

**GOES-R and JPSS Proving Ground Demonstration Proposal:
Hazardous Weather Testbed – 2026 Spring Experiment**

1. **Project Title:** 2026 Geostationary Operational Environmental Satellite R-series (GOES-R) and Joint Polar Satellite System (JPSS) Proving Ground – Hazardous Weather Testbed (HWT) Product Demonstrations
2. **Organization:** NOAA’s Hazardous Weather Testbed, Norman, OK
3. **Products to be Demonstrated as a GOES-R and JPSS Proving Ground activity at the HWT in 2026:**
 - a. Lightning Stoplight Product
 - b. NOAA/CIMSS ProbSevere LightningCast
 - c. OCTANE CONUS Suite (Speed, Direction, Cooling, and MesoAnywhere)
 - d. Solar Zenith Angle–Adjusted (SZA) Imagery
 - e. Synthetic GeoXO Imager (GXI) Imagery
4. **Demonstration Project Summary:**
 - a. **Overview:** GOES-R and JPSS products and capabilities will be demonstrated in the HWT during the 2026 Satellite Proving Ground Experiment. Experiment activities will take place during the weeks of April 27 - May 1, May 11 - May 15, and June 1-5. The HWT provides a conceptual framework and space to foster collaboration between research and operations to test and evaluate new and emerging technologies and science to advance National Weather Service (NWS) warning operations. Products will be demonstrated within a simulated warning operations environment using a real-time cloud-based AWIPS-II framework. NWS forecasters will be the primary evaluators. Various project scientists and subject matter experts will also be in attendance throughout the experiment to provide project expertise and to communicate directly with the user community. The exposure to appropriate GOES-R series and JPSS products and capabilities during the height of the spring severe weather season will provide NWS forecasters and scientists an opportunity to help determine best practices and operational applicability as well as critique and suggest improvements for algorithms in different stages of their development cycle. For the 2026 Spring Experiment, live GOES-R and JPSS products will be evaluated along with experimental GOES-R products.
 - b. **Plan, Purpose, and Scope:** The HWT provides the Satellite Proving Ground with an opportunity to demonstrate Baseline, Future Capabilities, and experimental products associated with the next-generation GOES-R series geostationary and JPSS polar satellite systems that have the potential to improve short-range hazardous weather forecasting, decision support services (DSS), and warnings. Additionally, the testbed allows forecasters to test and develop best practices for using GOES-R/JPSS data in convective situations, and will gauge the effectiveness of the NWS-wide satellite training. The structure of 2026 Satellite Proving Ground Experiment will be as follows.

Approximately 12 participants will be involved in the 2026 Satellite Proving Ground Experiment, with 4 forecasters per week attending three weeks of virtual demonstrations. Participants will receive training beforehand in the form of product user guides, PowerPoint slides, and online learning modules for the products being demonstrated.

Each day of the testbed will start at 10 am CDT and end at 6 pm CDT. Monday will begin with an overview of the evaluated products by subject matter experts, forecaster expectations for the week, introducing the HWT blog, and familiarizing participants with the AWIPS cloud instances. Operations will begin at 1pm CDT Monday through Thursday, and on Monday will consist of a mixture of additional instruction regarding experimental product features and applications. Tuesday through Thursday will begin with an open discussion from the previous day's events at 10am CDT, followed by a brief discussion of the day's anticipated convective threat (location/timing/mode/hazards). Lastly, forecasters will discuss new capabilities from the next-generation of GOES satellites (GeoXO) with subject matter experts related to the planned imagery (GXI), lightning mapping (LMX), and hyperspectral sounding (GXS) instruments in a focus group format. The GeoXO focus groups are intended to inform forecasters of GeoXO instruments and products, solicit feedback regarding the potential operational impacts, and answer questions about the instrument. Key questions and topics from these discussions will be collected by the Experiment PI and included as an appendix to the final report.

During the live demonstrations, forecasters will then work in pairs of 2 or 3 with real-time simulated short-term forecasts, warning operations, and decision support services (DSS) in County Warning Areas (CWAs) across the CONUS. Using the GOES-R HWT blog, participants will document their short-term experimental mesoscale forecast updates in real-time, highlight the impact of satellite-based imagery on these short-term forecasts, and provide verification on the quality of experimental products and the forecasts they produce. Warnings and advisories will be issued using AWIPS-II/WarnGen, with forecasters providing the motivation for their warnings and DSS messaging in a separate form. Feedback will be gathered throughout the experiment in the form of: 1) surveys to be completed at the end of each day and week, 2) real-time blogging, 3) daily and weekly forecaster debriefs, 4) real-time discussions during operations, and 5) submitted warnings and DSS messaging. The demonstrations will end 60 minutes prior to the scheduled end time for the day (5pm CDT), and the participants will complete their daily surveys. Each Friday will begin with the distribution of a weekly survey, followed by a weekly debrief session to summarize the week's activities, feedback, and recommendations. Figure 1 (below) depicts the previously described schedule.

Virtual Demonstration Schedule									
Hour (CDT)	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00
Monday		Orientation			Product Training/Operations				Wrap-Up/ Daily Surveys
Tuesday		Group Debrief	GeoXO Focus Group: GXI		Operations				Wrap-Up/ Daily Surveys
Wednesday		Group Debrief	GeoXO Focus Group: LMX		Operations				Wrap-Up/ Daily Surveys
Thursday		Group Debrief	GeoXO Focus Group: GXS		Operations				Wrap-Up/ Daily Surveys
Friday	Wrap-Up/ Weekly Surveys	Weekly Debrief							

Figure 1: A diagram of the virtual demonstration schedule. All times are in CDT (UTC-5).

- c. **Goals:** The main objective of the Satellite Proving Ground demonstrations within the HWT is to demonstrate and evaluate baseline, future capability and experimental products that have the potential to improve short-term forecasts, nowcasts and warnings of hazardous weather across the CONUS. Highlights of forecaster feedback will be organized in a final report which will be submitted to the Satellite Proving Ground and provided to product developers so that recommended changes and improvements to products can be addressed. The one-on-one interactions between the project scientists and NWS forecasters allow for valuable discussions during real-time hazardous weather events, maximizing research-to-operations-to-research (R2O2R) feedback, a key goal of the Proving Ground. Additionally, the real-time demonstration of experimental and baseline products ensures the algorithms work properly in AWIPS-II. Finally, exposing NWS forecasters to GOES-R series and JPSS baseline products and capabilities shortly after availability allows for the development of best practices for using the data in severe weather operations.

5. Participants Involved:

a. Providers:

- i. Lightning Stoplight Product (Kelley Murphy – UAH)
- ii. NOAA/CIMSS ProbSevere LightningCast (Mike Pavolonis – NESDIS)
- iii. OCTANE CONUS Suite (Speed, Direction, Cooling, and MesoAnywhere) (Jason Apke – CIRA/CSU)
- iv. Solar Zenith Angle–Adjusted (SZA) Imagery (Kevin Thiel – CIWRO/OU)
- v. Synthetic GeoXO Imager (GXI) Imagery (John Haynes – CIRA/CSU)

b. Consumers:

- i. Hazardous Weather Testbed

6. Project Schedule/Duration:

- a. Training sent to participants: 13 April 2026
- b. Product demonstration period: 27 April 2026 - 5 June 2026
 - i. Week 1: 27 April 2026 – 1 May 2026 (Virtual)
 - ii. Week 2: 11 May 2026 – 15 May 2026 (Virtual)
 - iii. Week 3: 1 June 2026 – 5 June 2026 (Virtual)

7. Project Decision Points and Deliverables:

- a. Proving Ground Operations Plan: 30 March 2026

b. Proving Ground Final Report: 1 September 2026

8. Responsibilities and Coordination:

- a. Kevin Thiel, OU/CIWRO and NOAA/SPC - Principal Investigator for Satellite Proving Ground activities taking place in the HWT in 2026
- b. Anthony Lyza, NOAA/NSSL - HWT Executive Officer

9. Budget and Resource Estimate: Funded through the GOES-R and JPSS Science Offices.

Product Name: NASA SPoRT Lightning Stoplight Product
Primary Investigator: Kelley Murphy (UAH/NASA SPoRT)

Hazardous Weather Testbed, Experimental Warning Program Relevance:

- The Lightning Stoplight product assists forecasters with lightning safety decision support by providing a color-coded visualization of recent lightning activity (“time since last flash” within a 30 minute window).
- The product supports decision-making surrounding lightning cessation to aid with on-site or remote support of outdoor activities (sports, festivals, airport weather warnings, etc.)
- The Lightning Stoplight will be evaluated on clarity of interpretation and ability to increase forecaster confidence in communicating a decreasing threat of lightning and “all-clear” notices.

Product Overview:

- The Lightning Stoplight displays as red, yellow, or green pixels, indicating where lightning has been 0 – <=10, 10 – <=20, and 20 – <=30 minutes ago, respectively.
- Lightning Stoplight is available over the CONUS, updating every minute.
- User-defined range rings can be overlaid to help provide clear communication thresholds, such as “there was lightning 10 minutes ago within 5 miles of your location.”

Product Methodology:

- The Stoplight identifies lightning that has occurred in a 2x2km grid over the previous 30 minutes, updating every minute.
- Lightning detection sources incorporated are both Gridded Geostationary Lightning Mapper (GLM; either GOES-East or West) Flash Extent Density (FED), and Earth Networks Total Lightning Network (ENTLN) Flash Point Data.
- Each minute, the times of the latest ENTLN events and areas with FED values greater than 0 are mapped onto the 2x2 grid and color-coded based on the most recent flash time.

Products:

- Stoplight East (GOES-East GLM + ENTLN)
- Stoplight West (GOES-West GLM + ENTLN)
- Latency of both Stoplight versions is about 30 seconds

Concept for Operational Demonstration:

- The Stoplight product is generated in three different file formats (netcdf4, geoTIFF, and geoJSON), and it can be viewed on three different platforms:
 - SPoRT Lightning Viewer: Stoplight regions and timing information are displayed on this interactive, web-based viewer.
 - GR2Analyst: Placefiles are generated and hosted on a NASA SPoRT server, which can be visualized alongside radar data in GR2Analyst.
 - AWIPS: Netcdfs are used to visualize Stoplight information within this platform.
- A training module on the product will be provided to forecasters (available on the SPoRT training page or the NOAA Commerce Learning Center).

Product Name: OCTANE CONUS Suite (Speed, Direction, Cooling, and MesoAnywhere)
Primary Investigator: Jason Apke (CIRA/CSU)

Hazardous Weather Testbed, Experimental Warning Program Relevance:

- Provides imagery information for mesoscale analysis and convective intensity context inferred from cloud-drifts within each mesoscale-sector image
- Products will be assessed in ability to complement native satellite imagery for forecaster monitoring of pre-storm environments, storm intensification, and decay.

Product Overview:

- The Optical flow Code for Tracking, Atmospheric motion vector, and Nowcasting Experiments (OCTANE) Suite includes products which highlight cloud-drift motion (speed and direction) and cloud-top cooling (derived using the motion fields) blended with the textures (brightness) from the 0.64 μm (10.3 μm) imagery during the day (night; Solar Zenith Angle $> 80^\circ$) using a Hue-Saturation-Value approach. OCTANE is also run on CONUS imagery to increase the temporal cadence of outputs from 5-min to 1-min.
- Wind products provided with each GOES-19 and -18 mesoscale and CONUS sector, with ~ 0.5 km (~ 2 km) spatial resolution during the day (night), CONUS GOES-19 products provided for MesoAnywhere (including 0.64 μm , 1.6 μm , and 10.3 μm infrared), provided in a movable $\sim 1500 \times 1500$ km sub-sector within CONUS.

Product Methodology:

- *Speed/Direction:* Computes motions by tracking brightness features (e.g., minima/maxima/gradients) in 0.64 μm (10.3 μm) satellite imagery sequences during the day (night), *Cloud-top Cooling:* Retrieves the 5-min 10.3 μm brightness temperature cooling trends following the cloud motion, *MesoAnywhere:* Uses derived imagery motions to interpolate brightness observed between two CONUS frames at each channel.
- Frequency: Winds: 1-min/30-sec (same as GOES-R mesoscale sectors) and 5-min (same as the CONUS), MesoAnywhere: 1-min, Latency: Winds: ~ 3 for Meso, 5-min for CONUS, MesoAnywhere: ~ 10 min, Input: Two sequential 1-min/5-min frames (winds) or 5-min (MesoAnywhere) 0.64 μm and 10.3 μm images.

Products:

- AWIPS: Speed/Direction HSV sandwiches, MesoAnywhere 0.64 μm , 1.6 μm , and 10.3 μm imagery, provided with AWIPS procedures to properly read and plot datasets.

Concept for Operational Demonstration:

- AWIPS-ready NETCDFs delivered to HWT via the LDM for each product (Winds: 48 MB/ mesosector file, 112 MB/CONUS file compressed), and MesoAnywhere Imagery (0.64 μm : 13 MB, 1.6 μm : 10 MB, and 10.3 μm : 10 MB/file compressed).
- We will compare CONUS outputs to mesosector winds outputs and see if forecasters find them useful. We will also continue MesoAnywhere demonstrations with some minor tweaks to improve latency and artifacts.

Product Name: NOAA/CIMSS ProbSevere LightningCast

Primary Investigator: Michael Pavolonis (NESDIS)

Hazardous Weather Testbed, Experimental Warning Program Relevance:

- LightningCast assists forecasters with probabilistic guidance of convective/lightning initiation, sustainment, and cessation.
- LightningCast can be a decision support tool that directly enables users to take action, such as seeking shelter in advance of lightning onset.
- Products will be evaluated on their ability to increase forecaster confidence and situational awareness of lightning initiation, sustainment, and cessation.

Product Overview:

- LightningCast is an AI model that uses images of GOES ABI data (and optionally) combined with MRMS data to predict the probability that GLM will observe lightning (in-cloud or cloud-to-ground) in the 60 minutes following an ABI scan.
- LightningCast uses the 0.64- μm (CH02) and 1.6- μm (CH-05) reflectances, and the 10.3- μm (CH13) and 12.3- μm (CH15) brightness temperatures from ABI as predictors as well as composite reflectivity at -10°C from MRMS.
- Predictions are made at a 2-km spatial resolution with the output reduced to an effective resolution of 8-km to reduce noise.

Product Methodology:

- At one scan time, radiance data is extracted from ABI L1b files and converted into reflectances or brightness temperatures.
- At the same scan time, reflectivity at -10°C is remapped to the ABI geostationary projection.
- These data are predictors of the trained AI model, a convolutional neural network.
- The LightningCast model predicts probabilities of lightning in the next 60 minutes (as observed by GLM) for every pixel in the scan domain.

LightningCast Products:

- LightningCast v1 – ABI only; $P(\geq 1 \text{ flash in } 60 \text{ min})$
- LightningCast v2 – ABI + MRMS; $P(\geq 1 \text{ flash in } 60 \text{ min})$
- LightningCast generates products for 6 ABI scan domains:
 - GOES-East CONUS and both Mesoscale domains
 - GOES-West CONUS and both Mesoscale domains
 - The ABI+MRMS product is available for the CONUS domain (both GOES-East and GOES-West).
- Each product for each domain will have a parallax-corrected and un-corrected field.
 - Parallax correction is performed with a constant cloud-height assumption of 9 km.
- LightningCast's latency for the CONUS/PACUS domains is 20 seconds and for the Mesoscale domain is 3 seconds, relative to the ABI scan end time.

Concept for Operational Demonstration:

- The data will be viewed by forecasters in AWIPSII with the gridded product resource.
- Forecasters will also be able to view output from a web-based meteogram tool.
- Forecasters will be comparing output between LightningCast v1 and v2.

Product Name: Solar Zenith Angle–Adjusted (SZA) Imagery
Primary Investigator: Kevin Thiel (CIWRO/OU)

Hazardous Weather Testbed, Experimental Warning Program Relevance:

- ABI Visible and Near-Infrared imagery rely on solar reflectance, which changes throughout the day. Adjusting for solar zenith angle provides more uniform reflectance throughout a scene, especially near sunrise/sunset. This may improve a forecaster’s interpretation of satellite imagery and subsequent RGBs with respect to convection.

Product Overview:

- ABI imagery from select bands will be adjusted for their local solar zenith angle and presented to forecasters in AWIPS-II, and incorporated into select RGB imagery.
- Forecasters in the testbed will view SZA imagery alongside ABI imagery to compare observed features and product utility.

Product Methodology:

- The cosine of the local solar zenith angle for all pixels in the ABI scene are calculated.
- Reflectance factor observations from ABI L2 CMIP are divided by the cosine of the local solar zenith angle.
- Updated RGBs are produced in AWIPS-II with the adjusted reflectance imagery included using identical RGB recipes.

Products:

- Product will be produced for GOES–East/–West Scenes for CONUS scenes.
 - ABI Channel 2 (0.64 μm)
 - ABI Channel 5 (1.61 μm)
- SZA imagery will be combined with ABI Channel 13 (13.3 μm) to produce SZA Day Cloud Phase Distinction RGB in AWIPS-II.

Concept for Operational Demonstration:

- Products may be delivered through local processing within the HWT LDM, and will also be available within the NSSL computing network, to display in AWIPS-II.
 - Estimated latency: 1-2 minutes.
- Forecasters will view SZA imagery alongside ABI imagery, and attempt to monitor convection. Additional emphasis will be placed on situations with high solar zenith angles, such as near local sunrise and sunset.

Product Name: Synthetic GeoXO Imager (GXI) Imagery
Primary Investigator: John Haynes (CIRA/CSU)

Hazardous Weather Testbed, Experimental Warning Program Relevance:

- Provides a demonstration/preview of two new channels that will be available on the GeoXO Imager (GXI), part of the next generation of geostationary satellites scheduled for launch in 2032.
- This experiment will give forecasters an opportunity to provide feedback on the potential value of the new channels, especially with regard to convective initiation and other forecasting challenges. There will also be opportunity to provide feedback about different ways that the information from these new channels can be visualized and displayed.

Product Overview:

- The imagery to be evaluated consists of simulated reflectance at 0.91 μm , a new “reflective” near-infrared channel sensitive to total column water vapor, as well as simulated brightness temperatures at 5.15 μm , a new infrared channel that will be more sensitive to boundary layer water vapor than existing water vapor bands on ABI. Information from these channels is expected to allow easier identification of water vapor boundaries in the atmosphere and therefore provide useful information in areas primed for convective initiation, even before clouds form.

Product Methodology:

- These simulated reflectances and brightness temperature, and associated derived products, are derived from daily model runs of WRF or HRRR as processed through the Community Radiative Transfer Model (CRTM).
- Although the temporal cadence and horizontal resolution do not exactly match what is expected from the GXI, the synthetic products still provide a useful representation of the kind of information forecasters will have access to with GeoXO.

Products:

- Synthetic imagery will include 0.91 μm reflectance, 5.15 μm brightness temperature, and water vapor transmittance (WVT), which is a derived product intended to enhance and highlight the water vapor signal from the 0.91 μm channel.
- Meteosat Third Generation (MTG) Flexible Combined Imager (FCI) data will also be used as “proxy data” for the GXI.

Concept for Operational Demonstration:

- Since the synthetic imagery is based on a model run rather than real-time weather observations, it is likely that the day’s observed weather will differ in some significant ways from what the model predicted. For this reason, we are likely to conduct discussions and evaluations in “retrospective mode”, evaluating the synthetic imagery for the *previous* day’s weather events. We will also provide a daily discussion using real-time observations from the MTG FCI over Europe and Africa to highlight the capabilities of the 0.91 μm channel with real observations.