





# Supplementary Weather Radar Network in Washington

Tara Leigh Goode, Vice President, Strategic Partnerships & Radar Operations Apoorva Bajaj, Government Business Development Executive Tuesday, March 26, 2024

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**Our Progress** 

**Benefits for Weather Sensitive Industries** 

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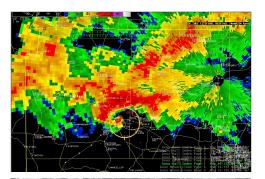
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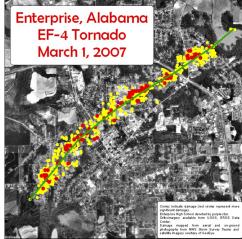
**Our Approach to Partnership** 

**Installation Process** 



### Why am I here?















### OUR MISSION

We fill gaps in traditional weather surveillance to help better prepare and respond to increasingly volatile weather patterns.

### Climavision: Weather Intelligence & Analytics Of The Future

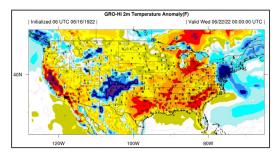
Building a national supplemental weather radar network...

... and a new Al Powered approach to NWP...

... to develop market leading analytics and forecasts



- Filling low-level data voids in the U.S. network
- Solid-state, dual-pol, X-band weather radars at 10x the resolution of S-Band radars



Leverage high-resolution observational data sets & Al climate tech to fill blind spots in existing forecasts.

- 1.5 billion global observational datasets captured daily
- Rapidly assimilate new and novel third-party datasets



Leading point-forecast solutions with #1 wind speed forecast and an asset-level database for hyper-tailored views of renewable generation



New approach to Numerical Weather Prediction that forecast the growth of major storm systems and big atmospheric changes with precision & speed.



Powered by in-house and cloud-based super-computing capabilities

Climavision is building next-gen weather solutions to fill long-standing gaps and address the challenges of a changing climate

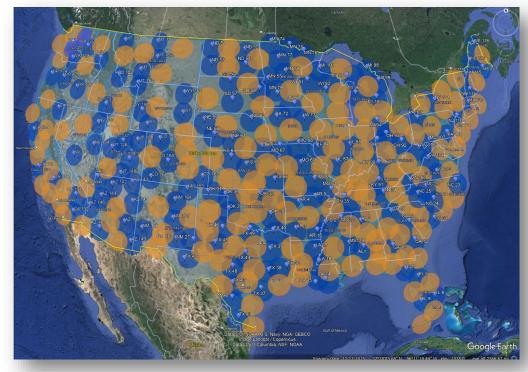


### Climavision Supplementary Radar Network

200+ RADARS OVER NEXT 4 YEARS!



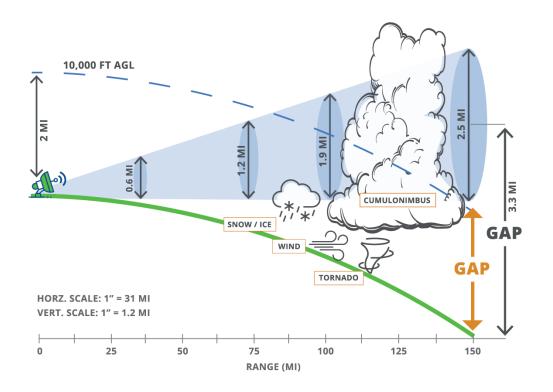




< 4,000 feet AGL

Not every community has complete weather radar coverage — low-level radar data gaps exist — in every state across this country. **Many are in rural communities**. It is a national problem that we are focused on fixing.

### **Why Do Coverage Gaps Exist?**



- The Earth is not flat the planet's curvature in tandem with radar beams that climb higher into the atmosphere the further you move away from each radar are the key factors
- Blockage can also be significant in mountainous regions or urban areas.
- Filling in these blind spots is critical for:
  - Flash floods
  - Low-level winds
  - Tornadoes
  - Improved forecast modeling which depend on measurements near the surface





### **Americans At Risk**

SEVERE WEATHER STATS





An estimated 60 million people, or one in five residents live in rural America, that consists of 97% of the US land mass.

-US Census Data 2020



There are about 100,000 thunderstorms each year in the United States. About 10% of these reach severe levels.

-NOAA/NWS Storm Prediction Center



98%

Only 80% of tornadoes and wind events are detected by NEXRAD <4000 AGL. With Climavision radars detection would increase to 98%.

-Dr. Micheal Simpson, 2024



**85%** 

Once the Climavision RaaS network is complete, 85% of the country will have maximum low level radar coverage.

-Dr. Micheal Simpson, 2024





Climavision is the recipient of a \$100 million strategic investment from The Rise Fund, TPG's global impact investing platform and the world's largest impact investing platform committed to achieving measurable, positive social and environmental outcomes alongside competitive financial returns.

### **Investing in the Future**

CLIMAVISION IS INSTALLING 200+ HIGH RESOLUTION WEATHER RADARS ACROSS THE COUNTRY TO SUPPORT EMERGENCY PREPAREDNESS

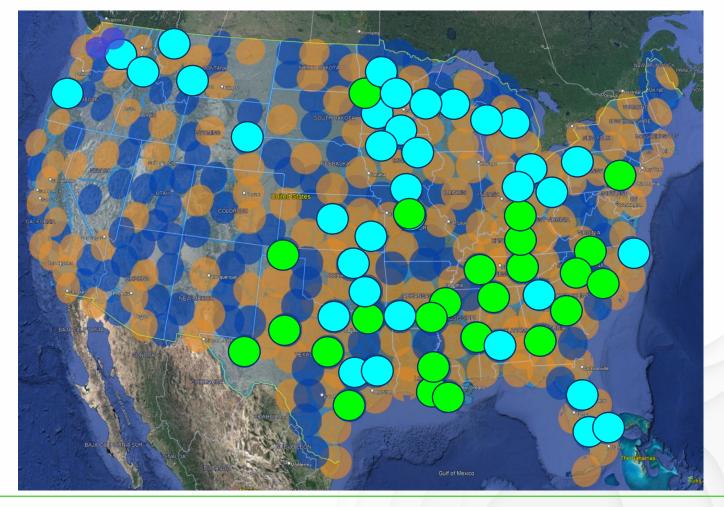
26

INSTALLED RADARS SINCE 2021 14

STATES WITH CLIMAVISION RADARS

#### NOAA OFFICES EVALUATING CLIMAVISION RADARS

- NATIONAL SEVERE STORMS LABORATORY
  - STORM PREDICTION CENTER
  - NWS RADAR OPERATIONS CENTER
- WEATHER FORECAST OFFICES ACROSS SOUTHERN & EASTERN REGION



## Operational Fleet & Plan

As of March 18, 2024







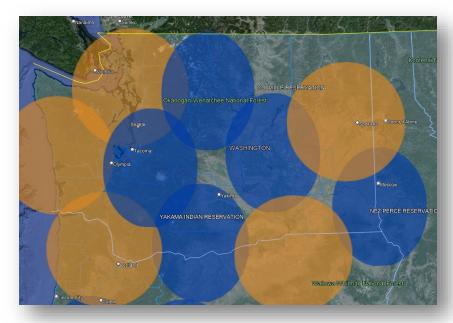
Operational (25)





### **Washington Plans & Progress**

- Up to 4 radars planned for Washington at NO COST to community.
  - Siting efforts have begun in Chelan
  - Radars are ready and stored in our warehouse
- Company will enter into "radar-as-a-service" contracts with government agencies and other weather-sensitive industries.
- Climavision owns, operates, and maintains radars.



Blue circles show 60 miles coverage provided by planned Climavision radars.







We are entrenched in the public safety & emergency management community

- Visited 59 cities in 16 states
- Hosted 24 Training **Sessions with Public** Safety officials from over 42 counties
- Participated in 21 **Emergency Management** conferences

- Installed 26 weather radars in 14 states
- Secured 34 radar partnerships
- Secured exciting partnership with Millersville University and Texas A&M University.





### **Private Solution to a Public Safety Challenge**

We take on the burden of infrastructure and get new, low-level data into the right hands

#### Most agree, low-level observations are needed

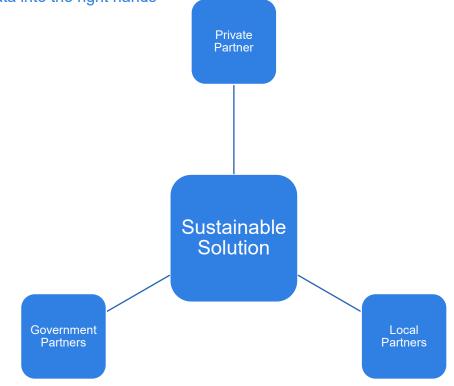
Challenges to solutions:

- Limited funding
- Ongoing investment
- Novel expertise
- Speed

#### We're designed to address these challenges.

Our partnerships:

- Accelerate the solutions radar site partners
- · Take on the burden of ownership
- Enable faster, downstream solutions
- · Are not transactional, we embed with communities
- Are comprehensive





## Our Partners are Enthusiastic & Passionate

They don't view this as someone else's challenge – they view this as a community challenge

#### **Columbia County, GA**

"Every citizen would want this. If you can even have an extra 30 seconds of time during weather events, I think it can inevitably save lives and that's our job." – Shawn Granato – Columbia Co EMA Director

#### **Scotland County, NC**

"Early detection is key. In our profession, the sooner we can be alerted to what's coming our way, the sooner we can notify our citizens. If we can achieve that, we're in a better position to save lives."

- Robert Sampson - Scotland Co EMA Director

#### **Grant County, KY**

"Hopefully this radar will give a little bit more info to keep people safe. Anytime you can do that, you've done your job in public safety."

Ken Little – Dry Ridge, KY City Administrator

#### **Grant County County, MN**

"We just want to supplement what [NWS] is already doing, and they're very good at their job. But we don't know what we don't know. If we can't see an area of the atmosphere, and that happens to be a part of the atmosphere where the weather's developing or the weather is happening, that is a concern for all of us." — Tina Lindquist — Grant Co EMA Director

#### **Russell County, KY**

We can't prevent something from happening, but this tool will give us a clue as to what areas we need to get into, what we're going to have to do, and hopefully help us know what kind of resources we need to apply to the situation." – Randy Marcum – Russell Co Judge

#### **Millersville University, PA**

This will serve the region really well when we have high-impact weather...it's another learning opportunity for students to better understand the different types of radar and the different types of data from those radars and how the combination of that will build a very powerful network of information."

– Dr. Sepi Yalda, Millersville University Profession and CDRE Director



### **Public/Private Partnership**

We partner with communities to find homes for radars.

#### **Municipal Partner to Provide Location for Radar**

Climavision is looking for permission to place the radar on your existing infrastructure.

A no-cost lease agreement is proposed, which outlines the county's access to the data and Climavision's access to the site. It also protects the municipality from any liability, cost, maintenance, or ownership of the radar.

#### LEASE AGREEMENT

1. PREMISES. Landlord hereby leases to Tenant, and Tenant hereby leases from Landlord, space on a water tower structure owned and operated by Landlord and certain land (collectively, the "Premises"), namely said tower being located at (lat/long) (the "Tower"), said demised space on the Tower being that area used to install and attach the radar system as shown on Exhibit "A" attached hereto ("Radar System"), and said demised land being a tract of land upon which a concrete pad, utility meter(s), emergency generator, and control cabinet will be placed thereon. ("Ground Equipment") as denicted on

#### **Climavision To Provide Data Access**

In exchange for a location for the radar, Climavision would provide the municipality with access to a live radar viewer which can be accessed via a URL. This data can be used by anyone within the county who works for the government - school boards, EMA, fire, police, and city/county leadership are common examples. This data is sold to others but would be free for you.







### **The Technology: X-Band Radar**

### Climavision

#### X-BAND RADAR

- Small dish 8ft
- Small radome 12ft
- 9200-9700mhz
- Low power for more scanning flexibility
- 10x resolution of S band
- Range 60 miles
- Sustainable, long-term solution

#### C-BAND RADAR

- Medium dish 14ft
- Medium radome 20ft
- 5200-5700mhz
- Medium power, medium range
- Typically media or privately owned
- Heavier and more expensive

#### S-BAND RADAR

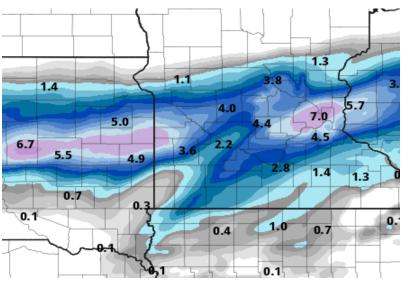
- Massive dish 20-28ft
- Massive radome 40ft
- 2700-2900mhz
- High power for long range scanning
- Govt-owned, closed frequency
- Heaviest and most expensive



### **Western MN Snow**

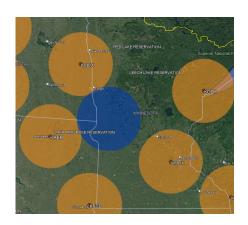
February 14, 2024

On Valentines Day, snow was reported near Climavision's Wendell, MN radar site. The image below shows snowfall totals reported from a variety of locations. Nearby NEXRAD radars overshot the precipitation that made it to the ground, leading to underestimations in the expected precipitation, whereas Climavision's Wendell radar was able to detect heavier bands of snow.







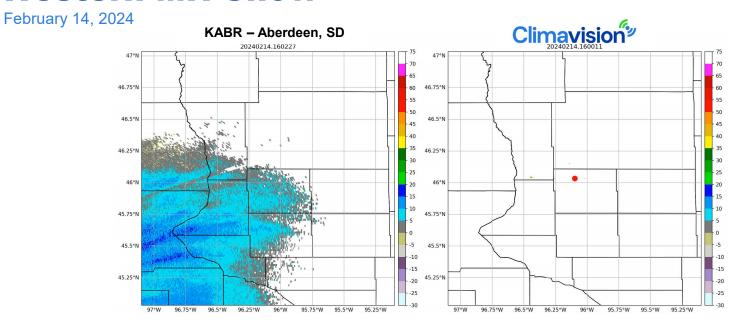


Climavision's radar in Wendell, MN sits in a prominent weather radar gap. The two closest NEXRAD radars sit over 100 miles away in North Dakota and South Dakota. The radar beams from KMVX and KABR sit at over 12,000 ft AGL over Wendell.

Data: 48-Hour Snow Accumulation via PivotalWeather Photos: twincities.com (top), nujournal.com (bottom)



### **Western MN Snow**



Climavision's radar imagery (right) showcases heavier bands of snow to the southeast of the Grant County radar location that KABR overshoots. With the supplemental low-level coverage, we are able to identify the heaviest bands of snow and better understand the precipitation that actually made it to the surface.



### **Pennsylvania Snow Squalls**

March 28, 2022

On Monday, March 28<sup>th</sup>, 2022, sudden, low-level snow squalls moved into Schuylkill County, PA causing an 80-car pile-up and 6 deaths. Response efforts were challenged because of the extreme weather and on the ground conditions. Because there was no weather radar visibility in this area, the squalls come in seemingly out of nowhere allowing minimal time for preparation or warnings.

https://www.pennlive.com/news/2022/03/i-81-snow-squall-crash-update-6-killed-24-hurt-80-vehicles-involved-investigators-say.html

Pileup in Pennsylvania caused by snow squall led to 6 deaths and involved 80 vehicles, police say

By Laura Studiey, Eric Levenson and Caroll Alvarado, CNN
(9) 3 minute read - Updated 8:09 PM EDT, Wed March 30, 2022



NEWS

I-81 snow squall crash update: 6 killed, 24 hurt, 80 vehicles involved, investigators say

Updated: Mar. 30, 2022, 5:50 p.m. Published: Mar. 30, 2022, 10:40 a.m.



Advertisemen



"We didn't see it coming."

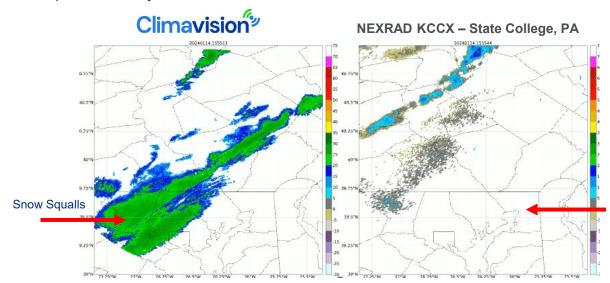
Orange circles represent NEXRAD systems out to 4,000ft AGL. Blue circles represent radar "gaps" and planned supplemental Climavision radar sites – areas with diminished coverage beyond the low-level visibility of NEXRAD systems. The nearest NEXRAD radar to Schuylkill County is over 9,000ft AGL leaving anyone who lives under that level vulnerable to volatile weather impacts.



### **Pennsylvania Snow Squalls**

January 14, 2024

On January 14<sup>th</sup>, several warnings were issued for snow squalls across southeastern Pennsylvania. Climavision radars were able to clearly detect these events while the nearest NEXRAD radars overshot some of the snow bands that occurred. The nearby Weather Forecasting Offices (WFO's) now have this information through a limited access. In the image below, Climavision's radar in Millersville shows superior continued tracking of the snow squalls as they continued eastward.



MARYLAND

MARYLA

Climavision now has a live system in Millersville, PA, With a range of 60 miles, the radar now fully covers the "gap" area in blue. The nearest NEXRAD radar to Millersville is KLWX in Sterling, VA which has a radar beam height of ~8,300 ft AGL followed by KCCX, ~9.8k ft AGL, and KDIX ~10k ft AGL. Climavision's radar can see from 150 ft AGL and up, better detecting weather phenomena near the surface and showcasing the power of a supplemental weather radar network. With both data sets, we have a better chance of protecting people and minimizing the detrimental and costly impacts of volatile weather, which often occurs in these lower levels.

Snow Squalls not visible on NEXRAD

HO:42

→ Post

MU Weather Center @MUweather · 21m
The new X-Band radar at @millersvilleu was undoubtedly of great assistance to the @NWSStateCollege and @NWS, MountHolly in issuing Snow Squall Warnings yesterday. The @climavision gan-pfilling radar can "see" the snow squalls in these areas due to the beam not "overshooting" them.

Mike Stanislaw @mikestanislaw · 12h
3rd busiest day for snow squall warnings in Pa, & as far as I'm aware no major pileups or fatalities. Hopefully in part to the great NWS teams working today. It's not easy to nail these down in poor radar...

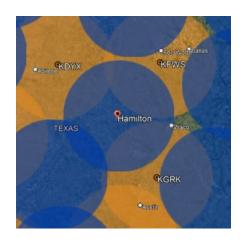


### **Hamilton, TX Wind Damage**

January 8, 2024

On January 8<sup>th</sup>, damage was sustained by the Hamilton Municipal Airport in Hamilton, Texas. No warnings were issued, and the SPC did not receive any wind or tornado reports, but damage at the airport is evidence of a strong storm.





Climavision's radar in Hamilton is in a prime location to detect weather phenomena just above ground level at the Hamilton Municipal Airport. Next nearest radar beam heights above Hamilton are:

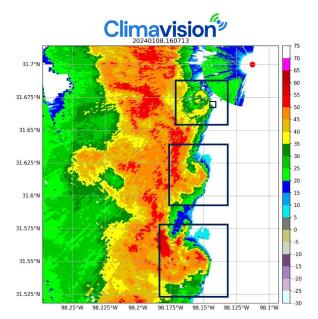
KFWS ~ 6,300 ft AGL KGRK ~ 6,800 ft AGL KDYX ~ 7,400 ft AGL

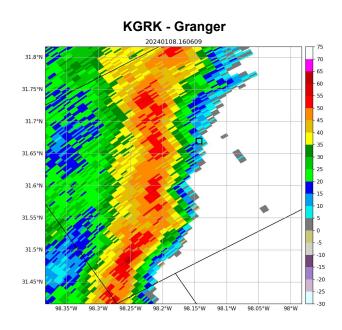
Credit: City of Hamilton Administration, Ryan Polster



### **Hamilton, TX Wind Damage**

January 8, 2024





Climavision's reflectivity indicates front reflectivity notches (highlighted w/ navy boxes). Working in conjunction with the radial velocity from Granger, one would be able to determine the beginning stages of rotation in these locations.



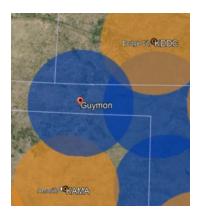
### **Oklahoma Fire**

March 3, 2024

At the beginning of March, several blazes were burning across Oklahoma and Texas, fueled by dry conditions and high winds. One of these fires occurred near Climavision's radar site in Guymon, Oklahoma. Nearby NEXRAD radars did not pick up on the smoke, but Climavision's radar was able to detect smoke plumes across the OK Panhandle.



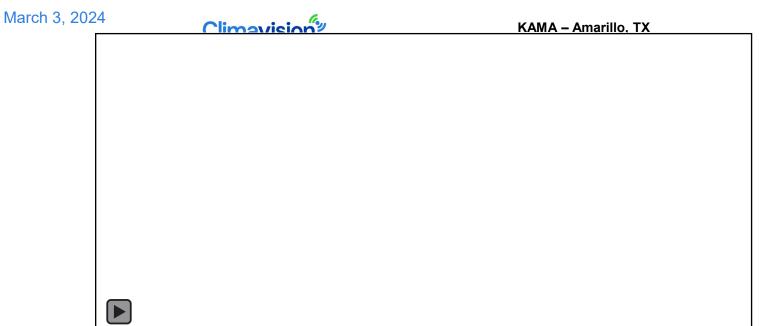
Photo of neighboring fires on the Texas panhandle Courtesy of Brandon Sullivan, Climavision VP of Product



The next nearest radars to Guymon, Oklahoma are in Amarillo, TX and KDDC in Dodge City, KS. Their respective beam heights over Guymon are: KAMA ~8.3k ft AGL KDDC ~10.8k ft AGI



### **Oklahoma Fire**



Climavision's radar imagery (left) clearly detects smoke plumes throughout Texas County and near the Oklahoma/Texas border. On the right-hand side, the KAMA NEXRAD in Amarillo, TX is not able to detect the smoke plumes that occur at ground level and just above.



Climavision Benefits for Weather Sensitive Industries

### Climavision Our Business Model

#### **Unique Solution**

We front the cost of the radar and then monetize data access for many industries. This allows us to pay for the technology and provide the data back to our community partners for free.

#### Radar-as-a-Service

Removes the costly infrastructure burden of owning, maintaining, and operating your own system and allows more entities to benefit from additional weather surveillance information.



Media



Insurance



Government



Agriculture



**Energy & Utilities** 



Drones & Advanced Aerial Mobility



Aviation



Transportation



### **Collaborations & Partnerships**

#### **GOVERNMENT**

- CRADA (Cooperative Research and Development Agreement) with NOAA Research-NSSL
- National Mesonet Program Contract
- Local Public Safety Access

#### **ACADEMIA**

- Millersville University
- Texas A&M University







### **Numerous Benefits For Rural Communities**

- Early Warning and Preparedness
  - Improved Alerts
  - Preparedness Planning



- Emergency Services
- Search and Rescue Operations
- Infrastructure and Transportation
  - Road Conditions
  - Bridges and Infrastructure Damage
  - Flood Prevention and Management







### **Numerous Benefits For Rural Communities**

- Energy Infrastructure Optimization and Reliability
  - Power and Grid Management
  - Outages
- Improved Agricultural Practices
  - Precision Farming
  - Drought Monitoring
- Insurance and Risk Mitigation
  - Risk Assessment





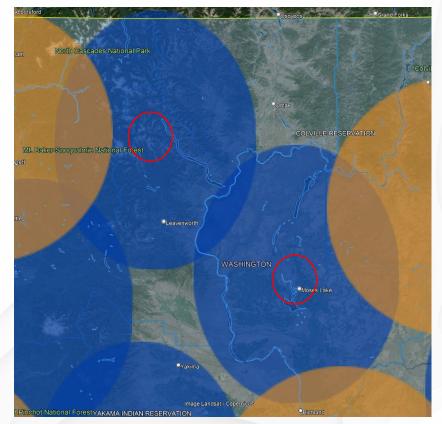


# **Gaps in Your Region**

These circles represent ~60 mile radius in coverage.







These circles represent a notional plan.



## **Site Selection - Meteorology**

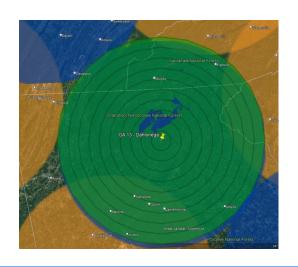
How do we evaluate from a meteorology perspective?

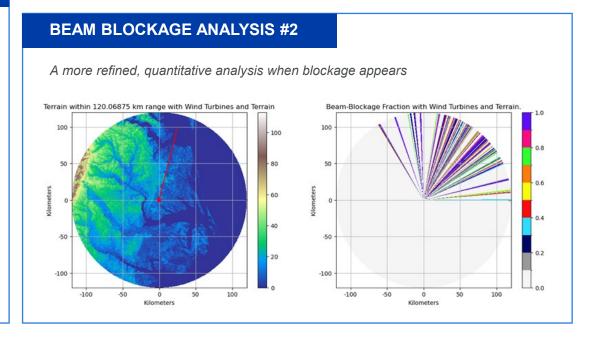
#### **Potential Considerations**

- Wind turbines
- Any immediate points of blockage
- Ground elevation
- Structure height

#### **BEAM BLOCKAGE ANALYSIS #1**

A general analysis that we can run in Google Earth







## **Site Selection**

What types of structures are good candidates from a structural perspective?

#### Good



We can co-exist with comms antennas that may be on top of water towers or rooftops.

**Composite Water Tower** 



Tall Building w/ Flat Roof



Single Pedestal Water Tower



Multi-leg Water Tower

### **Not the Best**



Standpipe



Old-Fashioned Water Tower



Structure with comms tower immediately next to it



Above-ground storage tank

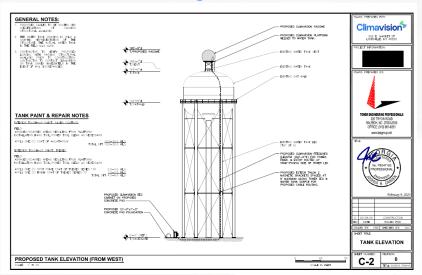


# **Engineering**

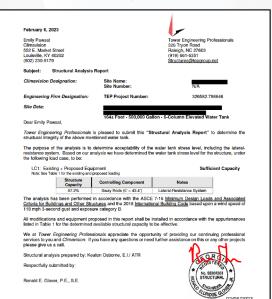


We conduct a structural analysis and will provide a full set of construction drawings before installation.

## **Construction Drawings**



## **Structural Analysis/FEA**



## **Installation**

After approval is received, this is what you could expect from an install perspective.

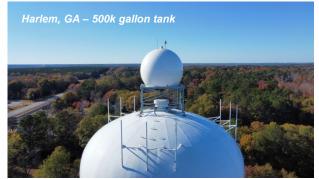
Climavision coordinates all of this.

# **Install Prep Utility Coordination – get the site "Radar** Ready" 1. Electric Nat gas/propane Fiber Tank inspection/repair (internal and external) 1. Tank maintenance providers Disinfection method Paint specs 3. Antenna relocation or special project considerations

#### Install

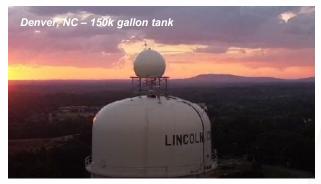
- 1. 7 day for install
- 2. Assemble equipment on ground
- 3. Lift and secure radar
  - The four footers of the radar's platform are secured via welding
  - 2. Crane onsite for ~4 hours.
- 4. Run cables, weld inspection/repair, test equipment, and clean up site

## **Recent Installations**













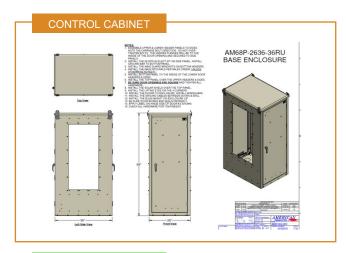


# **Platform and Cabinet Specs**

#### RADAR PLATFORM



Radar platform is 12'x10' and represents the footprint of the radar. The legs are adjustable and can be fully extended up to 7ft. Includes lightning rod and aircraft warning lights







# **Partnership Timeline**





These are typically the next steps.





# Thank you

**CLIMAVISION.COM** 

**CONTACT** 

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Apoorva.Bajaj@climavision.com

Tara Leigh Goode, VP, Strategic Partnerships and Radar Operations

Tara.goode@climavision.com

SEE WHAT YOU'VE BEEN MISSING

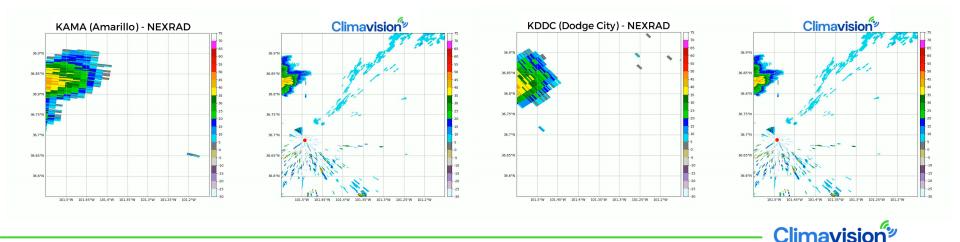
## **Texas County, OK Tornado**

June 27, 2023

A tornado near Climavision's Guymon, Oklahoma radar was spotted by broadcast media on June 27<sup>th</sup>, per SPC reports, before becoming rain wrapped. Climavision radar was able to detect and track this specific tornado incidence with high resolution and clarity.



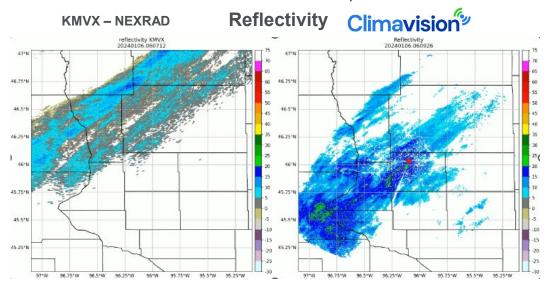
The beam height from Climavision's Guymon radar over Adam, OK is approx. 1,300 ft AGL whereas the beam from KDDC is approx. 8,600 ft AGL and KAMA 11,000 ft AGL.

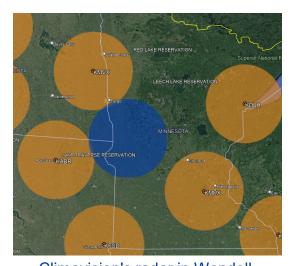


## Wendell, MN Snow - Jan.

January 6, 2024

Climavision's Wendell radar captured snow for several hours on January 6<sup>th</sup>. There was notable snowfall caught by Climavision's radar for both Traverse and Big Stone counties that was missed by NEXRAD radar, as well as for Grant and surrounding counties. High resolution by Climavision is also showcased in the radar loop below.





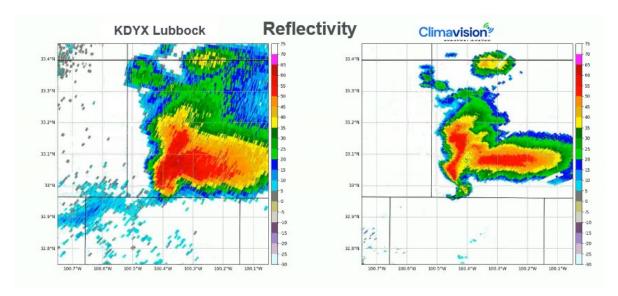
Climavision's radar in Wendell, MN sits in a prominent weather radar gap. The two closest NEXRAD radars sit over 100 miles away in North Dakota and South Dakota. The radar beams from KMVX and KABR sit at over 12,000 ft AGL over Wendell.



## **Stonewall County, Texas Tornado**

June 17, 2023

A Stonewall County tornado was indicated by storm chasers and locals on social media on June 17, according to the SPC. The first signs of a tornado were detected by Climavision's Snyder radar at 6:02 pm CDT (2302 UTC). NWS tornado warning was not issued until 6:23pm CDT (2323 UTC). Using the Climavision and NEXRAD radar networks in conjunction will improve tornado detection and lead to earlier warning times to protect life and property.



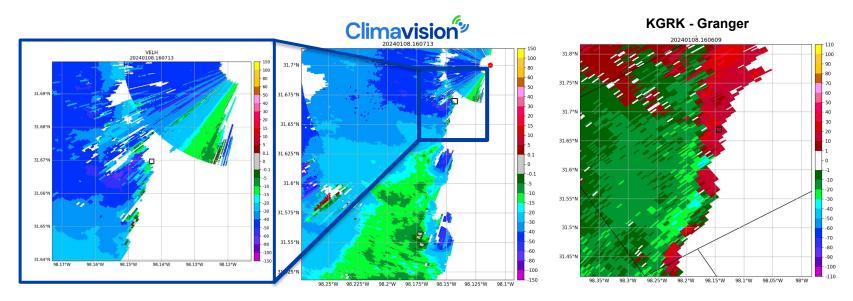


The beam from Climavision's Snyder radar that picked up the tornado is 1,500 ft above Stonewall County compared to the 5,600 ft height of the KDYX Lubbock radar beam.



## **Hamilton, TX Wind Damage**

January 8, 2024



Climavision's radar imagery (left) showcases wind speeds near 65 mph as the line of storms approached the airport. This can be seen by the values in purple on the popout image. KGRK shows lesser storm velocities that wouldn't necessarily indicate wind speeds capable of damage, as well as the beginning of rotation on the leading edge of the storm.

