GOES-R and GeoXO

QUARTERLY NEWSLETTER ■ JANUARY–MARCH 2022 ■ ISSUE 37

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

Congratulations to the team on another successful launch! GOES-T lifted off on March 1 right at the opening of the launch window. The satellite reached geostationary orbit on March 14 and is now GOES-18. Post-launch testing is now underway, and I look forward to GOES-18 taking its place as the operational GOES West satellite in early 2023. I am so proud of the team's accomplishments to get GOES-18 into orbit— a remarkable feat amid the COVID-19 pandemic. There's no time to rest on our laurels though, as we are busy with GOES-U integration and testing in preparation for launch in 2024 and progressing through GeoXO Phase A activities toward Milestone 2 later this year.

GOES-T HIGHLIGHTS

GOES-T lifted off at 4:38 p.m. on March 1, 2022, from Cape Canaveral Space Force Station, aboard a United Launch Alliance (ULA) Atlas V rocket, four years to the day after GOES-S. After a successful separation from the Centaur upper stage, GOES-T began flying on its own at 8:11 p.m. EST. Shortly after, the satellite completed the first stage deployment of its solar array, which generates electricity to power the spacecraft. NOAA announced a successful launch once NASA deemed the spacecraft healthy and confirmed it was operating on its own power. View launch photos and video of the launch. Watch the NASA GOES-T launch broadcast, co-hosted by NOAA's Kevin Fryar.

GOES-T lifts off from Space Launch Complex 41 at Cape Canaveral Space Force Station on March 1, 2022. Photo credit: NASA/Kevin O'Connell & Kevin Dav

On March 14, 2022, GOES-T executed its final engine burn, placing the satellite in geostationary orbit 22,236 miles above Earth. Upon reaching this milestone, GOES-T was renamed GOES-18. GOES-18 performed its second stage solar array deployment on March 15. In the following days, a series of maneuvers were conducted to place GOES-18 in its 89.5 degrees west longitude initial checkout position on March 20. The Post-Launch Test Readiness Review was completed on March 28 and post-launch testing and calibration are now underway.

DID YOU KNOW: **GOES-T's Atlas V rocket weighed roughly 1,118,812 pounds at launch and provided 2.35 million pounds of thrust at liftoff. It reached Mach 1 – the speed of sound – 35 seconds after liftoff.**

GOES-T ROAD TO LAUNCH

The GOES-T Launch Vehicle Readiness Review was held on Jan. 4, 2022, and certified the readiness to proceed with spacecraft/launch vehicle integration activities.

The GOES-T Safety and Mission Success Review (SMSR) was completed on Jan. 7, 2022, certifying that all required safety and mission assurance activities and processes have been performed, the baseline requirements have been met, and the program has not exceeded the acceptable risk envelope. The SMSR provided the basis for the NASA Chief Safety and Mission Assurance Officer and the NASA Chief Engineer to sign a certification of flight readiness.

On Jan. 13, 2022, the joint GOES-T Mission Readiness Review (MRR)/Mission Readiness Briefing (MRB) and Key Decision Point – E (KDP-E) were briefed to NASA Goddard Space Flight Center (GSFC)/NOAA NESDIS Center Management Council (CMC) and the joint NOAA NESDIS and NASA Science Mission Directorate (SMD) Program Management Council (DPMC). The MRR assessed the readiness status of spacecraft systems prior to launch, including the preparedness of launch systems, flight systems, ground systems, supporting facilities, and operations personnel. The KDP-E decision point confirms the end-to-end system is fully integrated, the MRR was successfully completed, and the program is prepared for the Flight Readiness and Launch Readiness Reviews. The KDP-E was briefed to the joint NOAA NESDIS and NASA Agency Program Management Council on Jan. 19, and the program received final approval to proceed toward launch.

On Jan. 27, 2022, the GOES-T spacecraft was lifted and mated to the payload adapter – a piece of hardware that interfaces mechanically between the rocket and the spacecraft. The payload adapter also allows the spacecraft to separate from the rocket when it gets to orbit. This event was the beginning of integrated operations, where the satellite and the rocket started to come together.

GOES-T is mated to the payload adaptor in preparation for encapsulation. Photo credit: NASA/Kim Shiflett

The rocket that launched GOES-T into space was placed on its stand in ULA's Vertical Integration Facility (VIF), adjacent to Space Launch Complex-41, on Jan. 31, 2022. The Atlas V first stage booster is the backbone of the launch vehicle. It holds the fuel and oxygen tanks that feed the engine for powering the spacecraft into orbit.

The GOES-T Atlas V first stage booster lifted into position on the stand in the VIF. Photo credit: NASA/Kim Shiflett

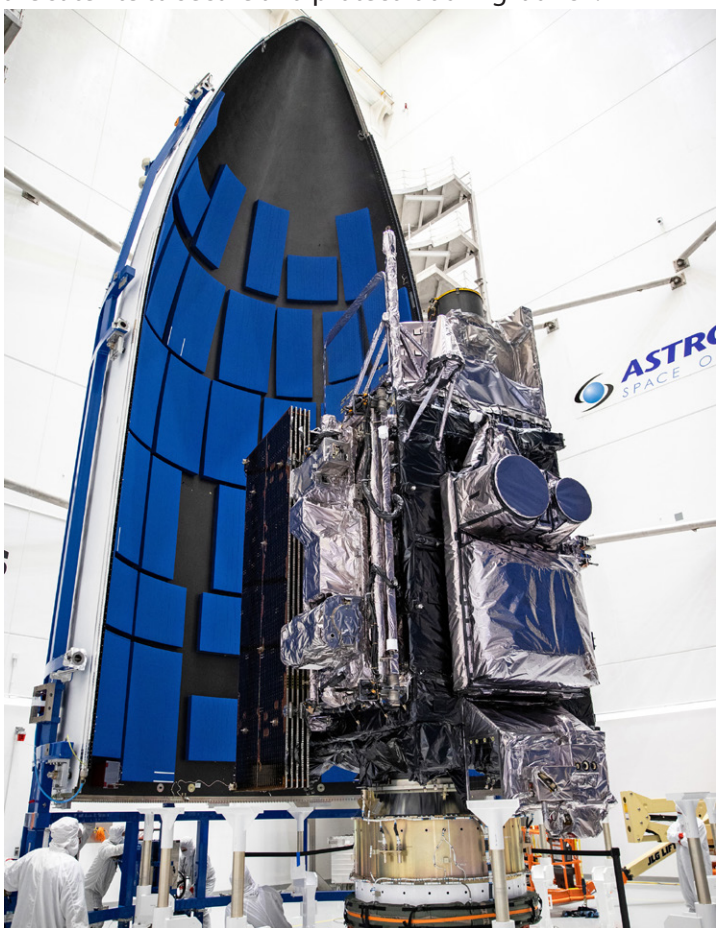
The final GOES-T mission rehearsal was conducted Jan. 31 – Feb. 4, 2022, at the NOAA Satellite Operations Facility in Suitland, Maryland. Mission rehearsal #6 rehearsed pre-launch, launch, separation, apogee engine burns, deployment, and health and safety nominal and contingency operations.

On Feb. 1, 2022, NOAA held a GOES-T virtual media day. Experts from NOAA, NASA, ULA, Lockheed Martin, and L3Harris previewed the upcoming GOES-T launch and mission. Watch a recording of the GOES-T media day.

The ULA Centaur upper stage was placed atop the Atlas V booster in the VIF on Feb. 7, 2022. The Centaur is the launch vehicle's "brain," providing guidance and flight control and containing fuel and oxidizer to insert the vehicle into orbit.

The Centaur upper stage is hoisted into the VIF to be placed atop the Atlas V rocket. Photo credit: United Launch Alliance.

The GOES-T satellite was encapsulated in the Atlas V fairing on Feb. 11, 2022. The payload fairing encapsulates the satellite to secure and protect it during launch.



The GOES-T satellite is in view inside the Astrotech Space Operations facility in Titusville, Florida, on Feb. 7, 2022, as it is prepared for encapsulation in the ULA Atlas V payload fairing. Photo credit: NASA/Ben Smegelsky

On Feb. 17, 2022, the GOES-T satellite, enclosed in its protective fairing, was transported to the ULA VIF and secured atop the Atlas V rocket.

The payload fairing containing GOES-T is lifted by crane for mating to the Atlas V rocket. Photo credit: United Launch Alliance

On Feb. 17, 2022, NOAA and NASA experts from the GOES-R Series Program provided an overview of the GOES-T mission and previewed the upcoming launch as part of the NASA GSFC 'Engage' series. The Engage series connects GSFC employees with the center's missions, programs and projects. The Engage event consisted of a panel discussion, followed by questions from the audience. View video of the event.

The GOES-T Flight Readiness Review (FRR) was completed on Feb. 22, 2022. The FRR updated the mission status, closed out actions from the Launch Vehicle Readiness and Mission Readiness Reviews, and certified the readiness to proceed with final launch preparation activities.

NASA, NOAA and United Launch Alliance controllers and engineers conducted a full GOES-T launch mission dress rehearsal on Feb. 23, 2022. Working from consoles in facilities at Cape Canaveral Space Force Station, the team ran through the same systems and processes they would use for the actual launch on March 1.

The GOES-T Launch Readiness Review (LRR) was completed on Feb. 26, 2022. The LRR authorized proceeding into the launch countdown. The Certificate of Flight Readiness was signed at the conclusion of the LRR.

Two GOES-T pre-launch press briefings were held at NASA's Kennedy Space Center. The GOES-T science briefing was held on Feb. 25, 2022, and the pre-launch news/mission briefing was held on Feb. 26 after the Launch Readiness Review. Briefing panelists included high-level officials and subject matter experts from NOAA, NASA, the GOES-R Series Program, United Launch Alliance, Lockheed Martin, L3 Harris, Space Launch Delta 45, and the U.S. Space Force.

GOES-T pre-launch news conference panelists, from left, Steve Volz, assistant administrator for Satellite and Information Services, NOAA; Pam Sullivan, director, GOES-R Program, NOAA; John Gagosian, director, Joint Agency Satellite Division, NASA Headquarters Science Mission Directorate; Tim Dunn, launch director, NASA's Launch Services Program, Kennedy Space Center; Scott Messer, program manager, NASA Launch Services, United Launch Alliance; and Jessica Williams, launch weather officer, 45th Weather Squadron, Space Launch Delta 45. Photo credit: NASA/Kim Shiflett

On Feb. 28, 2022, GOES-T was rolled out to the launchpad from ULA's VIF. NASA Edge provided live coverage of the GOES-T rollout, including live and pre-recorded interviews with NOAA and NASA experts.

The ULA Atlas V rocket carrying NOAA's GOES-T satellite rolls out from the VIF to the launchpad at Space Launch Complex 41 on Feb. 28, 2022. Photo credit: ULA

NOAA and NASA invited social media users to take part in the GOES-T launch virtually. The GOES-T virtual social, conducted on Facebook Feb. 26 – March 1, 2022, brought the GOES-T launch to social media users with behind-the-scenes tours to meet some of the people associated with the launch, see the sites, and learn about the science involved in the mission. View the virtual social videos on the GOES-R website.

Katy Mersmann from NASA (left), interviews Michelle Rizzo, GOES-R Program Chief Safety and Mission Assurance Officer, about what goes into assembling the satellite, making sure it will withstand the launch, putting it on top of a rocket, and getting it to orbit. They spoke at ULA's Vertical Integration Facility in front of the encapsulated GOES-T satellite. Photo credit: NASA/Liz Wilk

A media live shots/morning news event was conducted on March 1 prior to the GOES-T launch. This event allowed media to virtually interview subject matter experts from NOAA, NASA, the National Weather Service (NWS), and the GOES-R Series Program. More than 80 interviews were conducted with local, national, and international media outlets.

View additional GOES-T Road to Launch photos on Flickr and learn more about preparing the satellite for launch in this NESDIS photo essay.

The payload fairing containing GOES-T, secured on a transporter, travels to the ULA VIF to be mated with the launch vehicle. Photo credit: United Launch Alliance

GOES-R PROGRAM HIGHLIGHTS

Technicians install CCOR-1 on the GOES-U solar-pointing platform. Photo credit: Lockheed Martin

GOES-U integration and testing are progressing. In January 2022, the GOES-U team installed the Advanced Baseline Imager (ABI) sensor unit and the Geostationary Lightning Mapper (GLM) sensor unit onto the GOES-U spacecraft. The Compact Coronagraph (CCOR)-1 passed its Pre-Shipment Review in January, was shipped to the Lockheed Martin spacecraft facility in Littleton, Colorado, and was integrated with the GOES-U solar-pointing platform in February. The GOES-U Goddard Magnetometer (GMAG) completed its Pre-Environmental Review in January and thermal vacuum testing in March.

The GOES-R ground system simplified the flow of GOES-16 and GOES-17 data products to the GeoCloud, resulting in improved performance and faster data availability to users. The time from product generation until it becomes available to GeoCloud users was reduced from more than five minutes to less than five seconds.

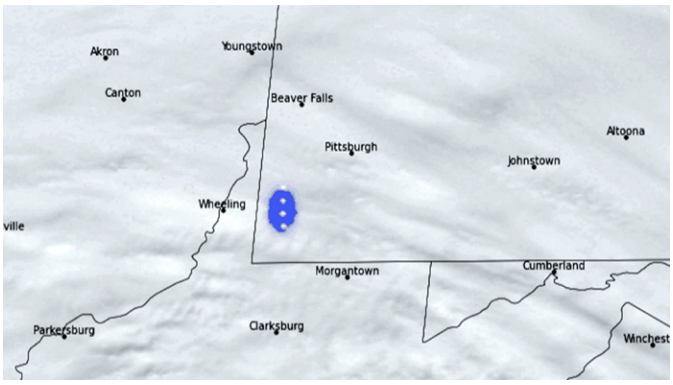
The GOES-16 Space Environment In-Situ Suite (SEISS) Energetic Heavy Ion Sensor and GOES-17 SEISS Solar and Galactic Proton Sensor data products are fully validated, following successful Full Peer Stakeholder – Product Validation Reviews on Jan. 19, 2022.

GeoXO HIGHLIGHTS

NASA released two GeoXO Phase A Study requests for proposals (RFP) for definition-phase studies. The GeoXO Atmospheric Composition (ACX) RFP was posted on Jan. 3, 2022, and the program expects to award contracts in May 2022. The GeoXO spacecraft RFP was posted on Feb. 24, 2022. Proposals were received in late March and are now under review.

On March 28, 2022, NESDIS hosted a Pathfinder Initiative Town Hall to provide NOAA staff a deeper understanding of the Pathfinders Initiative, including how GeoXO has used the initiative to deepen relationships with end-users and subject-matter experts, enhance valuation studies, and refine instrument and product selection. The NOAA Pathfinder Initiative is an avenue to enhance the relationship between NOAA and the user community to help ensure that our systems, products and services are useful, usable, and used.

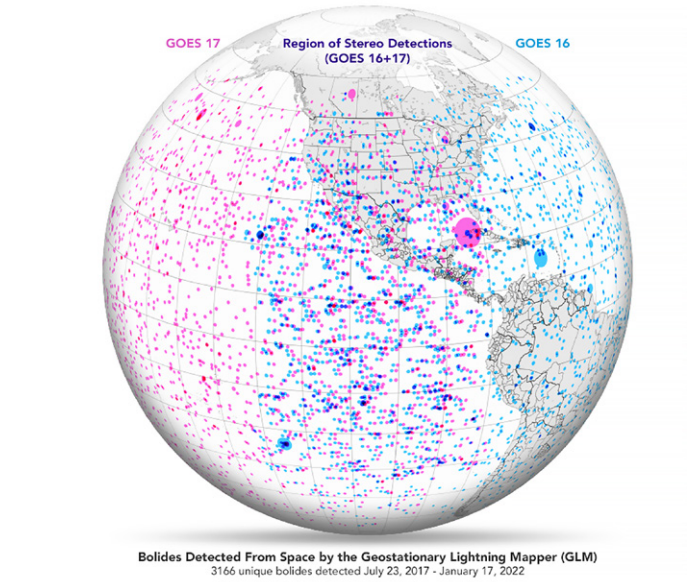
IMAGERY AND SCIENCE APPLICATIONS



GOES-16 GLM imagery of a bolide over southwestern Pennsylvania on Jan. 1, 2022. Image credit: NOAA

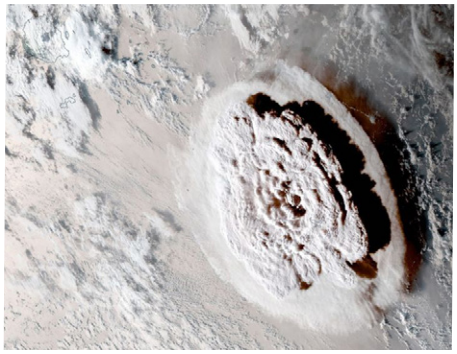
On Jan. 1, 2022, there were numerous reports of sonic booms in southwestern Pennsylvania. GOES-16's GLM picked up a large flash that wasn't associated with a thunderstorm. GLM data indicated the source of the mysterious sound to be a bolide – a large meteor exploding in the atmosphere. The GLM onboard GOES-16 (GOES East) and GOES-17 (GOES West) primarily monitors lightning activity. However, it can also detect bolides and has captured many of these exploding meteors. Loud booms with no visible source can cause a lot of anxiety – especially in populated areas. When GLM can quickly confirm the presence of a bolide, it helps calm fears.

The GOES-16 and GOES-17 GLMs captured more than 3,000 bolides between July 2017 and January 2022. Researchers are using GLM data to build a database of bolide events and their light curves—the trajectories and intensity of the light streaks they left across the sky. These data help model how asteroids enter the atmosphere, break up, and impact Earth. Such data also can inform models that assess the risk of larger meteor impacts, while aiding asteroid population studies that improve our understanding of the evolution of the solar system.



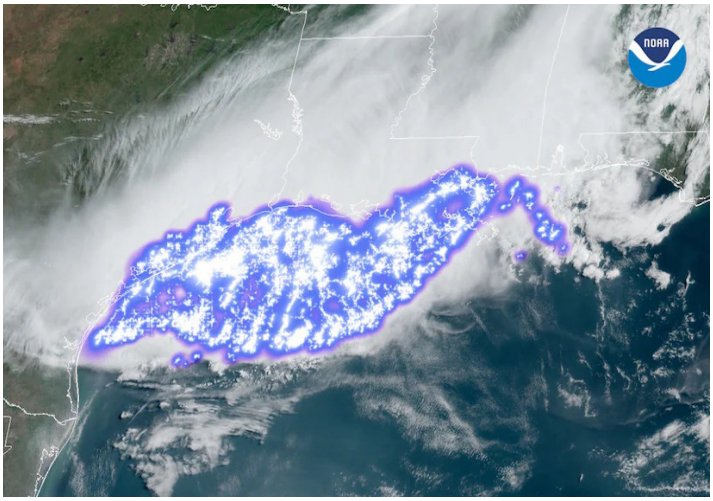
Distribution of bolides detected by the GOES-16 and GOES-17 GLM from July 23, 2017, to Jan. 17, 2022. Image credit: Jeffrey Smith/SETI and NASA

On Jan. 15, 2022, an underwater volcano in the South Pacific Kingdom of Tonga exploded violently in what was the largest recorded eruption on Earth in decades. The eruption generated atmospheric shock waves, sonic booms, and tsunami waves that traveled the world and were heard as far away as Alaska. Satellites operated by NOAA and its international partners play a crucial role in detecting volcanic activity, alerting those in harm's way of an eruption, and monitoring the hazards associated with volcanic eruptions, including volcanic ash and tsunamis. Scientists analyzed data from GOES-17 and Japan's Himawari-8 and determined the volcanic plume from the Jan. 15 eruption rose 36 miles into the mesosphere, likely the highest volcanic plume in the satellite record.



GOES-17 GeoColor imagery of the Hunga Tonga eruption on Jan. 15, 2022. Image credit: NOAA

On Jan. 31, 2022, the World Meteorological Organization (WMO) established two new world records for megaflashes of lightning in notorious hotspots in North and South America. Aided by GLM satellite technology, the WMO recognized the longest distance of a single flash and the greatest duration for a single flash. On Apr. 29, 2020, a mass of severe thunderstorms produced a 477.2-mile-long lightning strike over the southern United States. It stretched from near Houston to southeast Mississippi. The WMO also identified a new world record for the long-lasting lightning flash that lasted for 17.1 seconds over Uruguay and northern Argentina on June 18, 2020. The GLM offers the unique ability to measure lightning flash extent and duration continuously over broad areas.



The GOES-16 GLM captured the lightning flash over the southern United States on Apr. 20, 2020, which now holds the world record for the longest distance traveled for a single flash. Image credit: NOAA

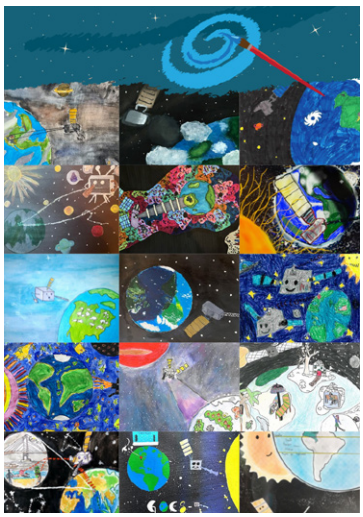
Fog and low stratus clouds over airports can create dangerous travel conditions that result in costly delays and disrupted travel plans. NWS offices monitor and issue warnings when conditions are favorable for the formation of fog and low-level clouds. These warnings are used by airlines to anticipate conditions, avoid delays, and reroute flights if necessary. Now, the NWS is using a new fog detection software developed by scientists at the University of Wisconsin-Madison Cooperative Institute for Meteorological Satellite Studies (CIMSS) and NOAA to assist with those warnings. The software uses machine learning techniques with near real-time data from weather satellites like GOES-16 and GOES-17 to monitor conditions 24/7 and issue potential fog warnings.

IMAGERY AND SCIENCE APPLICATIONS (CONTINUED)

The vernal equinox on March 20, 2022, marked the beginning of astronomical spring in the Northern Hemisphere. The spring equinox results in nearly equal daylight and darkness across the planet. GOES-16 and GOES-17 constantly observe the same region of Earth, allowing a view of the terminator – the edge between the shadows of nightfall and the sunlight of dusk and dawn – as it moves across the Western Hemisphere. A new Earth from Orbit video shows the vernal equinox as seen by GOES satellites and explains the change of seasons.

EDUCATION AND OUTREACH

On Jan. 31, 2022, the GOES-R Education Proving Ground at CIMSS hosted a GOES-T Countdown to Launch webinar for educators, which featured GOES-T instruments and capabilities, opportunities for student engagement, how students can use GOES satellite data, and information about the 2022 GOES Virtual Science Fair.



Collage of GOES-T art challenge selections. Image credit: NOAA SciJinks

The GOES-R Program and NASA Space Place conducted a GOES-T art challenge in January. Kids were asked to draw the GOES-T satellite observing the typical weather during that time of year where they live. We received more than 200 submissions and selected 25 to feature on the Space Place and NESDIS websites and the NASA TV GOES-T launch broadcast.

GOES-T will provide critical data for identifying and tracking environmental hazards of particular concern to the western U.S. A new video highlights how GOES-18 will locate wildfire hot spots, detect changes in fire behavior, predict the motion of fires, estimate a fire's intensity, and monitor smoke output and air quality effects from smoke. GOES-18 will also identify the lightning strikes most likely to ignite fires and characterize pyrocumulonimbus clouds that threaten the safety of firefighters.

The launch of NOAA's GOES-16 and GOES-17 satellites in 2016 and 2018 forever changed the world of environmental monitoring and hazard detection in the Western Hemisphere. As the first two of the GOES-R Series of advanced geostationary satellites, they have already begun providing an unprecedented leap forward in U.S. weather observations. Their advanced instruments stream back more detailed views of weather events faster than ever before. Now, that legacy continues with the launch of GOES-T. Watch the GOES-T launch guest presentation video.

The public was invited to play GOES-T launch bingo on March 1. NOAA SciJinks created bingo cards that people could print out and listen for words to mark off on their cards during the NASA TV GOES-T launch broadcast. The bingo game allowed the public to participate in the launch from home.

CONFERENCES AND EVENTS

On Jan. 5-6, 2022, the American Meteorological Society (AMS) Satellite Meteorology, Oceanography and Climatology Committee conducted two virtual "Accessing and Applying Geostationary Lightning Mapper Observations" training sessions. The first session introduced participants to GLM observations, imagery, and data products. The second session explored the value of GLM for diagnosing convection during severe storm warning operations and aviation applications.

GOES-R and GeoXO participated in the 102nd AMS Annual Meeting, which was held virtually Jan. 23-27, 2022. The 18th Annual Symposium on Operational Environmental Satellite Systems kicked off with a session titled "Overview and Applications of the Future GeoXO

CONFERENCES AND EVENTS (CONTINUED)

Satellite Series," followed by a panel discussion, "The Road to GeoXO." In addition, there were many talks and posters throughout the week outlining the current status, future plans, and science applications from NOAA's geostationary satellites.

GOES-R and the Joint Polar Satellite System (JPSS) conducted a virtual AMS Short Course, "Using GOES-R and JPSS Remote Sensing Capabilities to Enhance Weather, Climate, Water and Environmental Security," Feb. 16-17, 2022. The course taught participants how to access, use, and apply GOES-R and JPSS satellite data and products by exploring operational scenarios to address forecasting challenges and improve data-driven decision-making. Satellite subject matter experts provided instruction and demonstrated how to use readily available tools to process, display, and analyze GOES-R, JPSS, and other environmental satellite data and products to address precipitation, flooding, fire, and smoke effects on society's environmental security.

AWARDS AND ACCOLADES

Angela Michael received the NESDIS 2022 Outstanding Support and Policy Team Member Award for providing outstanding service to the GOES-R Program as a human resource administrative officer. Her support enables the program, flight, and ground teams to focus on the success of the GOES-R mission.

The GLM instrument team was honored with a 2021 American Astronautical Society Earth Science and Applications Award for providing a novel and unique observational capability that has directly contributed to the nation's weather forecasting by improving severe weather observations, predictions, and warning lead-times, and having created new interdisciplinary research opportunities for Earth and planetary sciences.

MEET THE TEAM

In this issue, meet Jim Valenti, GOES-R Assistant System Program Director. Jim was promoted to this role in December 2021 and now assists the program director with the development, acquisition, integration, installation, testing, and acceptance of the GOES-R Series satellite system. Jim has served in many capacities at NESDIS since joining NOAA in 2001, most recently as GOES-R Ground System Project Manager. Before joining NOAA, he served as a Space Operations Officer in the United States Air Force where he served as the project manager for the Air Force's Nuclear Detonation Detection System ground data processing system.

Jim's most significant career achievement was the improvement of the off-ice satellite communications capability at McMurdo Station, Antarctica. The increased communications capacity enabled the station to serve as a data acquisition station for the operational polar-orbiting constellations from NOAA, the United States Space Force, and the European Organization for the Exploitation of Meteorological Satellites, as well as NASA's polar-orbiting science missions.

While managing the two partner agencies' (NOAA and NASA) oversight and requirements can be challenging, "seeing the complex observation systems we develop come to fruition and function at a level that meets, and often exceeds, the needs of our customers is very rewarding," said Jim. "The observations collected by NOAA's environmental monitoring satellites provide critical information used every day, by nearly everyone, and they enable individuals, organizations, businesses, etc., to incorporate the information into their current and future action plans," he continued.

Jim holds a master's degree in space operations from the Air Force Institute of Technology and a Bachelor of Science in aerospace engineering from Penn State University. When not working, Jim enjoys cooking and tinkering with cars.

UPCOMING EVENTS

GOES-U launch vehicle Mission Specific Requirements Review
April 27, 2022

First public GOES-18 SEISS, ABI, GMAG and GLM imagery/data
May 2022

GOES-U System Integration Review
June 8-9, 2022

First public GOES-18 EXIS data
June 2022

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