GOES-R and GeoXO

Geostationary Operational Environmental Satellite Series GOES-R — NOAA ~ NASA

GeoXO GEOSTATIONARY EXTENDED OBSERVATIONS

QUARTERLY NEWSLETTER ■ OCTOBER–DECEMBER 2022 ■ ISSUE 40

A Note from Pam Sullivan, GOES-R /GeoXO System Program Director:

It is always amazing to see what our team can accomplish, but looking back at 2022, I think we achieved new heights! We launched GOES-T, now known as GOES-18, completed on-orbit checkout, executed two GOES-17 and GOES-18 data interleave periods, and handed the satellite over to NOAA's Office of Satellite and Product Operations. GOES-18 became NOAA's operational GOES West satellite on Jan. 4, 2023. GOES-U is progressing toward its planned launch next spring, completing thermal vacuum testing and preparing for mechanical testing. And the future of NOAA's geostationary satellite observations is assured, with the approval of the GeoXO Program. I could not be prouder of our team and what we accomplished this year and I can't wait to see what 2023 brings!

GOES-R PROGRAM HIGHLIGHTS

GOES-18 is now operational! The satellite entered service as GOES West on Jan. 4, 2023. In its new role, GOES-18 serves as NOAA's primary geostationary satellite for detecting and monitoring Pacific hurricanes, atmospheric rivers, coastal fog, wildfires, volcanic eruptions, and other environmental phenomena that affect the western contiguous United States, Alaska, Hawaii, Mexico, and Central America. GOES-18 replaces GOES-17 as GOES West. GOES-17 will serve as the on-orbit standby.
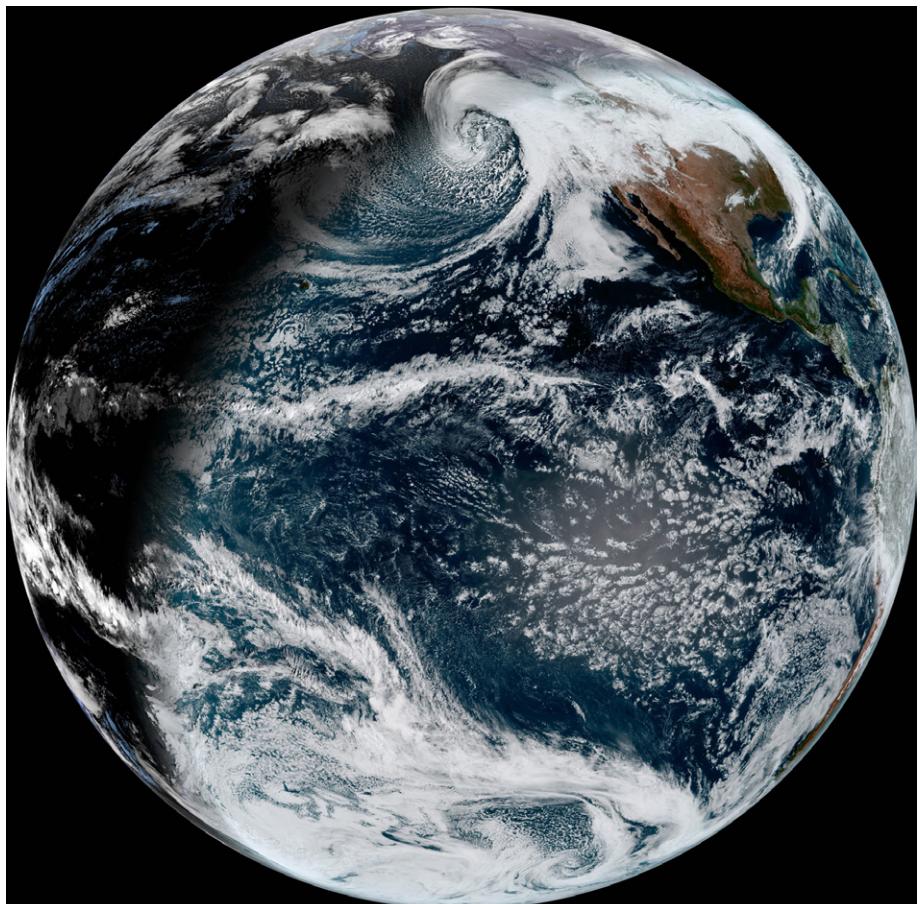
GOES-18 full disk GeoColor image from just after the transition to operations as GOES West on Jan. 4, 2023. Image credit: NOAA

DID YOU KNOW: Hurricane Nicole was the first hurricane to hit the United States in November since Hurricane Kate in 1985. Nicole also set the record for the latest in the season that a storm has hit Florida's east coast.

GOES-U completed thermal vacuum (TVAC) testing in November 2022. During TVAC testing, GOES-U was placed in a large 29 feet by 65 feet chamber and subjected to a vast range of temperatures, soaring as high as 188 degrees Fahrenheit and dropping as low as minus 67 degrees Fahrenheit to simulate the extreme temperatures of launch and the space environment. The fully integrated GOES-U satellite went through four cycles of TVAC, thoroughly testing the spacecraft bus and all seven instruments. GOES-U is now preparing for mechanical environments testing.
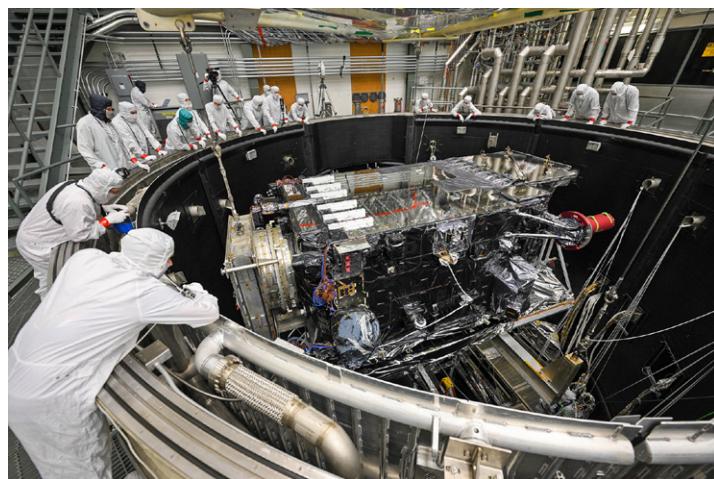
GOES-U is lowered into the thermal vacuum chamber. Photo credit: Lockheed Martin

The second operational interleave of GOES-17 and GOES-18 data was implemented from Oct. 13 – Nov. 16, 2022. During this time, the operational GOES-17 GOES Rebroadcast service was populated with an "interleave" of GOES-18 Advanced Baseline Imager (ABI) data (replacing the GOES-17 ABI data) and GOES-17 Geostationary Lightning Mapper (GLM) and space weather data. The data interleave provided forecasters with operational GOES-18 ABI data during times when GOES-17 ABI imagery was degraded due to a cooling system anomaly.

The second GOES-U end-to-end (ETE) test was completed on Oct. 10, 2022, during satellite thermal vacuum testing. ETE tests validate the compatibility between the flight and ground systems in a mission operations context. The operations team, located at the NOAA Satellite and Operations Facility in Suitland, Maryland, transmitted operational command sequences to the GOES-U spacecraft and instruments, located at the Lockheed Martin facility in Littleton, Colorado, and validated the responses.

All of the GOES-18 Level 1b data products are now provisionally validated. Nearly all of the GOES-18 Level 2+ data products are also provisionally validated. Provisional Peer Stakeholder – Product Validation Reviews for the remaining products are scheduled for March 2023. Provisionally-validated data are ready for operational use but are not fully validated. These data products are now available to the broader user community.

The Compact Coronagraph-2 (CCOR-2) began environmental testing after completing a successful Pre-Environmental Review in November 2022. The instrument completed electromagnetic interference /electromagnetic compatibility in December 2022. This testing confirmed electromagnetic radiation in space will not damage the instrument. CCOR-2 also completed vibration testing in December, which ensured the instrument can withstand the stresses it will experience during launch. CCOR-2 will fly on the Space Weather Follow-On Lagrange 1 mission.

The GOES-U launch vehicle Preliminary Design Review (PDR) was held on Nov. 17, 2022. The PDR demonstrated that the GOES-U launch vehicle preliminary design meets all the system requirements with acceptable risk and within cost and schedule constraints and is ready to begin implementation. GOES-U will launch on a SpaceX Falcon Heavy rocket in 2024.

The GeoCloud system received authorization to operate on Nov. 1, 2022. This authorization was a major information technology security milestone for GeoCloud.

The GOES-U CCOR Flight Operations Peer Review was completed on Dec. 13, 2022. The review demonstrated that all stakeholders are prepared to support the successful operation of the CCOR instrument.

GeoXO PROGRAM HIGHLIGHTS

The Department of Commerce (DOC) formally approved the GeoXO program on Dec. 14, 2022, following the Milestone 2 review board meeting on Dec. 12. GeoXO can now enter the development phase of the mission and start awarding industry contracts to build the spacecraft and instruments. The review board noted that GeoXO will be a seminal program for the Department.

The GeoXO flight project conducted Phase A Study final reviews for the sounder instrument with Ball Aerospace and L3 Harris in December 2022. These definition-phase study and development contracts will help design the instrument concept, mature necessary technologies, and help define potential performance, risks, costs, and development

schedule. The results of the study will be used to set performance requirements for the development contract.

NASA posted the draft request for proposal for the GeoXO Sounder (GXS) development contract on Dec. 20, 2022. Industry is invited to comment until Jan. 20, 2023.

IMAGERY AND SCIENCE APPLICATIONS

The NASA Short-term Prediction Research and Transition (SPoRT) Center developed DustTracker-AI, a machine learning model, to track dust at night. The model uses GOES-16 and GOES-17 satellite observations to identify the probability of dust in the imagery. Although dust is easily identified in visible imagery during the day, these satellite bands aren't available at night. The SPoRT team is running DustTracker-AI in real-time, and the product was made available to NOAA National Weather Service (NWS) forecasters. View a data visualization depicting an April 5-8, 2022, dust event using data from DustTracker-AI.
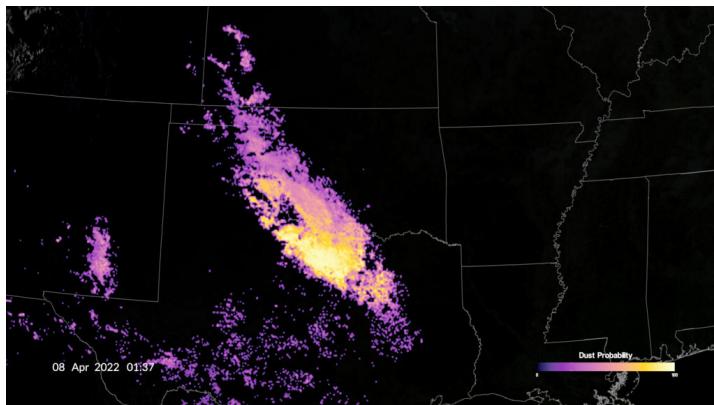
Example of dust probability at night using data from DustTracker-AI. Image credit: NASA's Scientific Visualization Studio

GOES-16 monitored the dangerous lake-effect snowstorm that brought more than six feet of snow to some areas of western New York in November 2022. NOAA satellite imagery provided insight into this event, from the large-scale features down to the individual snow bands. GOES multispectral imagery is valuable to supplement radar data during lake effect snow events. Specifically, nighttime microphysics red-green-blue (RGB) imagery helps to differentiate cloud types at night, including the mid-level and glaciated clouds associated with lake effect snow bands from higher ice clouds and lower liquid clouds.
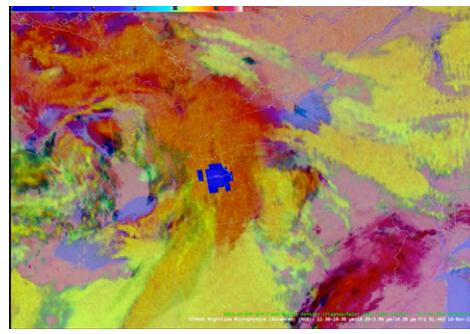
GOES-16 nighttime microphysics RGB with GLM flash extent density overlaid. Image credit: NOAA

The GOES-16 GLM monitored lightning activity as the storm produced prolific thundersnow, falling at a rate of up to three inches per hour off Lake Erie on Nov. 18. View more imagery of the storm from the RAMBB-CIRA Satellite Library.

Hawaii's Mauna Loa volcano began erupting on Nov. 28, 2022, for the first time since 1984. GOES-17 and GOES-18 captured the eruption, lava flow, ash plume, and sulfur dioxide emissions in great detail. GOES-17 provided one-minute imagery to help the NWS Pacific Region monitor the evolution of the eruption and volcanic plumes in real time. GOES-18, still undergoing post-launch testing, collected 30-second imagery of the eruption. This rapid-update imagery allowed forecasters to observe the hottest areas of the lava field as well as the constant emission of ash and vapor. View additional data and imagery of the eruption via the CIMSS Satellite Blog and RAMMB-CIRA Satellite Library.
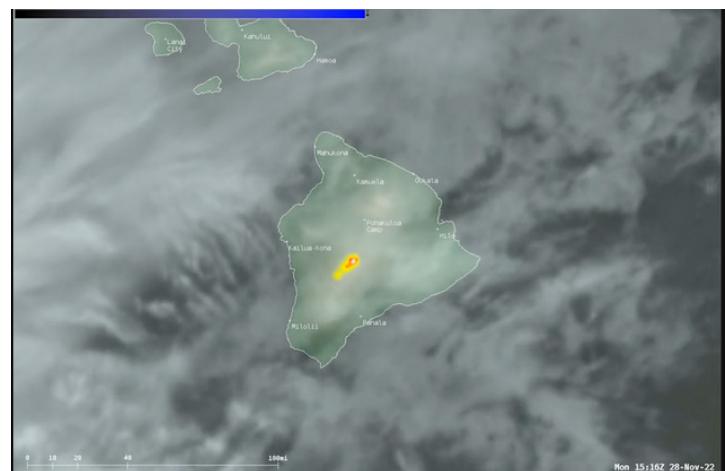

GOES-17 multi-channel infrared and near-infrared imagery shows the thermal signature of the Mauna Loa eruption. Image credit: NOAA

The 2022 Atlantic hurricane season officially came to a close on Nov. 30. The season produced 14 named storms (winds of 39 mph or greater), of which eight became hurricanes (winds of 74 mph or greater) and two intensified to major hurricanes with winds reaching 111 mph or greater. The 2022 season was also defined by a rare mid-season pause in storms that scientists believe was caused by increased wind shear and suppressed atmospheric moisture high over the Atlantic Ocean. After a quiet period in August, activity ramped up in September, with seven named storms, including the two major hurricanes, Fiona and Ian. The

season also included a rare late-season storm when Hurricane Nicole came ashore along the east coast of Florida on Nov. 10. NOAA satellites constantly monitored the Atlantic hurricane basin and provided valuable data and imagery to forecasters for tracking the development, movement, and intensity of tropical cyclones this season.
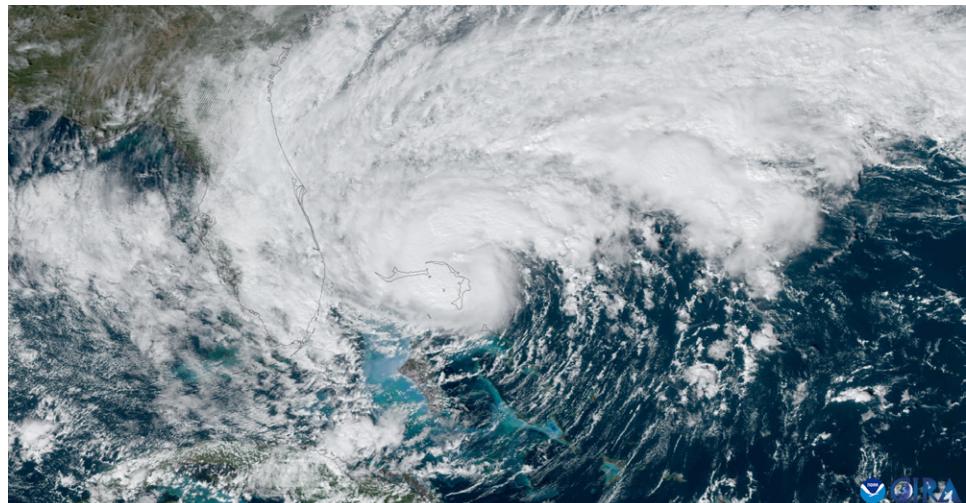
Hurricane Nicole approaches Florida on Nov. 9, 2022, in this GOES-16 GeoColor image. Credit: NOAA/CIRA

EDUCATION AND OUTREACH

The GOES-R Program, in partnership with JPSS, NOAA Satellite and Information Service, NASA Goddard Space Flight Center, and the Cooperative Institute for Research in the Atmosphere (CIRA) produced five "Earth from Orbit" videos this quarter. Earth from Orbit is a series of short videos that showcase a compelling weather event, environmental hazard, or interesting meteorological phenomenon, as seen by NOAA satellites. A web article with additional information accompanies each video.

GOES-17 imagery of smoke from wildfires in the Pacific Northwest in October 2022. Image credit: NOAA/NASA Goddard Space Flight Center

The 2022-2023 GOES Virtual Science Fair kicked off in October 2022. Students can participate by submitting projects using data from GOES East or GOES West to investigate weather and natural hazards. There will be three winning teams or individuals: middle school, high school, and grades 13/14 (community college or university). Projects will be accepted through April 2023. The Cooperative Institute of Meteorological Satellite Studies at the University of Wisconsin-Madison is facilitating the science fair.

GOES-R/GeoXO chief of staff and meteorologist Kevin Fryar gave a NOAA Environmental Data Talk (NEDTalk), "Geostationary Satellites - Tools for a You and a Meteorologist" on Nov. 14, 2022, as part of NOAA DataFest, a month-long celebration of NOAA's vast collection of environmental data. In his NEDTalk, Fryar explained geostationary satellites and how their data impact our daily lives.
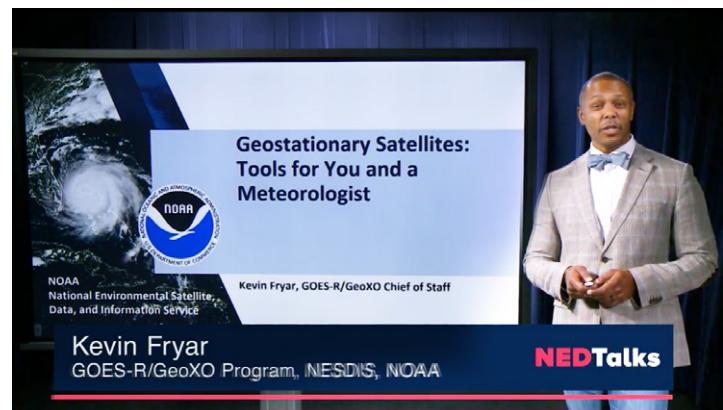
Kevin Fryar presenting his NEDTalk, Tools for You and a Meteorologist. Image Credit: NOAA

A new NOAA SciJinks article explains humidity, why it happens, and how it affects our weather. Humidity is, in general, a measure of water vapor in the air. Meteorologists typically describe water vapor in the atmosphere in two different ways: absolute humidity and relative humidity. Dew point is an absolute measure and helps us understand how muggy and humid it feels outside. This information helps improve forecasting for events such as heavy rain, flash flooding, and more.

Tellus Science Museum, a Smithsonian affiliate in Cartersville, Georgia, is hosting a new exhibit, "Treasures of NOAA's Ark," from Dec. 3, 2022, through Oct. 29, 2023. The exhibition highlights NOAA's legacy of science, service, and stewardship and explores how we are all connected to the environment. An exhibit preview on Dec. 2 included a lecture from Kevin Fryar, chief of staff for NOAA's GOES-R satellite, which highlighted how weather affects us all every day. Fryar discussed how NOAA develops satellites, how we use them, and what it's like to monitor hurricanes, wildfires, lightning, and more from 22,000 miles above our planet.

Registration is now open for the 2023 GOES-R DataJam. The DataJam is a two-week virtual competition for college undergraduate and graduate students to showcase their best use of GOES-R Series data. The goal of this educational event is to expand the remote sensing knowledge base and technical skillset of the participating students, while also providing them the opportunity to network with NOAA and NASA professionals and gain recognition for great ideas, leadership, and teamwork. The GOES-R DataJam is planned for October 2023.

CONFERENCES AND EVENTS

An RGB Developers and Users Workshop was held at the Cooperative Institute for Research in the Atmosphere (CIRA) in Fort Collins, Colorado, on Oct. 18-20, 2022. The workshop was co-hosted by NOAA, CIRA, the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), and the World Meteorological Organization (WMO). NWS forecasters have adopted the use of RGB displays from the GOES-16 and GOES-17 ABI in addition to the Visible Infrared Imaging Radiometer Suite and other platforms, and international colleagues continue to develop new RGBs and learn new RGB applications from various platforms. In-person participants included visitors from Germany, Poland, Hungary, Morocco, Niger, Kenya, Japan, Indonesia, Costa Rica, and Mexico. Many people from other parts of the world participated virtually.


RGB Developers and Users Workshop participants. Photo credit: NOAA

NOAA, along with the Caribbean Meteorological Organization Headquarters Unit, the Caribbean Institute for Meteorology & Hydrology, and the University of Leeds conducted a WMO Caribbean Region IV

Satellite Applications virtual training workshop on Dec. 5-8, 2022. The Satellite Applications Workshop included an overview of GOES-R and JPSS satellite capabilities, how to access data to address forecasting challenges, and how to improve data-driven decision-making to advance WMO and the AmeriGEO societal benefit areas (water, disasters, health, etc.). Forecasters, researchers, and students from 27 countries participated.

Several GOES-R and GeoXO team members participated in the 2022 American Geophysical Union (AGU) Fall Meeting on Dec. 12-16, 2022, in Chicago, Illinois. On Dec. 13, the session "Earth Observations from Geostationary Satellites: Applied Research and Applications II" highlighted instrumentation aboard the GOES-R Series that has allowed Earth observations that were previously not possible as well as plans for observations from the future GeoXO mission. A Town Hall, "NOAA's Geostationary Extended Observations (GeoXO) Satellite Atmospheric Composition Capabilities" was held on Dec. 15. Additional presentations and posters throughout the week highlighted applications from geostationary satellites. The NOAA booth in the exhibition hall also featured several GOES-R and GeoXO presentations and outreach materials.
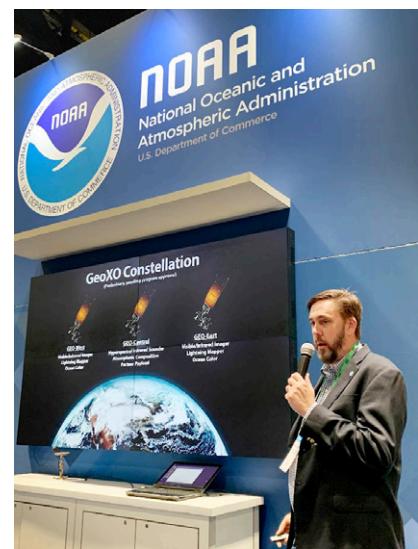
NESDIS GEO scientist Andy Heidinger gives a talk about the new GeoXO program at the NOAA exhibit at AGU. Photo credit: NOAA

AWARDS

GOES-R/GeoXO system program director Pam Sullivan received a 2022 Presidential Rank Award, one of the most prestigious awards in the federal career civil service. Chosen by President Biden, the Presidential Rank Awards recognize the hard work and important contributions of dedicated civil servants in the American federal workforce. Sullivan was honored with the Distinguished Executive Award for her sustained exceptional leadership, accomplishments, and service. Only one percent of the Senior Executive Service may receive the Distinguished rank and Sullivan was the only recipient from NESDIS this year.

Monica Todirita received a DOC Bronze Medal for leadership, for preventing a launch slip on GOES-U by effectively and efficiently leading the test and verification of the ABI flight unit thermal radiator. **The GeoXO Operational Requirements Working Group (XORWG) received a DOC Bronze Medal for scientific or engineering achievement**. The XORWG was honored for ensuring that NOAA's next-generation geostationary satellite system will meet the most critical observing needs for our nation and partners. The Bronze Medal is the highest honor award granted by the Under Secretary of Commerce for Oceans and Atmosphere, the Department of Commerce. Bronze Medal recognizes federal employees for superior performance.

Andy Heidinger was honored with a NOAA Administrator's Award, for developing and providing satellite cloud fields for solar energy applications, including the siting of solar collectors in North and South America. The NOAA Administrator's Award recognizes employees who have demonstrated exceptional leadership, skill, and ingenuity in their significant, unique, and original contributions that bring unusual credit to NOAA, DOC, and the federal government.

Melissa Dahya received the 2022 NESDIS Outstanding Mission Operations Team Member Award for her exemplary engineering leadership as the director of the GOES-18 post-launch test program. Her leadership ensured the successful checkout of the GOES-18 satellite.

MEET THE TEAM

In this issue, meet Steve Grippando, GOES-R and GeoXO ground system project manager. Steve joined the team in May 2022 and oversees the design, development, acquisition, integration, installation, test, verification, and deployment of the GOES-R and GeoXO ground systems.

Steve enjoys meeting the public and hearing how they use GOES-R data to plan their lives and work. "While traveling to Florida recently for work, I heard several accounts of how people used GOES-R images to plan for Hurricane Ian," he said.

Steve has a Master of Business Administration and a Bachelor of Science degree in chemistry from Arizona State University. He previously served in the U.S. Air Force and worked at a variety of commercial satellite companies and EUMETSAT in Germany before joining NOAA in 2008.

Steve is married with a daughter in high school. During the COVID-19 pandemic, he took up the hobby of restoring vintage hand tools and furniture. He enjoys the restoration process and saving items from landfill.

UPCOMING EVENTS

GOES-R Summit
March 21-22, 2023

Space Symposium
Apr. 17-20, 2023

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