather Radar Antennas: Conventional and Phased Array

## Conventional Antennas

Mechanical scanning via rotation of the antenna (Smearing)

☹ Limited Scanning Capabilities



## Phased Array Antennas

Electronic scanning with fixed antenna (No Smearing)

☺ Flexible Scanning Capabilities





# Other methods for obtaining higher-temporal resolution data

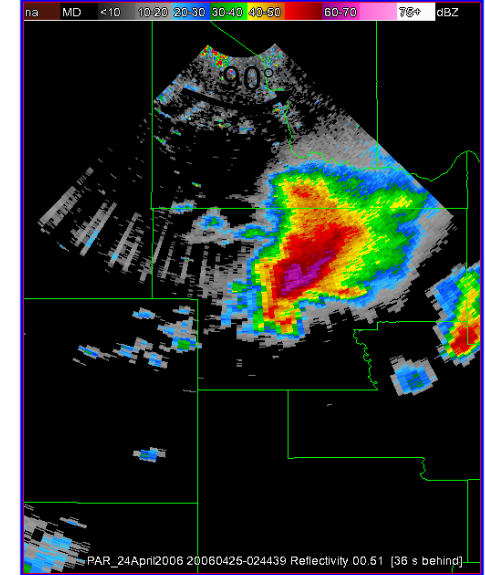
Ultimate Goal



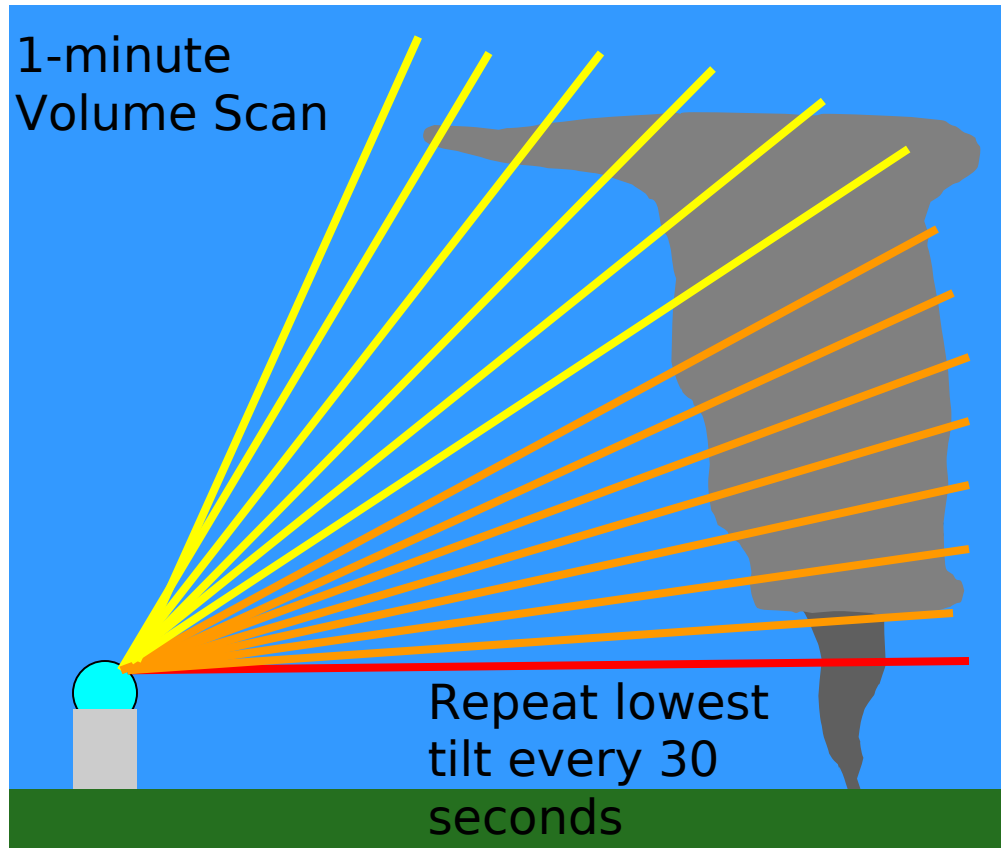
What we have now



1-min Scan Rate



# Other methods for obtaining higher-temporal resolution data



# Experiment Overview

## WHO

19 National Weather Service forecasters from 17 Offices

## WHAT

Analyze PAR and WSR-88D data during real-time and playback events

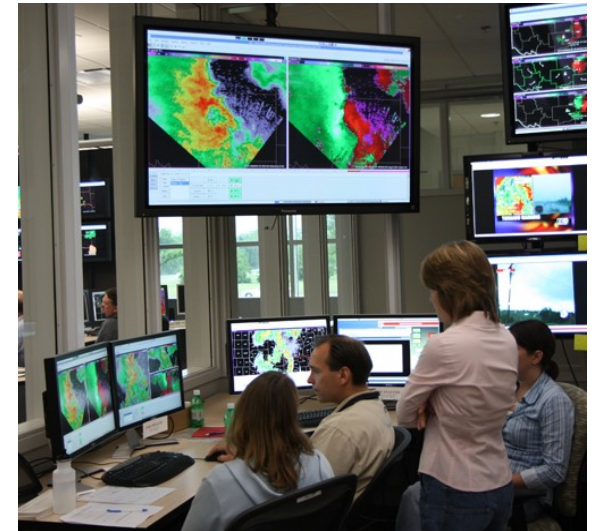
Issue warnings; respond to survey

## WHEN

28 April – 6 June 2008; Mon – Thur, 1 – 9 pm

## WHERE

NOAA HWT, NWC, Norman, OK





# Experiment Overview

## WHY



### To assess:

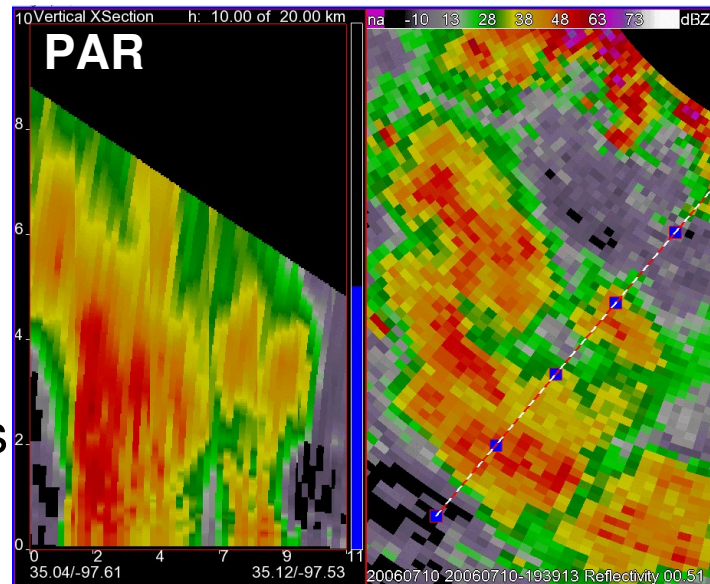
- 1) Strengths and limitations of PAR data in analysis of severe storms
- 2) How characteristics of PAR scan strategies affect interpretation of severe storms
- 3) How PAR data affects warning decision making
- 4) How PAR data may be of benefit to operational responsibilities

# CASE #1: Microburst (N=17)

10 July 2006

**PAR**

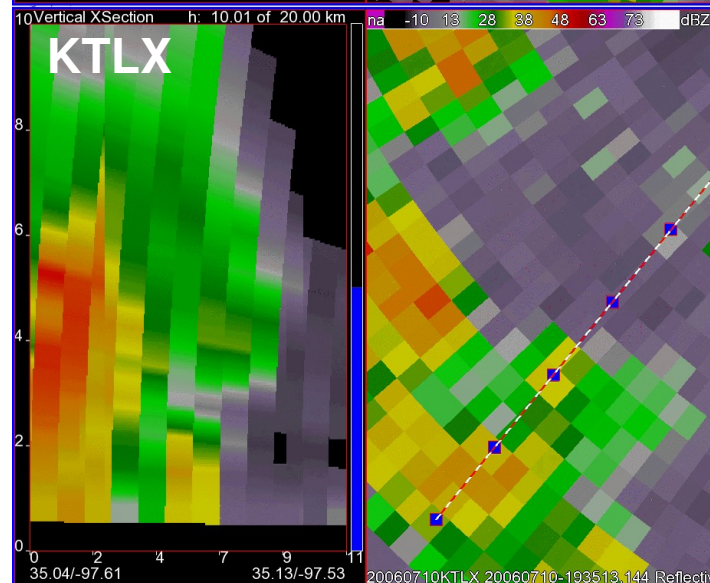
VCP 12 BMX  
90° sector  
Images ~ 34 s



**WSR-88D**

VCP 12

Images ~ 4.1 min



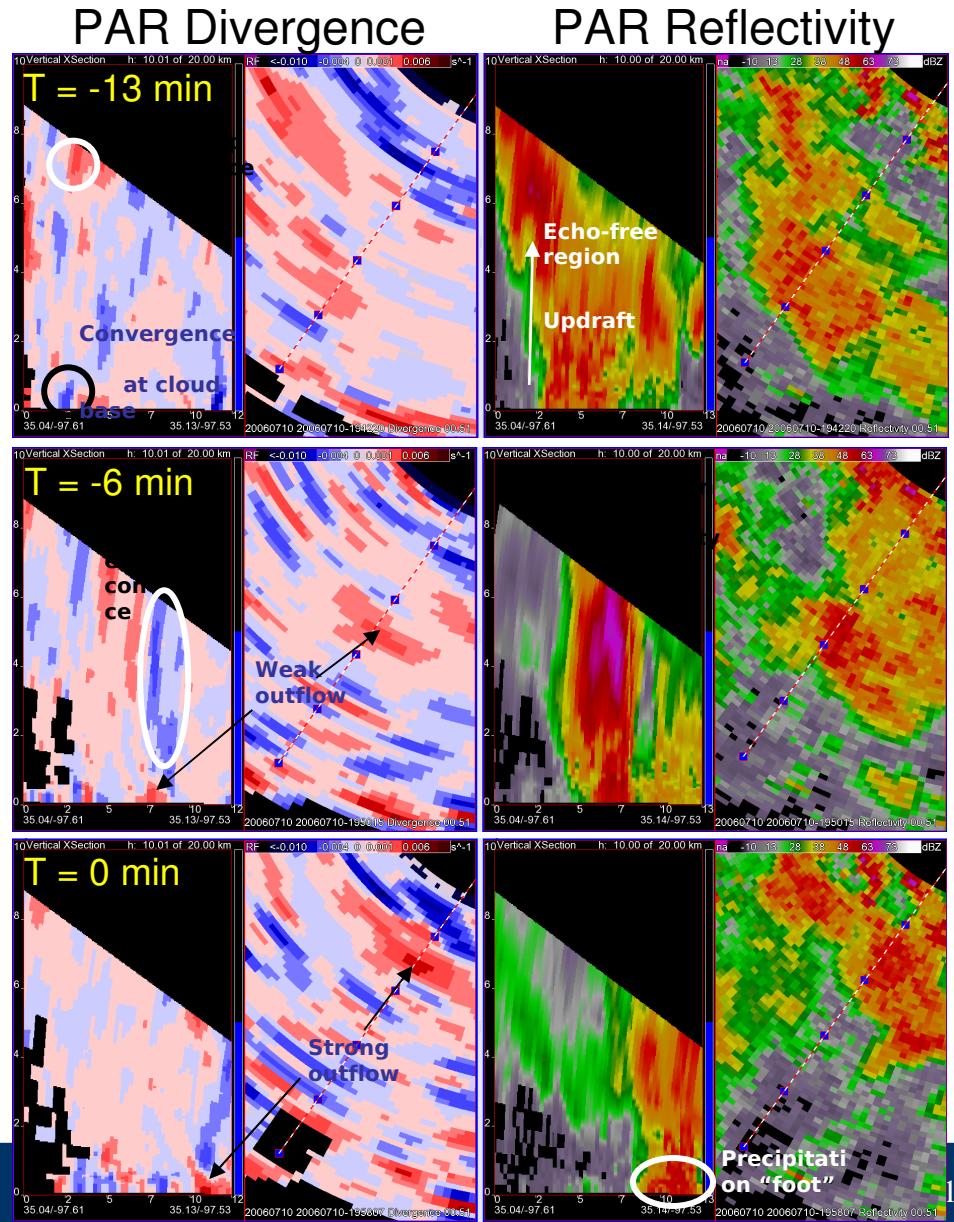
# Benefits of High-temporal Sampling

Be prepared to make better  
 predictions of  
 microburst development

*"You can diagnose better what's going on so you can have more evidence in issuing or not issuing ground level severe winds which were considerably under-played by KTLX, 27 kt vs 57 kt."*

Words used to describe the data:

*"very useful"*  
*"extremely helpful"*  
*"valuable"*





# Benefits of the Project Support System (PSS)

## Detailed Analysis of

PAR developing

signature storm

60° sector

“Allowed the tornado

structure & evolution

“Rapid updates 3-4 min

before”

case; rotation and the

signature appeared on

features.”

to with higher

confidence.”

Images ~ 4.1 min

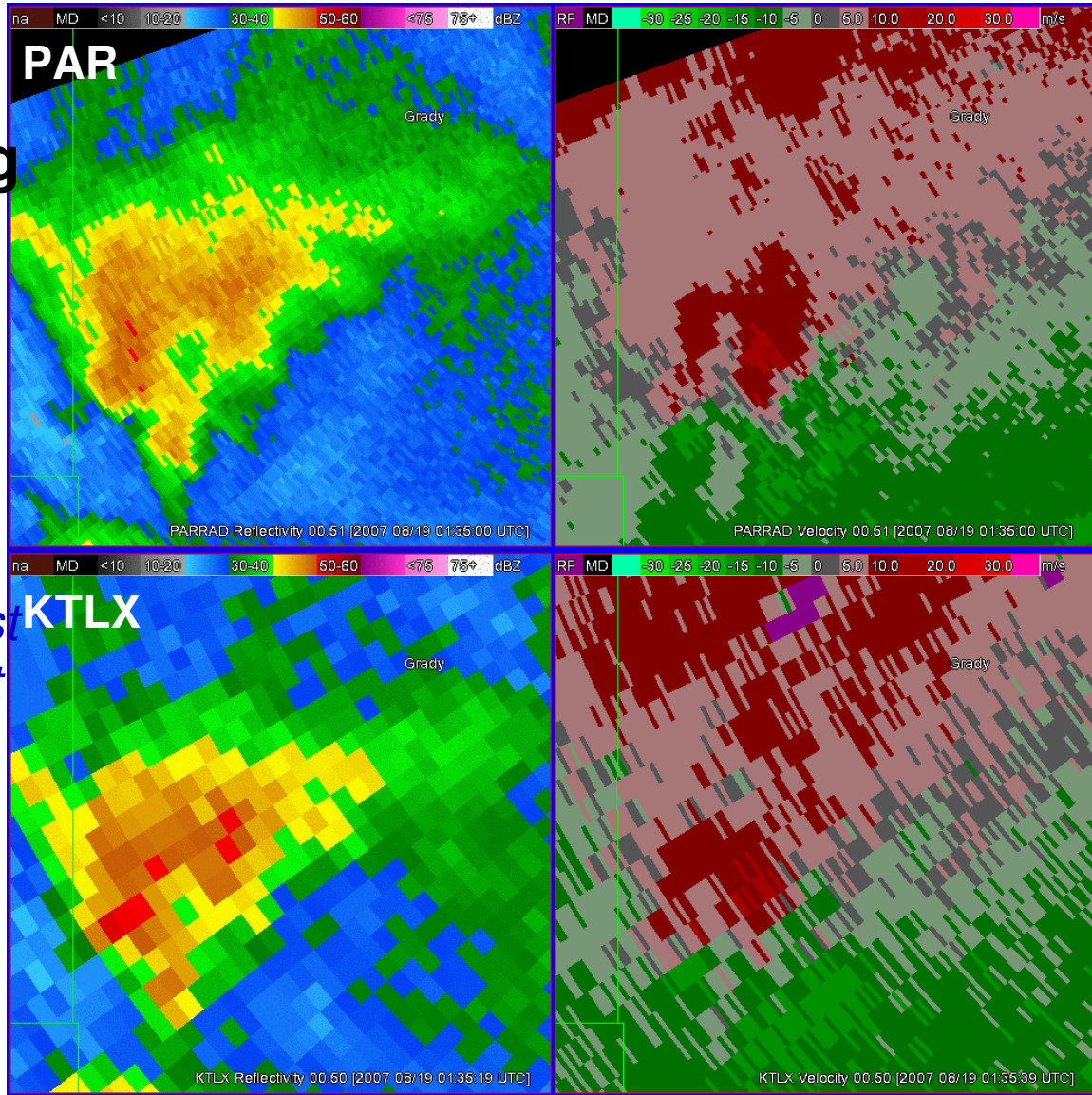
Images ~ 43 s

Images ~ 4.1 min

Images ~ 4.1 min

Images ~ 4.1 min

Images ~ 4.1 min



# Concept of Operations

## *Recalibration of the warning decision process*

*Need to gain experience as to how many consecutive scans need to be examined prior to issuing a warning*







# What have we learned?

## Objective:

Determine how to best capitalize on PAR capabilities to address 21<sup>st</sup> century forecast and warning needs.

## For the two cases evaluated by forecasters:

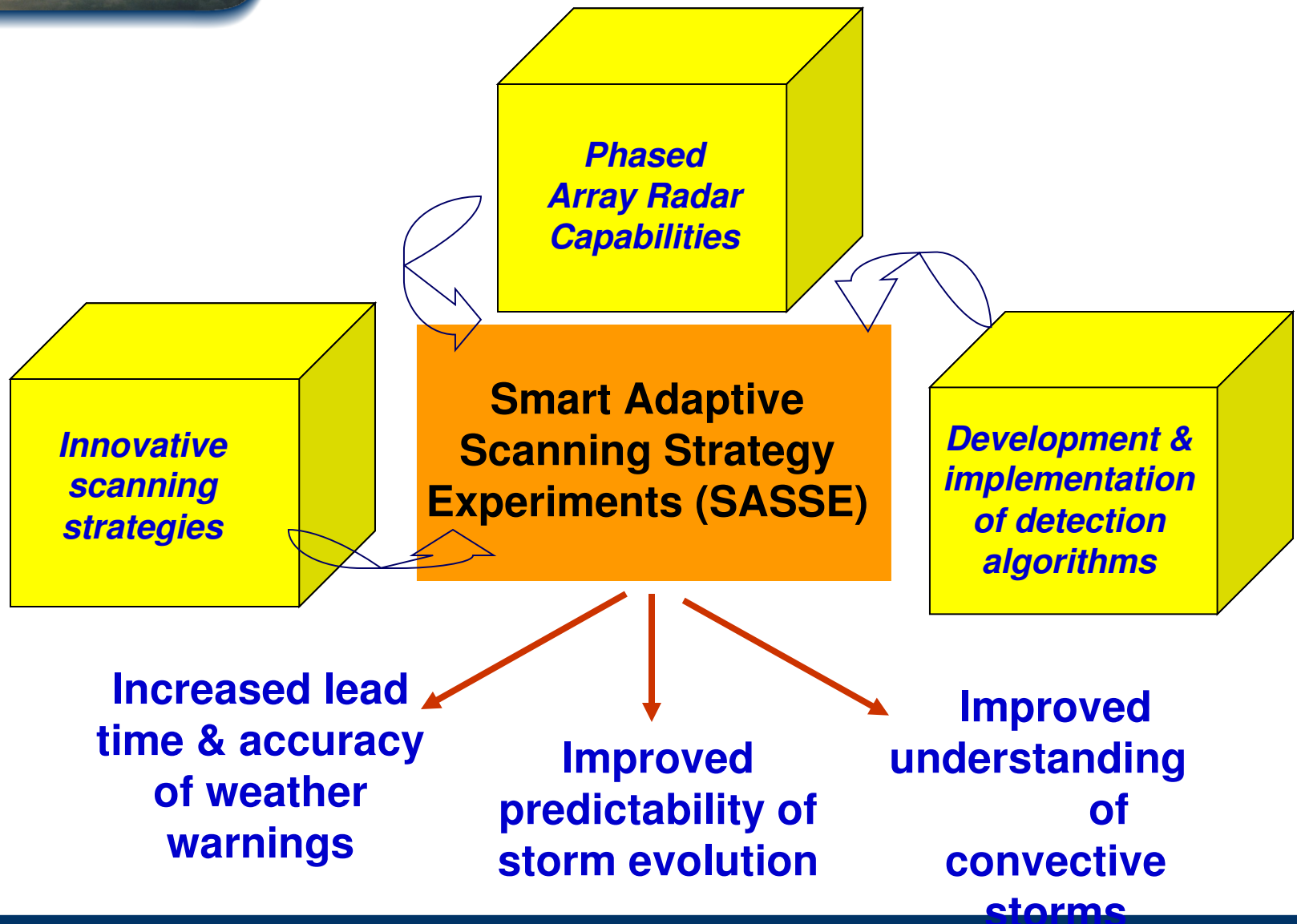
High-temporal sampling was beneficial to their warning decision-making process

Improved capability to identify, analyze, and monitor storm processes related to severe weather

Few minutes additional lead time

Higher confidence in decision-making

# Next Steps



# Made Available by US Navy

Spy-1A Antenna

+

Partnership

=

PAR

