LANGLEY SCIENCE A Year in Review 2025

National Aeronautics and Space Administration

2025 ANNUAL REPORT

Science at NASA's Langley Research Center

*Conceptual Cover Illustration

VIEW OUR DIGITAL REPORT FOR A MORE INTERACTIVE READING EXPERIENCE.

SCIENCE AT NASA'S LANGLEY RESEARCH CENTER

WE HELP AMERICANS RESPOND TO CHALLENGES AND SOCIETAL NEEDS.

We conceive, build, and fly cutting-edge satellites and instruments; harvest data from those tools and from commercial partners; combine it with expert insights and the world's most advanced models — all to advance solutions for society.

CONTENTS

Our Vision 4
Pioneer 6
..... Technology Development 8
..... Flight Projects 12
Discover 20
..... Planetary 20
..... Space Weather 24
..... Earth Science: Space-based 30
..... Earth Science: Airborne 38
..... Earth Science: Ground-based 54
Inspire 56
..... Science Data in Action 58
..... Scientific Exchange 76
..... Leadership in Action 80

VISIT THE INDEX TO SEARCH THE LANGLEY SCIENCE ANNUAL REPORT BY TOPIC.

VISIT OUR WEBSITE TO LEARN MORE ABOUT SCIENCE AT NASA'S LANGLEY RESEARCH CENTER.

DIRECTOR'S MESSAGE

It is my distinct pleasure to present the 2025 Annual Report for Science at NASA's Langley Research Center in Hampton, Virginia. Over the past year, our science organization has demonstrated exceptional technical excellence, resilience, and public service in advancing research that benefits the nation and the world. In a dynamic fiscal and operational environment, the Langley team has remained steadfast in its commitment to discovery, innovation, and measurable impact.

Our science portfolio continues to expand in both scope and influence. This year, we strengthened and broadened our space weather capabilities, enhancing our ability to understand and forecast conditions that affect critical infrastructure, communications, aviation, and national security. Across our Earth and atmospheric science programs, we are not only delivering high-quality observational data but also applying those data to real-world challenges. From improving air quality insights to supporting economically sound energy and infrastructure decision-making and aiding disaster response, Langley science is translating research into action that serves society.

Innovation remains a defining characteristic of our organization. We are optimizing limited resources by developing integrated small satellite and CubeSat missions that deliver high-impact science at a fraction of traditional mission costs, highlighted by the successful launches of Arcstone and Athena in 2025. These efforts demonstrate how disciplined systems engineering and creativity can accelerate discovery while maintaining fiscal responsibility.

At the same time, our airborne science teams deploy some of the most powerful lidar capabilities in the world, providing unparalleled atmospheric measurements that strengthen our understanding of Earth's complex systems. Our in-situ capabilities further serve as the gold standard for validating and improving remote sensing and modeling products. Together, these investments reinforce Langley's leadership in advanced measurement technologies across ground, air, and space.

Our progress is amplified through strong partnerships across NASA, federal agencies, academia, industry, and international collaborators. Engagement with Earth Science Division leadership this year reaffirmed the unique value of Langley's expertise—from instrument development and radiation budget measurements to technology maturation and mission implementation. Even amid budgetary pressures, there is clear recognition of the indispensable capabilities our team provides to NASA and to the nation.

Equally important is our commitment to the future. We are cultivating a new generation of world-class scientists and engineers by providing meaningful, hands-on opportunities in flight and field research, ensuring continuity of excellence for years to come.

As we look ahead, we remain focused on delivering high-quality data products, research results, successful airborne campaigns, and new technology and mission approaches that advance knowledge and inform decisions. It is an honor to share the accomplishments of the Langley science community—an organization dedicated to innovation, integrity, and service to humanity.

J.D. Reeves

Director, NASA Langley's Science Directorate

J.D. Reeves

OUR VISION

We pioneer solutions to discover transformative science that inspires society.

PIONEER.

We pioneer technical solutions to challenges across aeronautics, space exploration, and science. We advance and infuse new technologies from development into applications within multiple markets, missions, projects, or operational systems.

DISCOVER.

We utilize multiple observational perspectives to discover meaningful scientific knowledge that drives innovation and answers fundamental questions ranging from Earth's oceans to deep space.

INSPIRE.

At the root of our discoveries, we connect and engage communities through transparent, open data as we enable solutions and responses to challenges and societal needs that drive the U.S. economy and lead to wide-ranging applications and benefits.

OUR EXPERTS

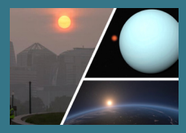
We are driven to explore the unknown, discover essential science, push the boundaries of our scientific and technical limits, and then push further.

PEOPLE PROFILES:

OUR END-TO-END APPROACH

- Research & Analysis
- Instrument System Development
- Data Retrieval
- Calibration & Validation
- Data Distribution
- Modeling & Simulation

OUR CORE FOCUS AREAS



ATMOSPHERIC COMPOSITION

From the Earth's surface to the stratosphere, we study changes in the atmosphere that could affect habitability, and we apply that knowledge to explore other planetary atmospheres.

EARTH'S ENERGY BUDGET

We study Earth's absorbed solar and outgoing thermal infrared radiant energy to include long-term weather and climate patterns that impact society and quality of life.

SCIENCE DATA IN ACTION

We use NASA's science data to meet real-world challenges for disasters response, coastal resilience, weather predictions and forecasting, energy efficiency and agriculture.

SPACE WEATHER INVESTIGATIONS

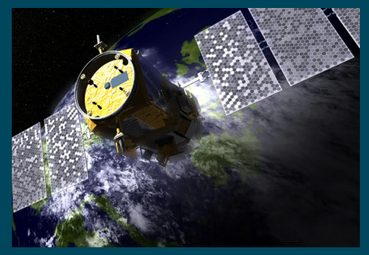
We study the physical processes of space weather and help data users explore new models to predict space weather activities and to understand space weather effects on Earth.

LEARN MORE ABOUT LANGLEY SCIENCE:

PIONEER | TECHNOLOGY DEVELOPMENT

RESIDENT EXPERTISE WITH AN IN-DEPTH UNDERSTANDING OF KEY LIDAR PERFORMANCE DRIVERS POSITIONS LANGLEY TO SERVE AS A BRIDGE TO THE BROADER COMMUNITY IN LASERS, DETECTION SUB-SYSTEMS, AND OPTICAL FILTERING.

NASA Langley is equipped with collaborative subject matter experts and unique facilities to pioneer solutions to challenges across aeronautics, space exploration, and science, that enables new technologies with multiple infusion pathways across aerospace missions and markets.

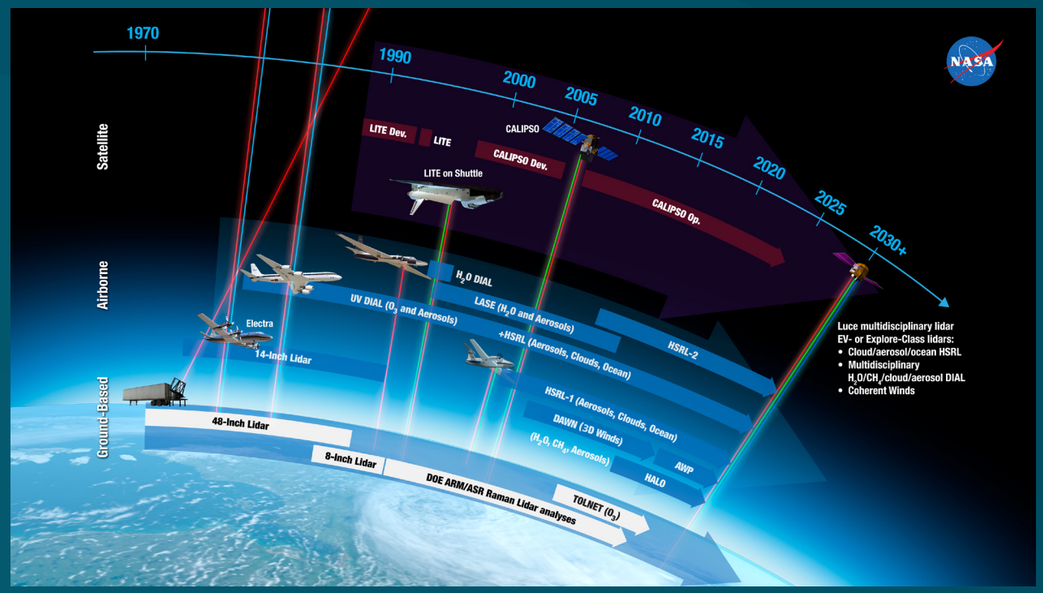


SCIENCE

AERONAUTICS

SPACE EXPLORATION

WORLD-CLASS LIDAR TECHNOLOGY



One of the key differentiators between Langley and other Centers and university labs is our end-to-end science-driven capability in lidars for atmospheres and oceans. Langley possesses capabilities in lidar instrument implementation from concept development through hardware development, deployment, mission operations, and data processing/archival.

Langley's breadth of lidar expertise spans:

SCIENCE
Understanding the Science and Applications Traceability Matrix (SATM) and observations required.

ALGORITHMS
Converting measured signals into the required observations.

ENGINEERING
Designing, building and testing lidar instruments for ground, airborne, and space applications; developing unique lasers based on science requirements; laser component and system modeling; incorporating state-of-the-art technologies for transmitter and receiver; etc.

CALIBRATION & VALIDATION
Ensuring that the lidar design provides calibrated measurements with required precision and accuracy.

LIDAR TECHNOLOGY

FOR ATMOSPHERES & OCEANS

NASA Langley has decades of demonstrated expertise in the design, development, operation, and science analysis of Earth observation lidar systems to study atmospheres and more recently, oceans.

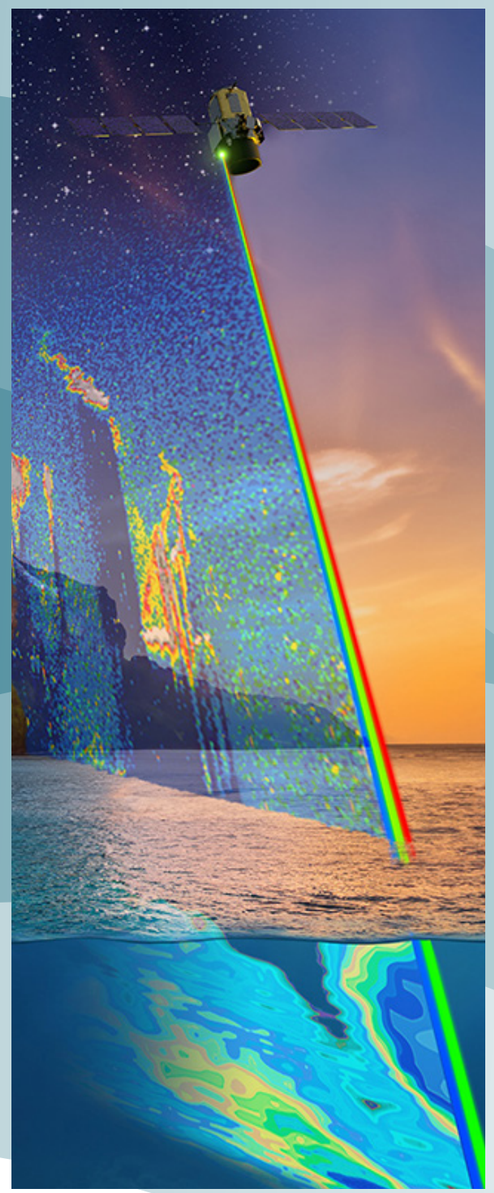
In the same way a radar system uses radio waves, a lidar detection system sends short pulses of laser light towards a given object or area. The laser light strikes the lidar system's target and reflects backwards to a detector in the instrument.

For many of Langley's lidar systems, the "targets" are air molecules, aerosol and cloud particles suspended in the atmosphere, or water molecules and particles suspended in the ocean.

By sending out tens to thousands of laser light pulses every second, lidar systems are able to provide information on things like the altitude of the suspended particles (or depth of ocean particles), optical properties of suspended particles, wind speed and direction, and concentrations of important gases in the atmosphere, such as ozone, water vapor, and methane.

When lidars are deployed on moving platforms such as aircraft or spacecraft, they provide "curtains" of data showing cloud, wind, aerosol and even ocean composition at varying altitudes/depths and horizontal location. With multiple overpasses of a region, the lidar data can be used to understand the vertical and horizontal transport of particles and gases in the atmosphere.

Langley has opened a new frontier in lidar remote sensing of oceans, spearheaded by the first-ever global ocean retrievals of CALIPSO data and advanced through the world's most accurate airborne ocean-profiling lidars (using the High Spectral Resolution Lidar technique) to serve the next-generation spaceborne observing system.



Lidar: Earth Applications for Societal Benefit

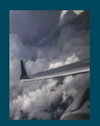
Weather Forecasting by observing cloud distributions & properties to improve retrievals

Water Resource Management by providing satellite-based snow depth/water equivalents.

Climate Modeling by providing measurements of aerosol, cloud and biological processes improving climate prediction

Air Quality through more precise measurements of aerosols to better forecast impacts on human health

Disaster Monitoring by rapidly conveying observations and predictions of volcanic plumes and wildfire smoke.



LIDAR CAPABILITIES FOR PLANETARY SCIENCE

The benefits of lidar for planetary science don't end on Earth. Lidar has many applications in planetary science, such as surface topography, and global profiles of major atmospheric parameters, such as winds, density, temperature, and aerosols, literally shining a light on new aspects of these fields. Spectroscopic methods being developed at Langley may aid in investigation of gases in planetary atmospheres.

Entry, Descent, & Landing (EDL) and Navigation Doppler Lidar (NDL)

To land safely on various types of planetary surfaces, NASA has developed several types of advanced technologies. Flash lidar, which produces a large beam that takes photos, helps to determine risks in landings. In earnest development at NASA Langley is the Navigation Doppler Lidar (NDL), a high-performance, compact, and cost-effective velocity and altitude sensor which can accurately measure the velocity and position of a landing vehicle. NDL sends three laser beams towards the ground and measures range and velocity. The measurements from the three beams are then combined, proving the velocity and position information with ultra-high precision.

Surface Topography, Exploration, and Characterization

Understanding the patterns on a land surface using lidar surface topography capabilities can have many benefits, among them identifying potential areas at risk of landslide hazards and water runoff. Langley is also developing lidars that have the capabilities necessary to study other planetary bodies, such as Mars and the Moon.

Investigations of Planetary Atmospheres and Materials

The benefits of lidar for planetary science don't end on Earth. Spectroscopic methods being developed at Langley may aid in investigation of minerals, organics, and biogenic materials, as well as atmospheric studies of Mars and Europa, among other celestial bodies.

Searching for Evidence of Life on Other Planets

Langley's Engineering Directorate has designed, fabricated and built a Raman spectrometer in-house for remote and in-situ detection under the PICASSO Program and successfully demonstrated its performance by acquiring Raman spectra from minerals, organic and biogenic materials or biomarkers (e.g. amino acids). The flourescents produced from the Raman spectrometer can aid in the search for minerals, water and life on other planets such as Mars and Europa as well.

PIONEER TECHNOLOGY DEVELOPMENT

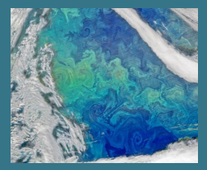
NASA Langley has pioneering expertise and capabilities that infuse **technologies** for predictive and explanatory science that unlocks potential, accelerates discovery, and solves complex problems.

HIGHLIGHTED TECH IN DEVELOPMENT

Blue Lidar for Ocean Profiling Up to Two Times Greater Depths

NASA Langley is advancing ocean profiling lidar technology that includes an innovative interferometric receiver technique to measure the vertical profile of temperature and salinity.

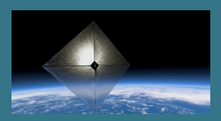
These blue-wavelength lasers are expected to profile to up to two times greater depths than the current state-of-the-art to quantify global plankton stocks, plankton community composition, diel vertical migration of zooplankton and fish, and mixing layer depths.



Deployable Optic Collector to Reduce Costs of Space-Based Lidar Instruments on CubeSats

The Smart Polyimide Expandable Collector to enable Investigations for Earth Science (SPECIES) is a NASA project developing a large, lightweight, and deployable optical collector for small satellites, like CubeSats.

The collector uses a diffractive optical element (DOE) made of polyimide that can be folded for launch and unfurled in space using an extendable boom. This technology addresses the need for larger apertures for space-based instruments like lidar while overcoming the high cost and mass of traditional optics.



Cross-Cutting Differential Absorption Lidar for Humidity Profiles from Space

The Atmospheric Boundary Layer Lidar PathfindEr (ABLE), a cross-cutting Differential Absorption Lidar (DIAL), is a pathfinder mission concept to enable the first demonstration of humidity profiles from DIAL in space.

Water vapor is the most dominant of the short-lived greenhouse gases and plays a critical role in Earth's weather and climate systems.

ABLE will increase the collective scientific understanding of natural phenomena using remote sensing technology.

Game-changing Approach to Measure ERB with Increased Data Quality and Reduced Cost

Using an innovative and integrated approach, NASA's DEMETER mission DEMonstrates the Emerging Technology that measures the Earth's Radiation Budget from top of the Earth's atmosphere.

DEMETER preserves the existing ERB data continuity while increasing capability with a solution that reduces cost, size, mass and overall risks associated with data gaps.

DEMETER's 'right-sized' ERB sensorcraft will fly as a constellation of small sensorcraft in multiple Low Earth Orbit planes. Current constellations contain nine significantly larger observatories that are distributed in Low earth and geostationary orbits. DEMETER reduces the mass on orbit by a factor of nearly 70.

Innovative Sunlight Denoising Technique For Future Spaceborne Lidars

NASA Langley has developed a quantum computing technique to improve daytime lidar measurement quality and reduce the cost of future spaceborne lidars. The goal is to optimize and test an innovative quantum-accelerated data analysis technique to subtract sunlight noise in space lidar data. This approach will be compared to a deep-learning autoencoder for select Cloud Aerosol Transport System (CATS) and ICESat-2 lidar. In addition to cost reduction analysis, this technique explores quantum computing for lidar data processing.

NASA's Earth Science Technology Office (ESTO) invests in technologies to advance our understanding of Earth's natural systems.

We also advance and infuse Langley-developed **tools** from development into applications within multiple markets, missions, projects, or operational systems.

HIGHLIGHTED TOOLS

High-Precision, Real-Time Tool for Severe Thunderstorm Signature Detection

NASA Langley has developed a machine learning-based tool to detect severe thunderstorm signatures from geostationary satellite imagery, primarily focusing on identifying features like overshooting cloud tops (OTs) and above anvil cirrus plumes (AACPs).

In testing, the models have been shown to successfully detect OTs and AACPs with high precision. The software has also successfully been run for real-time and archived applications.

The goal of this software is for users to accurately detect these severe storm signatures for a variety of forecast and research applications.

Software Use

This software is intended for research and operational use. Users can contact the software team regarding its use. It is especially recommended that our team be contacted before publication or public presentation. This is the first official release of this software; these products are still undergoing validation, testing, quality control, and debugging.

Database to Study Aurora, Airglow in Planetary Atmospheres

Studying aurora and airglow in planetary atmospheres necessitates an accurate understanding of atomic and molecular cross-sections for ionization, excitation, and dissociation. However, model inter-comparisons often result in discrepancies due to differences in cross-section input data rather than the underlying physical approximations.

ATMOCIAD (ATomic and MOlecular cross-section for ionization and aurora database) offers a more consistent and reliable foundation for studying the interactions between stellar radiation and planetary atmospheres -- these interactions dictate a planet's climate, atmospheric composition, and ultimately, its potential for habitability.

Reference Models of Planetary Atmospheres Used by Flight Mechanics

NASA Langley and NASA Marshall provide an integrated approach to understanding robust aerospace systems that can perform in all atmospheric bodies in the Solar System, from Venus and Earth to Uranus and Neptune.

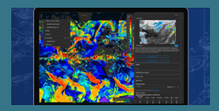
The Global Reference Atmospheric Models (GRAM) Suite, which provides engineering level reference models of planetary atmospheres (density, pressure, temperature, and winds) that are used by flight mechanics for simulations and other tools.

World-Class Global Datasets and Products with In-House Algorithms

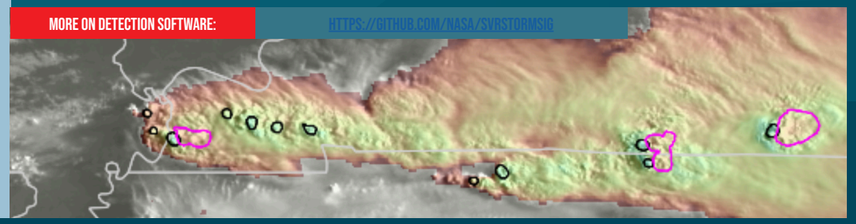
SatCORPS is the only system capable of producing hourly global information on clouds, atmospheric thermodynamics. It also produces precise, fast radiation data for applications and operational use.

In 2025, the SatCORPS team completed a new system for creating operational, hourly, 3-km resolution Global Cloud Composites (GCC). This critical data is used by the National Laboratory for building solar radiation databases, and for global cloud analysis systems used for weather forecasting.

Learn more on pages 56-57.



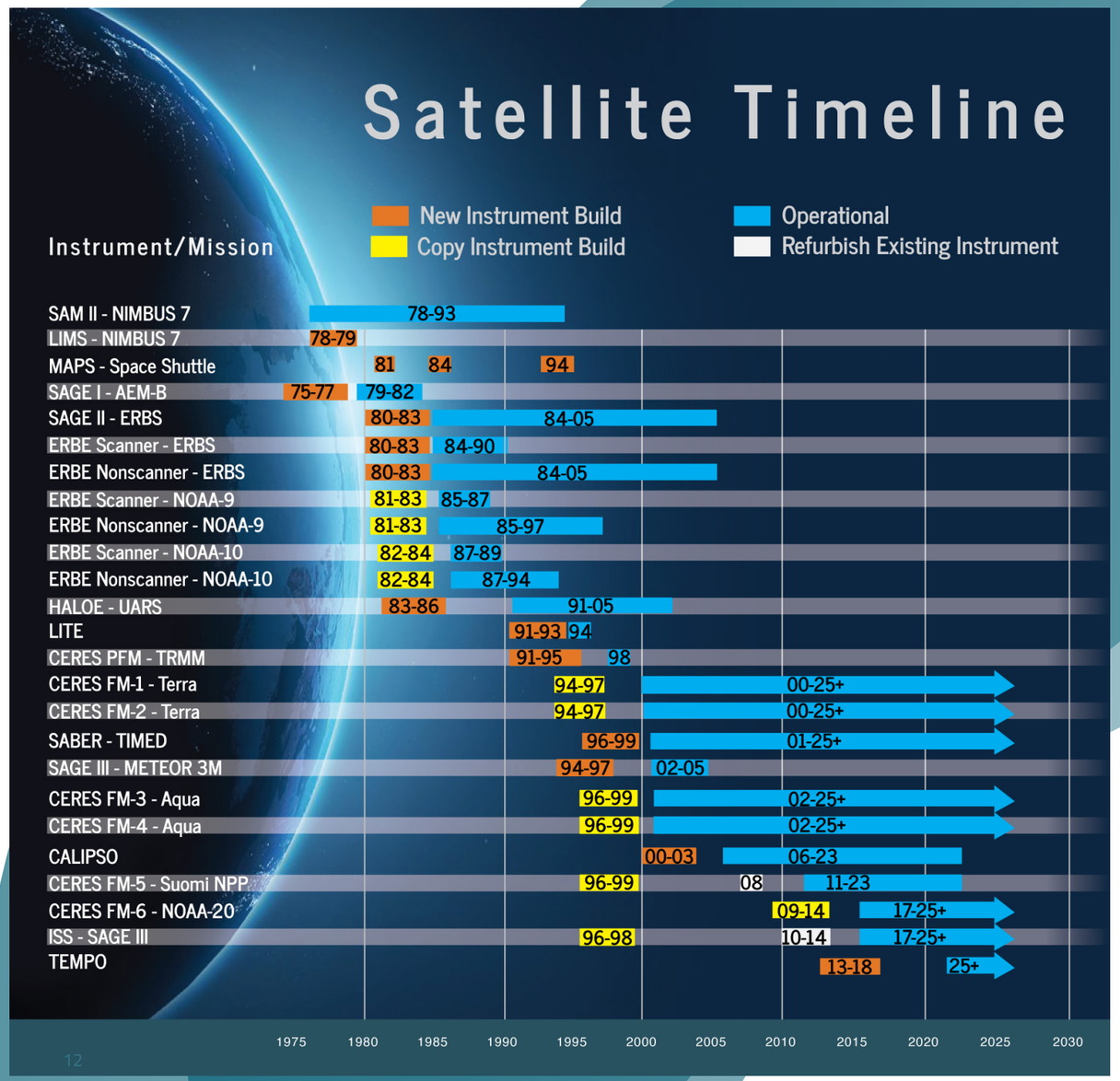
MORE ON DETECTION SOFTWARE: HTTPS://GITHUB.COM/NASA/SVRSTORMSIG



DID YOU KNOW?

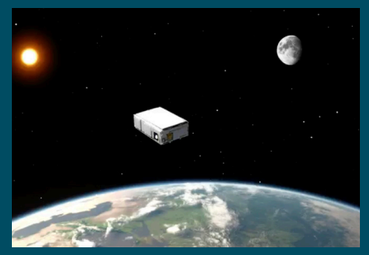
NASA Langley has a **100% success rate** for on-orbit instruments?

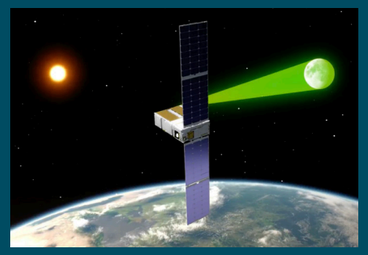
Satellite Timeline

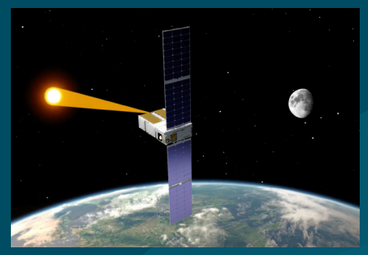


FLIGHT PROJECTS

NASA Langley develops complex, intricate spaceflight and atmospheric flight hardware to explore the unknown. Langley's Flight Projects division uses an integrated approach to science, engineering, safety, mission assurance, and management, which enables us to take on and accomplish the most challenging of missions. The Science Directorate partners with other Langley directorates to accomplish the goals of NASA science. Flight Projects are thoughtfully progressed through 'Lifecycle Phases' with clearly established objectives.







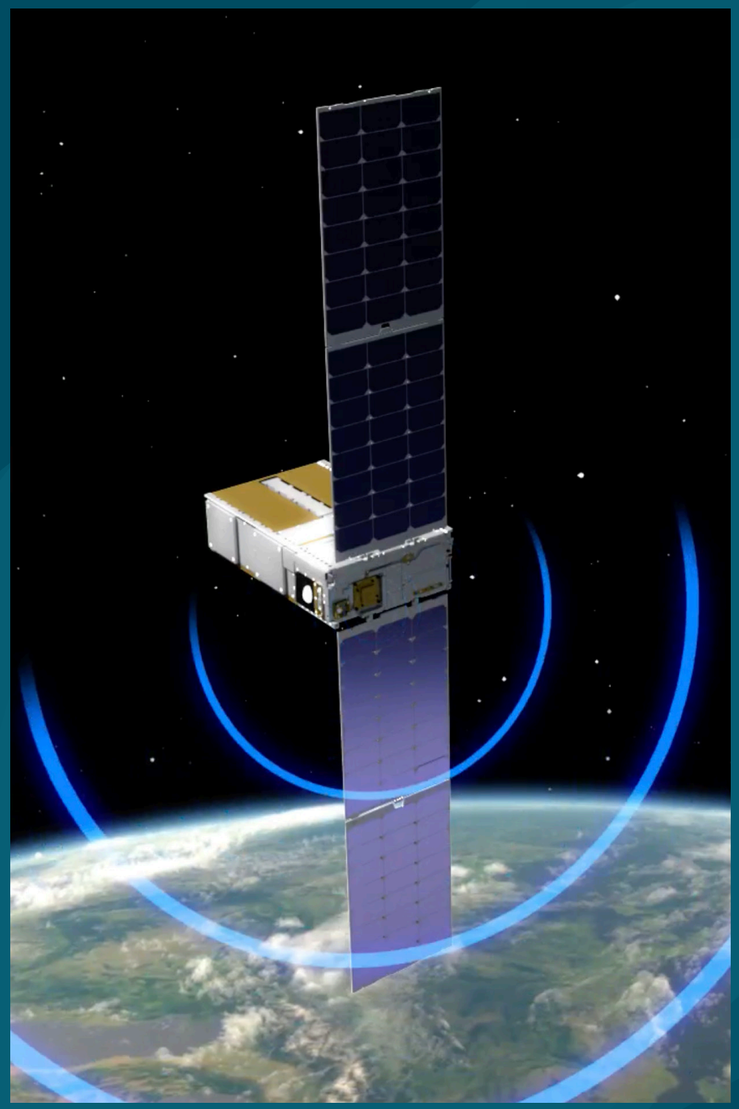
Arcstone

In 2026, Arcstone completed a successful commissioning for the instrument and the main structure of the satellite, or bus. Testing began shortly after launching from Vandenberg Space Force Base in California June 23 on a SpaceX Transporter-14 rideshare mission.

On Aug. 13, the Arcstone spectrometer, the first instrument dedicated to improving the accuracy of lunar reflectance measurements from space, began gathering validated lunar and solar spectral measurements, beginning the active portion of the mission. The measurements of sunlight reflected off the Moon can be used to fine-tune spacecraft instruments by calibrating sensors on-orbit.

This agency technology demonstration has the potential to improve the quality of data from Earth-viewing sensors in orbit by showing that a high-accuracy, universal calibration standard of lunar reflectance can be created and used across the international scientific community and commercial space industry.

The Arcstone technology demonstration project is funded by NASA's Earth Science Technology Office's In-space Validation of Earth Science Technologies. Arcstone is led by NASA Langley in partnership with the University of Colorado Boulder's Laboratory for Atmospheric and Space Physics, USGS, NASA's Goddard Space Flight Center in Greenbelt, Maryland, Resonon Inc., Blue Canyon Technologies, and Quartus Engineering.



SMALLSATS TAKE FLIGHT

NASA's Arcstone and Athena EPIC instruments launched in 2025 to test and demonstrate ground-breaking technologies.

Athena EPIC

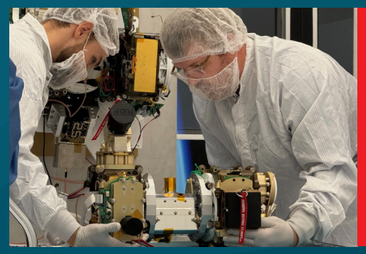
NASA's Athena EPIC satellite launched aboard a SpaceX Falcon 9 rocket from Space Launch Complex 4 East at Vandenberg Space Force Base in California on July 23 at 2:13 p.m. EDT as a rideshare mission with several other payloads.

NASA's Athena Economical Payload Integration Cost mission, or Athena EPIC, is a test launch for an innovative, scalable space vehicle design to support future missions. The small satellite platform is engineered to share resources among the payloads onboard by managing routine functions so the individual payloads don't have to.

This technology results in lower costs to taxpayers and a quicker path to launch.

The HISat instruments are similar in nature to a child's toy interlocking building blocks. They're engineered to be built into larger structures called SensorCraft. Those SensorCraft can share resources with multiple payloads and conform to different sizes and shapes to accommodate them. This easily configurable, building-block architecture allows a lot of flexibility with payload designs and concepts, ultimately giving payload providers easier, less expensive access to space and increased maneuverability between multiple orbits.

Scientists at NASA's Langley Research Center in Hampton, Virginia, designed and built the Athena sensor payload, which consists of an optical module, a calibration module, and a newly developed sensor electronics assembly. Athena EPIC's sensor was built with spare parts from NASA's CERES (Clouds and the Earth's Radiant Energy System) mission. Several different generations of CERES satellite and space station instruments have tracked Earth's radiation budget.



NOAA (National Oceanic and Atmospheric Administration) and the U.S. Space Force are government partners for this demo mission. Athena EPIC's industry partner, NovaWurks, provided the space vehicle, which utilizes a small satellite platform assembled with a Hyper-Integrated Satlet, or HISat.

THIS TECHNOLOGY RESULTS IN LOWER COSTS TO TAXPAYERS AND A QUICKER PATH TO LAUNCH.

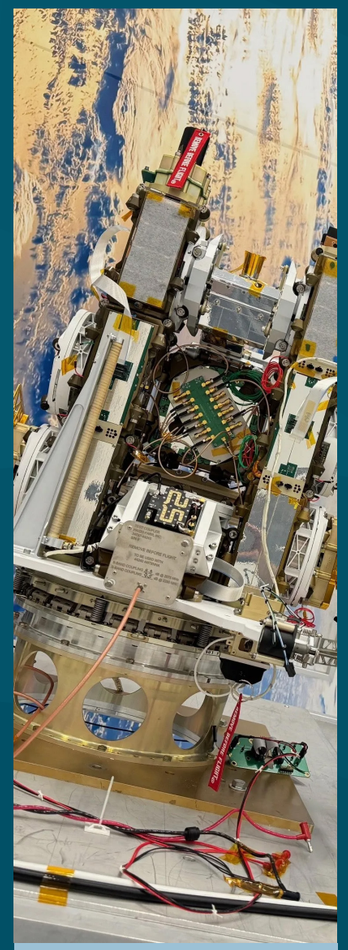


IMAGE ABOVE: THE FULLY ASSEMBLED AND TESTED ATHENA EPIC SATELLITE WHICH INCORPORATES EIGHT HISATS MOUNTED ON A MOCK-UP. SPACEX PROVIDED LAUNCH PEDESTAL.. CREDIT: NOVAWURKS

PIONEER | FLIGHT PROJECTS

Selected as a NASA New Frontiers mission, Dragonfly will send a robotic rotorcraft to Titan, the largest moon of Saturn.

Launch is scheduled for July 2028 and the spacecraft will arrive at Titan in late 2034. The relocatable lander will study Titan's prebiotic chemistry and extraterrestrial habitability using a sophisticated scientific payload. Multiple takeoffs and landings during a three-year surface mission will enable the Dragonfly lander to explore multiple areas of Titan situated near the equator.

The mission is managed by the Johns Hopkins Applied Physics Laboratory (APL) in Laurel, Maryland. Lockheed Martin (LM) Space Systems is responsible for the cruise stage and aeroshell, and LM's Sikorsky division provides rotorcraft expertise. NASA is leading the effort for entry, descent, and landing (EDL) testing and analysis, including flight mechanics, aeroshell aerodynamics, aerotherodynamics, and thermal protections systems. NASA Langley also provides subject matter experts for modeling and testing of the parachute decelerator system (PDS), which is provided by Airborne Systems. Langley's Atmospheric Flight and Entry Systems Branch is responsible for providing critical flight mechanics analysis and aerodynamics analysis/testing of the EDL sequence, including whether critical mission requirements are met with acceptable risk.

Learn more about the Dragonfly at: https://dragonfly.jhuapl.edu/

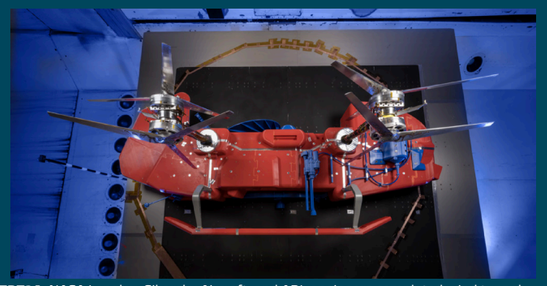
Dragonfly Rotorcraft Clears Key Tests Ahead of 2028 Titan Launch

The Parachute Decelerator Subsystem (PDS), managed by NASA Langley for the Entry, Decent & Landing (EDL) Phase of the Dragonfly Mission, completed Critical Design Review (CDR) and a series of development tests from the component- to full scale-levels in 2025. PDS operation during EDL is critical to safe landing of the rotorcraft on Titan. The team is now working to qualify hardware for flight.

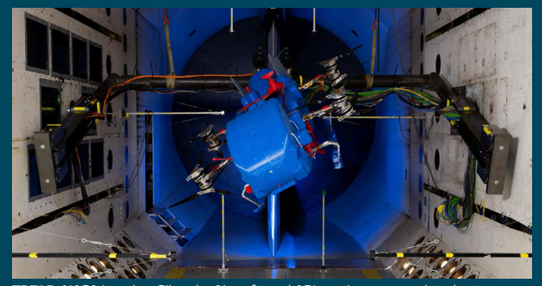
With the completion of the recent round of tests, the Dragonfly mission will move forward to the integration and test phase in January 2026.

Langley's Transonic Dynamics Tunnel (TDT) is a closed-circuit, continuous flow, variable pressure wind tunnel. The TDT is dedicated to identifying and solving aeroelasticity issues confronting fixed-wing aircraft and helicopter and tiltrotor configurations.

NASA engineers worked with APL to conduct aerodynamic analyses of the Dragonfly rotor system to determinethe effects of Titan's thick atmosphere, stress loads and vibration on performance. NASA Langley's Transonic Dynamics Tunnel (TDT) was used for this testing due to suitability of the facility for simulating Titan's cold and dense atmosphere. The rotorcraft's Solimide-based foam coating was subjected to structural and thermal tests to ensure its durability and ability to protect the lander from Titan's temperatures.

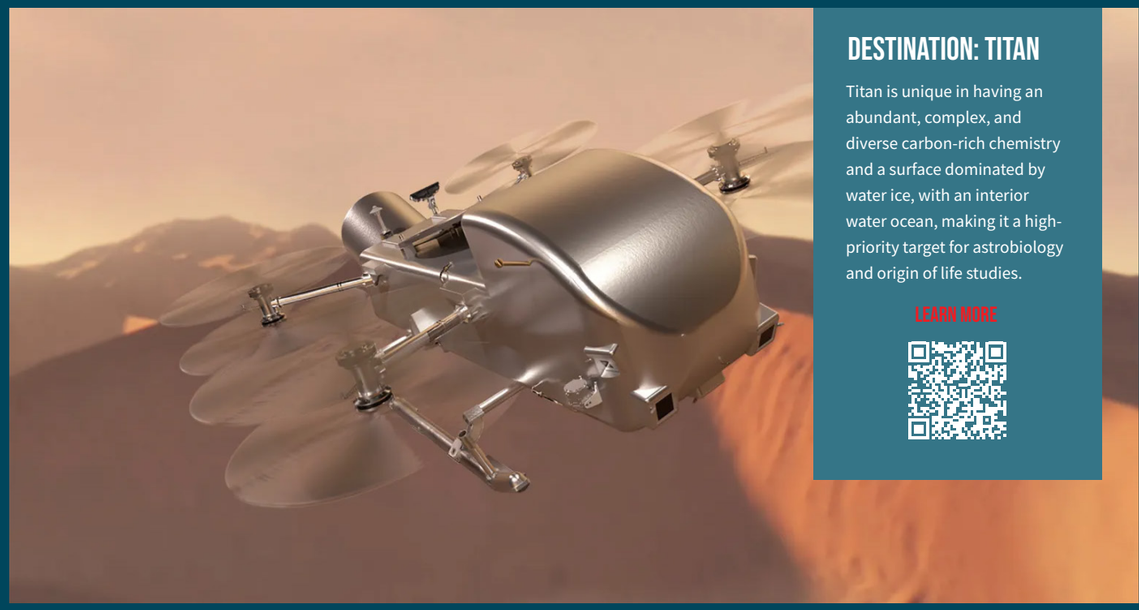


TDT2A: NASA Langley, Sikorsky Aircraft, and APL engineers completed wind tunnel testing of a full scale, semi-span model of the Dragonfly rotorcraft lander in the TDT. The model consisted of four three-bladed rotors as well as 3D printed fuselage instrumented with pressure sensors as well as science mission instrumentation. The rich dataset acquired during this test entry will be used to validate Dragonfly computational design tools, a critical step for the Program, since Titan's unique combination of a dense atmosphere and low gravity makes flight testing of this vehicle impossible.



TDT2B: NASA Langley, Sikorsky Aircraft, and APL engineers completed a two-month-long wind tunnel test of a 68% scale, full-vehicle model of the Dragonfly rotorcraft lander in the TDT. The model, mounted on a custom-built apparatus that allowed simultaneous model pitch and roll, consisted of 8 three-bladed rotors as well as 3D printed fuselage instrumented with pressure sensors. The rich dataset acquired during this test entry will be used to validate Dragonfly computational design tools, a critical step for the Program.

DRAGONFLY



DESTINATION: TITAN

Titan is unique in having an abundant, complex, and diverse carbon-rich chemistry and a surface dominated by water ice, with an interior water ocean, making it a high-priority target for astrobiology and origin of life studies.

LEARN MORE

Langley's Flight Tranducers Help to Ensure a DrEAM Entry for Dragonfly

Dragonfly Atmospheric Flight Transducers (DrAFT) are a part of the Dragonfly Entry Aerosciences Measurements (DrEAM) instrumentation suite on the Dragonfly entry vehicle. A team from NASA's Langley and Ames Research Centers completed the required environmental testing of DrAFT to ensure survivability during transit and entry into Titan's atmosphere.

The transducers were also put through a full characterization test by Langley engineers to down select which units would be installed on the Dragonfly entry vehicle heatshield. This test involved measuring the sensor output at pressures and temperatures beyond the expected EDL environment. This shows the transducers can operate beyond what is expected during the entry event.

A first of its kind automated dynamic pressure test was also performed on the candidate set of transducers to simulate the initial pressure pulse and slow pressure rise that they will experience during atmospheric entry. This allowed the engineers to gather data on the hysteresis on a flight-like timescale.

DRAGONFLY'S MISSION INVOLVES IDENTIFYING POSSIBLE LANDING SITES AND STUDYING TITAN'S HABITABILITY.

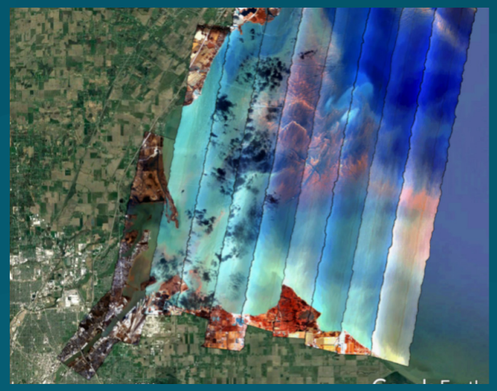
In 2026, NASA Langley will formulate ideas and plans to mature two new instrument systems for planetary exploration.

HYPERPIX: HYPERSPECTRAL PLANETARY IMAGING EXPLORER

HyperPIX technology will help answer key questions about the origins of our solar system, the search for life, and the study of our planetary neighborhood.

The Hyperspectral Planetary Imaging Explorer (HyperPIX) instrument will capture a hyperspectral snapshot image covering a broad spectral range from an investigation scene offering high spectral and spatial resolutions. HyperPIX will combine the functions of a mapping spectrometer to an imaging instrument without increasing the design complexity of the imaging instrument. This work targets the notional instrument requirements for an orbiting planetary science platform, but the technique can be adapted to surface measurements.

For validation and demonstration, HyperPIX prototype architecture will leverage the Stratospheric Aerosol and Gas Experiment (SAGE IV) Pathfinder instrument using solar occultation technique.



SUCR: STANDOFF ULTRA-COMPACT RAMAN INSTRUMENT

From a rover or lander platform, SUCR technology will determine the presence of water on Mars, and identify and characterize minerals, organics, biogenic and potential biomarkers (amino acids) that might be associated with life.

The Standoff Ultra-Compact micro-Raman (SUCR) sensor with a Raman spectrometer demonstrated acquisition of Raman signals from water, ice, minerals, organics, biomarkers (such as amino acids), and lunar simulants within a target distance of several centimeters. The SUCR sensor operates in both daylight and nighttime conditions without collecting the samples.

Current state-of-the-art Raman sensors can investigate and identify minerals, organics, and biogenic materials or biomarkers in-situ. But these current state-of-the-art micro-Raman systems (used Continuous Wave (CW) lasers) have some limitations, 1) require sample collection and sample manipulation, 2) shields daylight background radiation, 3. in-situ detection, and 4) slow acquisition.

NASA Langley designed, fabricated, and built an innovative Standoff Ultracompact micro-Raman spectrometer in-house for remote and in-situ detection under 2014 & 2016 Planetary Instrument Concept and Advancement of Solar Systems Observation (PICASSO) and 2018 IRAD programs. The feasibility concept of this technology is to mature the SUCR sensor as a payload for next-generation Mars Exploration Missions or an In-Situ Resource Utilization (ISRU) lander for Mars outposts.

HyperPIX and SUCR were awarded through the Planetary Instrument Concepts for the Advancement of Solar System Observations (PICASSO) program, which supports the development of instrument hardware to enhance or enable the scientific return on future planetary missions to other worlds within our solar system.

SAGE IV: Science in a Shoebox

SAGE IV is a solar occultation imager capable of meeting or exceeding SAGE-quality ozone, aerosol and water vapor measurements at significant size and cost reduction. The simple design offers extensibility for greater utility and coverage.

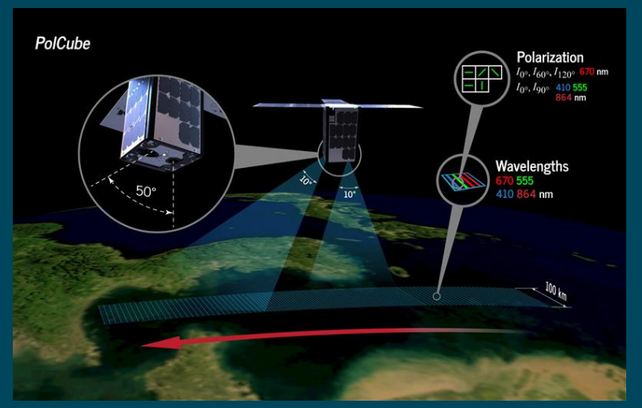
[VIDEO]: NASA's SAGE IV Pathfinder is 'science in a shoebox,' which enables a sustainable way to monitor the health of Earth's ozone layer at roughly 1/10 the cost and size of previous SAGE instruments.

PolCube: CubeSat Polarimeter for Earth Science

The proposed PolCube mission is an international collaboration between NASA Langley and the Korea Astronomy and Space Science Institute (KASI). The goal of the mission is to validate ocean and air polarimetric science measurements from a CubeSat.

PolCube's accurate and high-resolution aerosol-retrieval products will provide unique spatial and temporal coverage of the Earth that can be used synergistically with other instruments, such as the PACE (Plankton, Aerosols, Clouds and Ecosystems) and GEMS (Geostationary Environmental Monitoring Spectrometer) mission to improve air-quality forecasting.

In 2025, the PolCube team completed calibration. A Technical Interchange meeting will take place in early 2026 ahead of the tentative launch and data retrieval in Spring 2026.



DISCOVER
PLANETARY SCIENCE

We bring the tools to better understand harsh planetary conditions like wind, dust storms and ice for environmental survival and to avoid landing hazards.

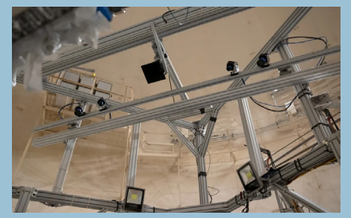
NASA intentionally applies knowledge and technology developed for planetary missions to its Earth science efforts, and vice-versa. This includes adapting satellite technologies for different planetary bodies and using Earth observations to inform broader explorations of the cosmos.

As NASA's Artemis heads to the Moon and Mars, NASA Langley applies extensive Entry, Descent and, Landing (EDL) knowledge and experience in terrain navigation, plume surface interaction, and lunar lander technologies.

In 2025, NASA researchers employed a new camera system to capture data imagery of the interaction between Firefly Aerospace Blue Ghost Mission-1 lander's engine plumes and the lunar surface.

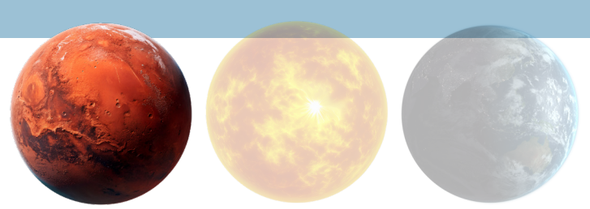
Through NASA's Artemis campaign, this data will help researchers understand the hazards that may occur when a lander's engine plumes blast away at the lunar dust, soil, and rocks.

The data also will be used by NASA's commercial partners as they develop their human landing systems to safely transport astronauts from lunar orbit to the Moon's surface and back, beginning with Artemis III.



"The data from these tests at NASA Langley will be critical in developing and validating models to predict the effects of plume surface interaction for landing on the Moon and even Mars, ensuring mission success for the HLS landers and the safety of our astronauts."

-- Daniel Stubbs, Engineer with HLS Plume and Aero Environments Team at NASA Marshall



As we continue our planetary exploration with Artemis, NASA will send astronauts to the Moon for scientific discovery, economic benefits, and to build upon our foundation for the first crewed missions to Mars – for the benefit of all.

ARTEMIS AND BEYOND

LEARN MORE ABOUT NASA LANGLEY'S CONTRIBUTIONS TO ARTEMIS

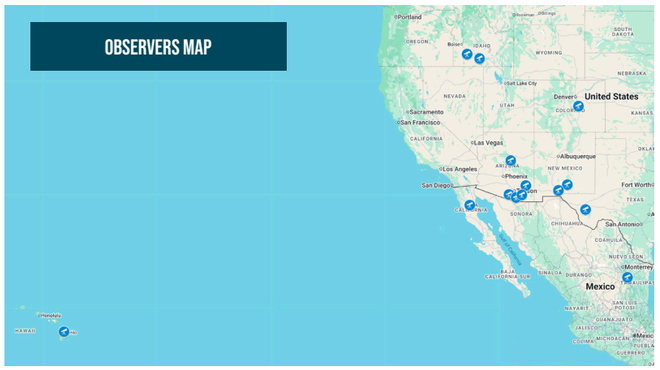
PLANETARY ALIGNMENT OFFERS A RARE OPPORTUNITY TO STUDY URANUS

When a planet's orbit brings it between Earth and a distant star, it's more than just a cosmic game of hide and seek. It's an opportunity for NASA to improve its understanding of that planet's orbit, atmosphere and rings. Planetary scientists call it a stellar occultation and that's exactly what happened with Uranus on April 7.

Observing the alignment allows NASA scientists to precisely measure the temperatures, pressures, and densities of Uranus' stratosphere – the middle layer of a planet's atmosphere – and determine how it has changed over the last 29 years since Uranus' last significant occultation.

"This was the largest collaboration ever for a giant planet stellar occultation and I'm grateful for every team member's expertise to make it possible," said William Saunders, science principal investigator and analysis lead at NASA's Langley Research Center. Dr. Saunders and Principal Investigator Kunio Sayanagi led a team of 34 astronomers using 18 professional telescopes to observe the stellar occultation.

Langley scientists are currently interpreting these new temperature measurements to understand how Uranus' middle atmosphere has changed over the past several decades and to compare to changes in the upper and lower atmospheres. Understanding how energy is transported up and down in Uranus' atmosphere, is essential to plan the design of the Uranus Orbiter and Probe mission, the highest-priority planetary Flagship mission recommended for launch in the 2030s by the 2023 Planetary Decadal Survey. In particular, precise density measurements of Uranus' stratosphere are essential for improving the atmospheric probe and incorporating the aerocapture orbit insertion technologies being developed at Langley. Preliminary observation results were presented at the American Geophysical Union meeting in December.



THESE INVESTIGATIONS WERE POSSIBLE BECAUSE A LARGE NUMBER OF PARTNERS PROVIDED MANY UNIQUE VIEWS OF THE STELLAR OCCULTATION FROM MANY DIFFERENT INSTRUMENTS.

BY THE NUMBERS:

- To observe the rare event, which lasted about an hour and was only visible from Western North America, planetary scientists at NASA Langley led an international team of over **30** astronomers using **18** professional observatories.

- **14** telescopes had good weather and were able to make observations.

- At least **7** telescopes observed the atmospheric occultation (the primary objective) with high signal to noise.

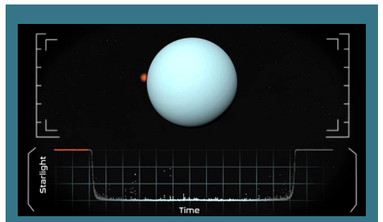
- At least **7** telescopes detected multiple Uranus ring occultations.

- Test observations in 2024 allowed the occultation team to model Uranus' expected location during the occultation by **125** miles.

DID YOU KNOW?

- Uranus is almost **2 billion** miles away from Earth and has an atmosphere composed of primarily hydrogen and helium.

- While Saturn is the most well-known planet for having rings, Uranus has **13** known rings composed of ice and dust.



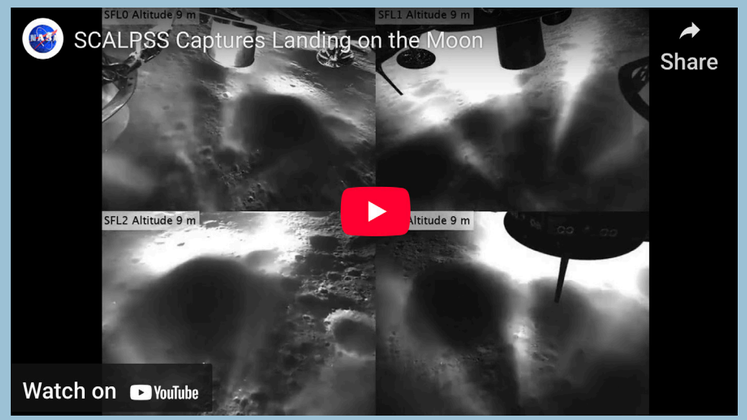
VIEW OCCULTATION RENDERING

SCALPSS: DESIGNED TO ADAPT TO VARIOUS LUNAR LANDERS FOR VALIDATION AND IMAGERY

A team at NASA's Langley Research Center in Hampton, Virginia, supported by Marshall Space Flight Center in Huntsville, Alabama, has captured first-of-its-kind imagery of a lunar lander's engine plumes interacting with the Moon's surface, a key piece of data as trips to the Moon increase in the coming years under the agency's Artemis campaign.

The Stereo Cameras for Lunar-Plume Surface Studies (SCALPSS) 1.1 instrument took the images during the descent and successful soft landing of Firefly Aerospace's Blue Ghost lunar lander on the Moon's Mare Crisium region on March 2, as part of NASA's Commercial Lunar Payload Services (CLPS) initiative.

As trips to the Moon increase and the number of payloads touching down in proximity to one another grows, scientists and engineers need to accurately predict the effects of landings. Data from SCALPSS will better inform future robotic and crewed Moon landings.



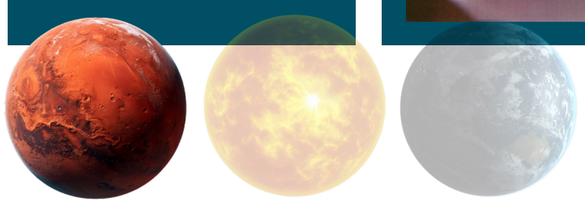
NASA CAMERAS ON BLUE GHOST CAPTURE FIRST-OF-ITS-KIND MOON LANDING FOOTAGE.

SCALPSS is crucial for understanding how to prevent damage to nearby equipment, such as habitats or other landers, from kicked-up dust during future Artemis missions. In 2025, data was successfully collected and returned to Earth, showing, for the first time, in-depth footage of the plume-surface interaction.

VIEW CAMERA ANIMATION

2025 MARKS THE 50TH ANNIVERSARY OF THE LANGLEY-MANAGED VIKING PROJECT LAUNCH

NASA's Viking Project found a place in history when it became the first U.S. mission to land a spacecraft safely on the surface of Mars and return images of the surface. Assigned in 1974, Langley Research Center led the project, managing the overall program and landing, while JPL managed the spacecraft, orbiters, and deep space network.



DISCOVER

SPACE WEATHER

We advance research and applications to help predict and track space weather events across the solar system to enhance safety for air travelers, astronauts, and life on Earth.

NASA's recent airborne science flights over Greenland are advancing global radiation safety by improving models that predict cosmic radiation exposure for air travelers and astronauts.

The Space Weather Aviation Radiation (SWXRAD) campaign gathered rare, high-latitude measurements to validate NASA's Nowcast of Aerospace Ionizing Radiation System (NAIRAS), which informs flight safety and future space mission planning.

By collecting data in Earth's least magnetically shielded region, scientists can refine models that protect pilots, passengers, and spacecraft crews from harmful radiation. This research not only enhances aviation safety on Earth but also lays the groundwork for protecting astronauts during lunar and Martian missions.

Jamie Favors, NASA Space Weather Program director, and Chris Mertens, SWXRAD principal investigator, discussing a dosimeter at NASA's Langley Research Center as specialized instruments are integrated onto NASA's B200 King Air aircraft before deploying to Greenland.

Web Article LEARN MORE ABOUT THE SWXRAD CAMPAIGN

SWxPO: Facilitating User-Focused Space Weather Research and Application

The Space Weather Program Office (SWxPO), hosted at NASA Langley Research Center, is led by an experienced program management team that works closely with the Space Weather Program at NASA Headquarters, and making Space Weather a more user-friendly topic for anyone interested in learning more about the science.

LEARN MORE ABOUT NASA'S SPACE WEATHER PROGRAM OFFICE:

We utilize multiple observational perspectives to discover meaningful scientific knowledge that drives innovation and answers fundamental questions ranging from Earth's oceans to deep space.

NASA'S RADIATION FORECASTS SHIELD U-2 PILOTS DURING EXTREME SOLAR STORM

NASA's Nowcast of Aerospace Ionizing Radiation System (NAIRAS), based at NASA Langley, played a pivotal role in safeguarding U.S. Air Force (USAF) pilots in November.

NAIRAS is a modeling system that features real-time global maps of hazardous radiation in the atmosphere. Models are used to create exposure predictions for both aircraft and spacecraft, ensuring the safety of pilots and passengers alike.

During intense solar storms that occurred Nov. 9-13, NAIRAS was instrumental in forecasting dangerously elevated radiation levels, prompting immediate action from the USAF. Thanks to NAIRAS' real-time warnings, the USAF made the critical decision to cancel select missions, thereby protecting their U-2 pilots from the heightened radiation exposure. This proactive measure highlights how NAIRAS can be used to maintain aircrew safety during rare high-radiation events like the ones that occurred in November.

The USAF has since expressed their gratitude to NASA, acknowledging the direct contribution of NAIRAS to the safety and well-being of their pilots.

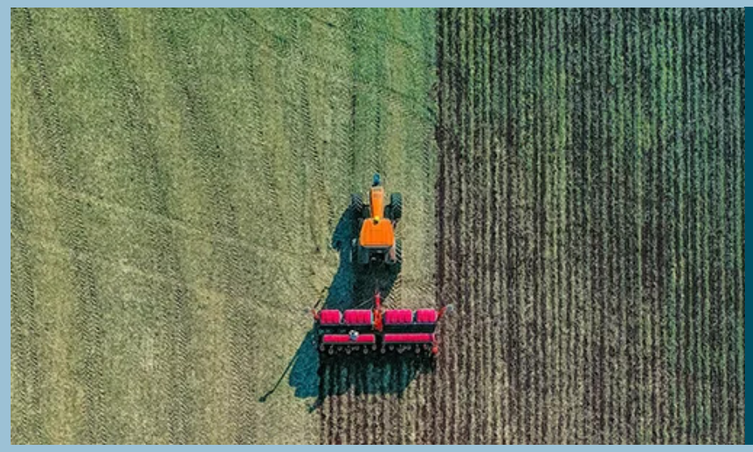
As solar activity continues to pose potential hazards, systems like NAIRAS can play a critical role in providing timely and accurate data to protect those who venture into the skies. This radiation protection capability results from collaboration between Langley's NAIRAS team and the Community Coordinated Modeling Center at NASA's Goddard Space Flight Center that ensures the USAF's continuous access to the model outputs.

NAIRAS VERSION 3.0 OFFERS REAL-TIME GLOBAL PREDICTIONS OF THE ATMOSPHERIC RADIATION ENVIRONMENT, UPDATED HOURLY. FLIGHT PATH SIMULATIONS ARE AVAILABLE TO USERS FOR SPECIFIC TIME FRAMES OR FROM FILE UPLOADS.

NAIRAS RADIATION PREDICTION MODEL

The NAIRAS model predicts biologically hazardous radiation exposure to crew and passengers onboard aircraft or spacecraft from the ever-present galactic cosmic rays (GCR), inner radiation belt trapped protons (TRP) in low-Earth orbit (LEO), and the episodic, transient solar energetic particles (SEP) originating from solar eruptive events. The NAIRAS model also predicts the radiation flux and fluence quantities for the assessment of microelectronic single event effects (SEE) to avionic and spaceflight electronic systems.

NAIRAS MODEL CATALOG



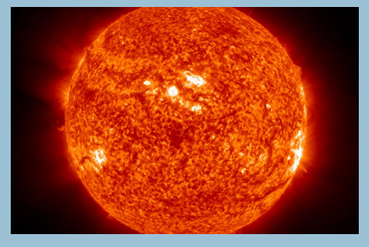
RESEARCH HIGHLIGHT

Assessment of Space Weather Impacts on Precision Agriculture Using the Global Navigation Satellite System

The results will provide valuable educational material to inform farmers about space weather impacts on precision agriculture such as positioning errors. Lessons learned from this study would guide future co-development space weather projects to integrate of spaceweather data and modeling with end users.

The research indicates that as precision agriculture continues to advance with drones and autonomous robots, improving the resilience of GNSS systems against space weather is critical for future food security.

Research in this field, particularly during the intense solar activity of 2024–2025 (Solar Cycle 25), highlights significant vulnerabilities in GNSS-reliant agriculture.



Key Impacts of Space Weather on Precision Agriculture Include:

- Ionospheric Disturbances: Solar activity, such as coronal mass ejections and flares, increases ionization in the ionosphere, which bends or disrupts radio signals from GNSS satellites.

- **Positioning Errors:** During severe geomagnetic storms (e.g., May 10, 2024), GPS/GNSS receivers—crucial for tractors and autonomous machinery—experienced significant errors, with reported deviations in precise point positioning (PPP) reaching up to 70 meters in the Central US.

- Operational Inefficiencies: Inaccurate positioning leads to sub-optimal field management, such as skips or overlaps in planting, fertilizing, and spraying, directly reducing resource use efficiency and crop yields.

- Data Loss: When GNSS signals are lost, yield monitors fail to georeference data, preventing farmers from analyzing field performance or participating in data-driven decision-making.

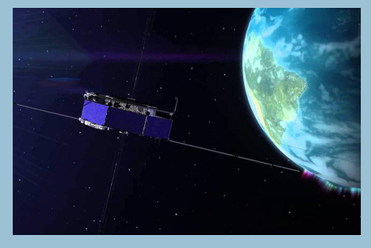
- Equatorial Plasma Bubbles (EPBs): In regions near the geomagnetic equator, such as Brazil, these bubbles cause severe scintillations (rapid fluctuations in signal amplitude and phase), disrupting agriculture during key seasons.

Findings and Mitigation Strategies Include:

Heightened Risk: As precision agriculture relies heavily on GNSS, increased solar activity during the solar maximum (2024–2025) makes these disruptions more frequent.

Financial Impact: The May 2024, geomagnetic storm resulted in estimated losses of $500 million to $565 million for US Midwestern crop producers.

PUBLICATION HIGHLIGHT (.PDF)



Mitigation Efforts: Research suggests that using dual-frequency GNSS receivers can mitigate some errors, reducing them to centimeter-level accuracy even during disturbed conditions. Additionally, adopting Real-Time Kinematic (RTK) and Simultaneous Localization and Mapping (SLAM) techniques can help maintain operational accuracy.

TECH REPORT: Characterizing the Space Radiation Environment of Transatlantic Flights and Estimating Radiation Exposure to Commercial Crew

TECH REPORT: Enhancing Aurora Watch Planning of Arctic Cruises During Polar Tourism Peak

SHIELDS-1 DEMONSTRATES SPACE WEATHER SCIENCE AND SPACECRAFT RESILIENCE

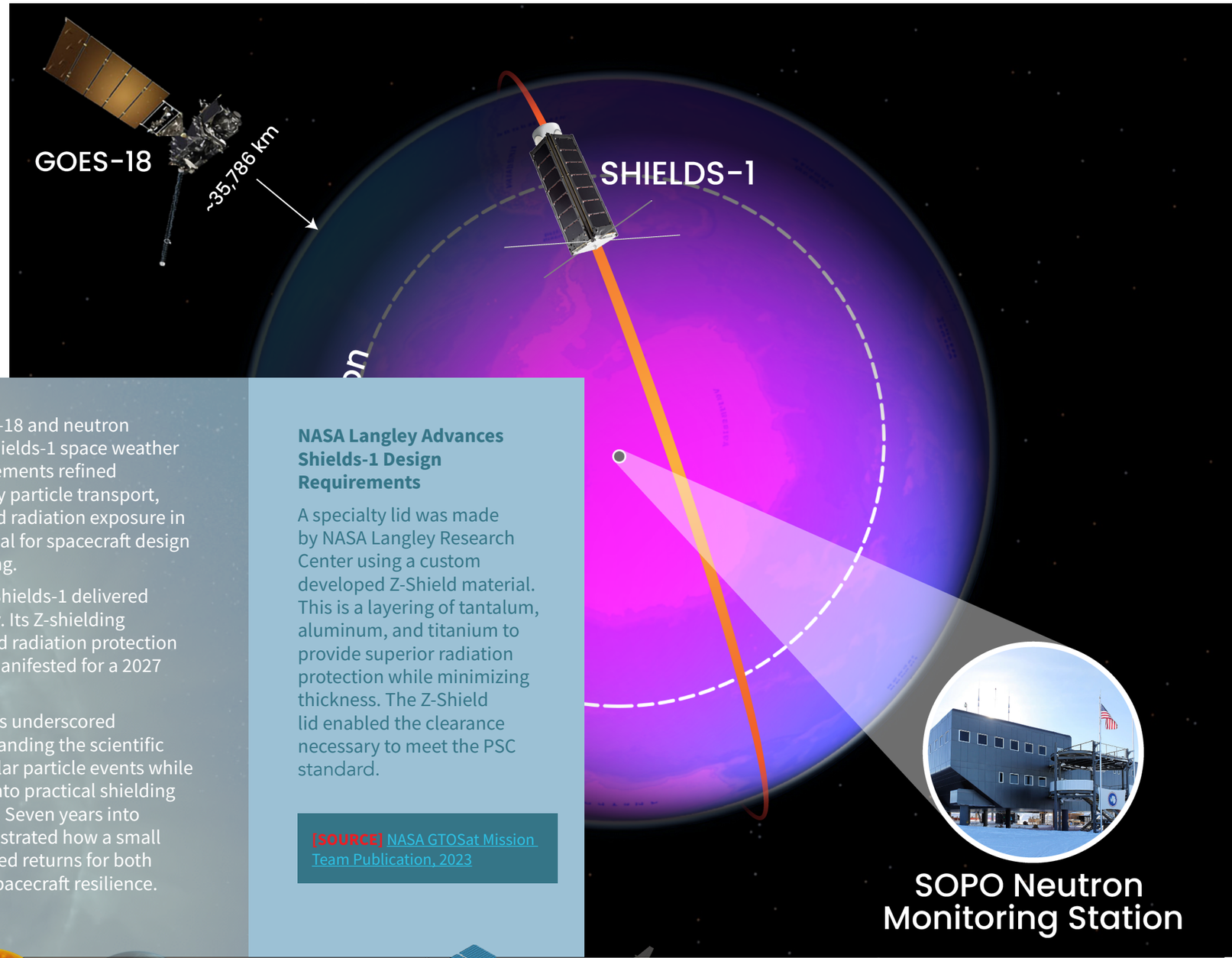
As it approached its seventh year in orbit on December 16, Shields-1 emerged as one of the most quietly consequential spacecraft in NASA's Space Weather Program. Launched in 2018 as a 3U CubeSat on the ELaNa-XIX, the small satellite matured into a high-impact science platform, delivering rare, science-grade measurements of high-energy solar particles in polar low Earth orbit.

Equipped with eight dosimeters capable of detecting protons above 100 MeV, Shields-1 collected one-minute dose and dose-rate data, enabling detailed radiation heat maps tied to orbital position. That precision proved critical on November 11, 2025, when the spacecraft recorded the most energetic solar particle event in 19 years. It detected the onset at 1052 UTC over the South Pole, capturing the highest intensities and contributing to Ground Level Enhancement (GLE)-77.

The data revealed polar particle bursts not detected by GOES-18 and documented dose rate peaks that were only partially observed by ground-based neutron monitors. The GOES-18 and neutron monitoring data validated Shields-1 space weather observations. These measurements refined understanding of high-energy particle transport, shielding cutoff latitudes, and radiation exposure in polar orbits—insights essential for spacecraft design and space weather monitoring.

Beyond its scientific return, Shields-1 delivered mission-enabling technology. Its Z-shielding architecture directly informed radiation protection strategies for SMD GTOSat, manifested for a 2027 launch.

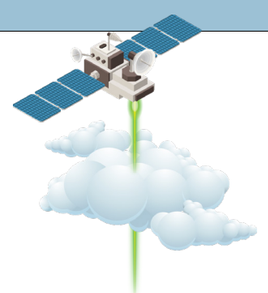
Together, these achievements underscored Shields-1's dual impact—expanding the scientific understanding of extreme solar particle events while translating that knowledge into practical shielding solutions for future missions. Seven years into its flight, the CubeSat demonstrated how a small platform could deliver outsized returns for both space weather science and spacecraft resilience.

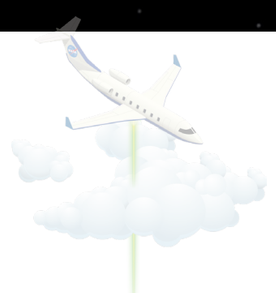


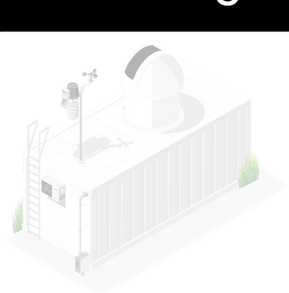
NASA Langley Advances Shields-1 Design Requirements

A specialty lid was made by NASA Langley Research Center using a custom developed Z-Shield material. This is a layering of tantalum, aluminum, and titanium to provide superior radiation protection while minimizing thickness. The Z-Shield lid enabled the clearance necessary to meet the PSC standard.

[SOURCE] NASA GTOSat Mission Team Publication, 2023



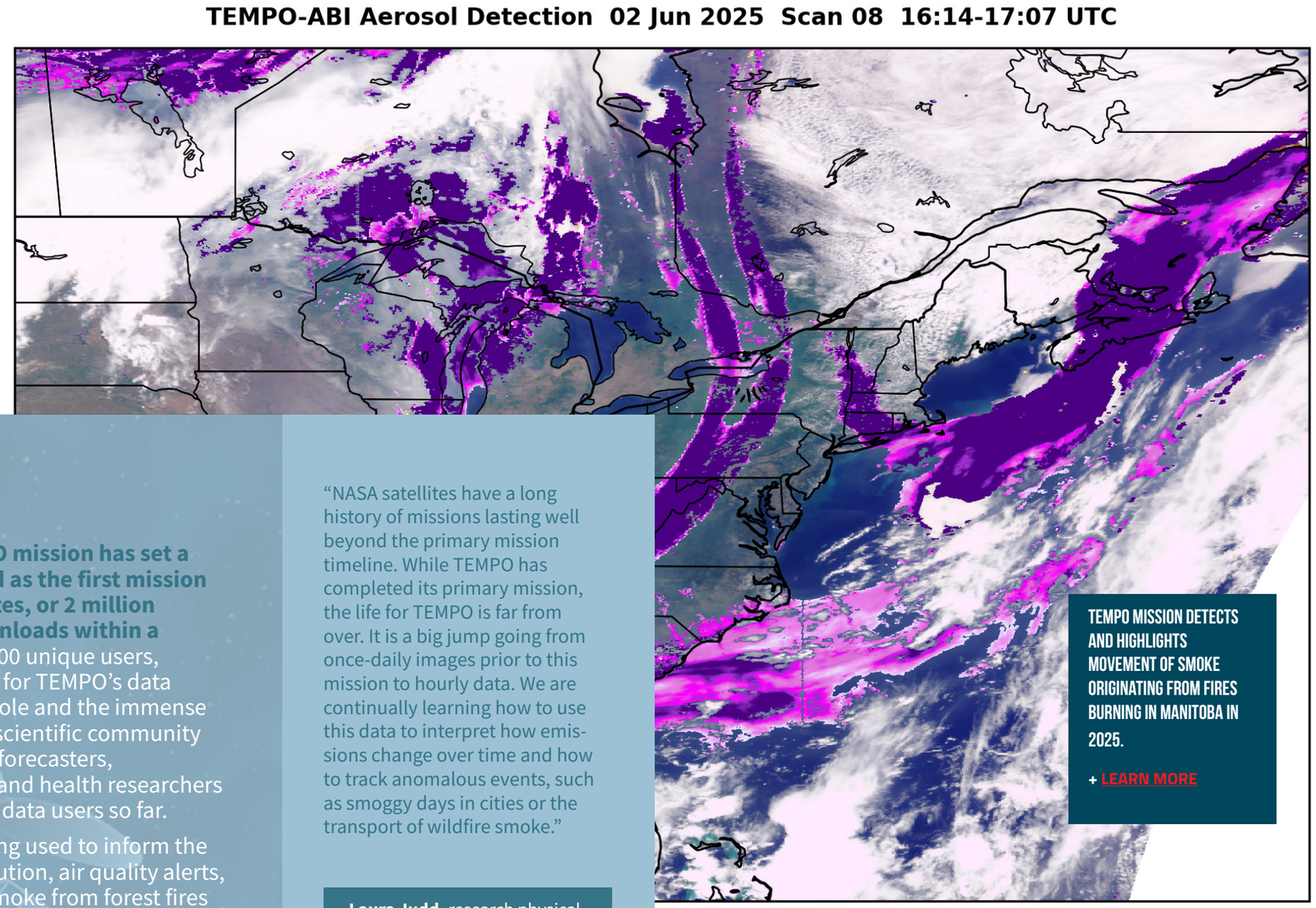




DISCOVER

EARTH SCIENCE: SPACE-BASED

We operate space-based satellites to provide insights into our home planet and help improve public safety with information that can only be gathered from space.



TEMPO CREATES REVOLUTIONARY AIR QUALITY DATASETS

Since launching in 2023, NASA's Tropospheric Emissions: Monitoring of Pollution mission, or TEMPO, has been measuring the quality of the air we breathe from 22,000 miles above the ground. June 19 marked the successful completion of TEMPO's 20-month-long initial prime mission, and based on the quality of measurements to date, the mission has been extended through at least September 2026.

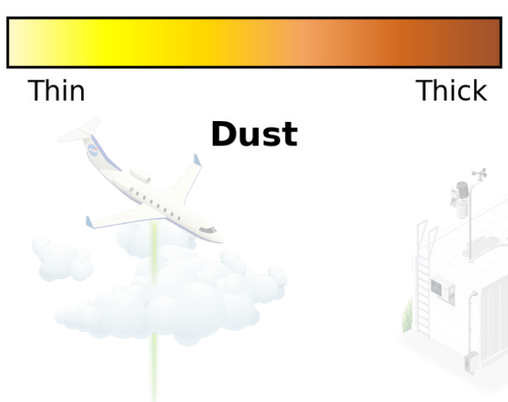
The TEMPO mission is NASA's first to use a spectrometer to gather hourly air quality data continuously over North America during daytime hours. It can see details down to just a few square miles, a significant advancement over previous satellites.

TEMPO data is archived and distributed freely through the Atmospheric Science Data Center. **The TEMPO mission has set a groundbreaking record as the first mission to surpass two petabytes, or 2 million gigabytes, of data downloads within a single year.** With over 800 unique users, the substantial demand for TEMPO's data underscores its critical role and the immense value it provides to the scientific community and beyond. Air quality forecasters, atmospheric scientists, and health researchers make up the bulk of the data users so far.

TEMPO datasets are being used to inform the public of rush-hour pollution, air quality alerts, and the movement of smoke from forest fires with many other science applications.

"NASA satellites have a long history of missions lasting well beyond the primary mission timeline. While TEMPO has completed its primary mission, the life for TEMPO is far from over. It is a big jump going from once-daily images prior to this mission to hourly data. We are continually learning how to use this data to interpret how emissions change over time and how to track anomalous events, such as smoggy days in cities or the transport of wildfire smoke."

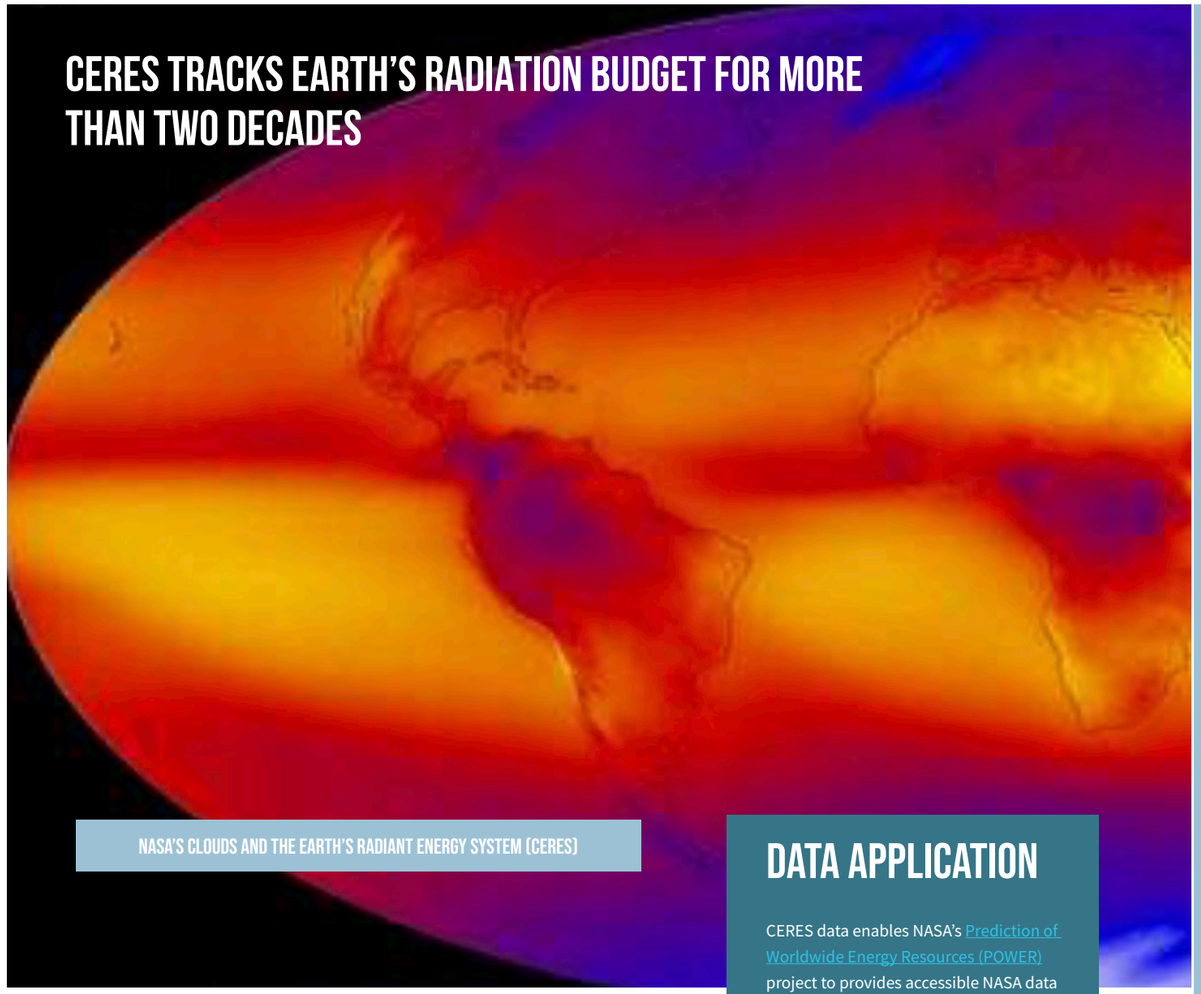
- Laura Judd, research physical scientist and TEMPO science team member at NASA Langley



DISCOVER

EARTH SCIENCE: SPACE-BASED

CERES PROVIDES CRITICAL RADIATION MEASUREMENTS WITH BROAD SCIENCE APPLICATIONS.



CERES TRACKS EARTH'S RADIATION BUDGET FOR MORE THAN TWO DECADES

NASA'S CLOUDS AND THE EARTH'S RADIANT ENERGY SYSTEM (CERES)

The Clouds and the Earth's Radiant Energy System (CERES) was initially designed in the late-1980s and early-1990s as a facility instrument for NASA's Earth Observing System (EOS). Since its inception, NASA's Langley Research Center (LaRC) has led this effort. CERES has a long history with seven different instruments flying on five different missions since 1997. As of today, six CERES instruments remain in orbit – two are no longer operational: the Proto-Flight Model (PFM) unit flew on the Tropical Rainfall Measuring Mission (TRMM) and functioned for a brief period, and FM2, which was powered-off in January 2025 due to battery constraints on Terra. The active CERES instruments are found on Terra (FM1), Aqua (FM3 and 4), the Suomi National Polar-orbiting Partnership (Suomi NPP) (FM5), and the first Joint Polar Satellite System (JPSS-1) mission, now known as NOAA-20 (FM6). Suomi NPP and the JPSS mission are partnerships between the National Oceanic and Atmospheric Administration (NOAA), which owns the satellites, and NASA, which operates them.

DATA APPLICATION

CERES data enables NASA's Prediction of Worldwide Energy Resources (POWER) project to provides accessible NASA data for application in energy, infrastructure and agoclimatology.

POWER PROJECT WEBSITE

DATA VALIDATION

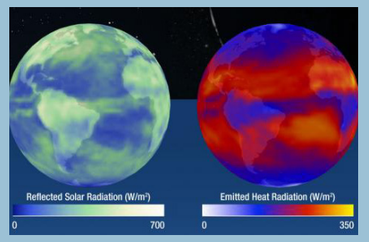
Langley also hosts surface validation sites like CRAVE for CERES data, ensuring accuracy for climate modeling.

CRAVE WEBSITE

CERES LEVEL 4 DATA NOW AVAILABLE VIA LANGLEY'S ATMOSPHERIC SCIENCE DATA CENTER.

As host satellites age and orbits drift, CERES has continued to evolve while continuing to provide climate-critical measurements.

Temperature and radiation analysis by CERES team members links CERES findings with broader climate research initiatives. One focus is the World Climate Research Programme's



Explaining and Predicting Earth System Change effort, which examines Earth's energy imbalance and its drivers.

Work is also underway to understand how orbital drift and cross-platform differences affect top-of-atmosphere fluxes. Algorithm development remains central to sustaining the climate data record. The Edition 5 cloud algorithms aim to keep derived cloud properties consistent between MODIS instruments on Terra and Aqua and VIIRS sensors on Suomi NPP and NOAA-20, despite differences in spectral bands. CERES-derived products continue to evolve as underlying meteorological datasets and radiative transfer schemes are updated.

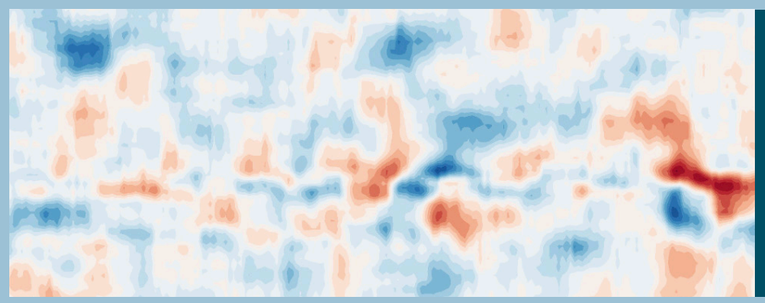
The team is also advancing methods to compare Earth radiation budget instruments and prepare for future missions.

The CERES team reviewed progress on new and planned Earth radiation budget missions. A pathfinder project, Athena EPIC, used a small satellite platform carrying a spare CERES longwave detector and calibration hardware to test a modular spacecraft concept for potential future instruments rehement.

Looking ahead, the Libera mission will fly on JPSS-4 and is designed to extend the CERES radiation budget record with new detectors, building on lessons from a CubeSat instrument that uses the same vertically aligned carbon nanotube absorbers.

The CERES data products capture variations in Earth's Radiation Budget at hourly, daily and monthly timescales and at spatial scales ranging from 20 km to global.

The CERES data are used by the climate, weather and applied science research communities to address a range of research topics that involve the exchange of energy between the Earth and space and between the major components of the Earth system.

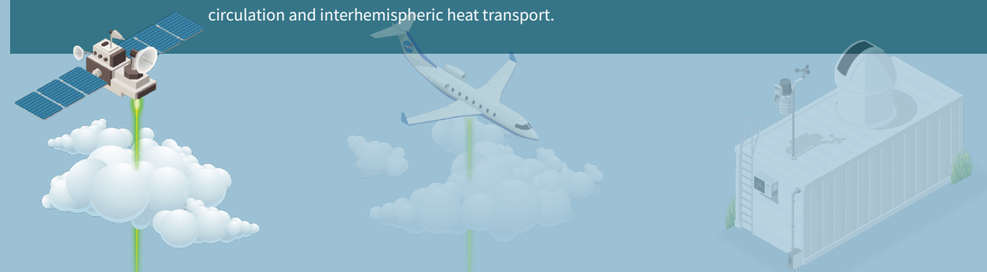


THE EARTH IS GETTING DARKER

Published in the Proceedings of the National Academy of Sciences, this new study highlights an emerging imbalance in the planet's "radiation budget." The radiation budget is the delicate balance between the sunlight Earth absorbs and the energy it emits back into space.

EMERGING HEMISPHERIC ASYMMETRY OF EARTH'S RADIATION

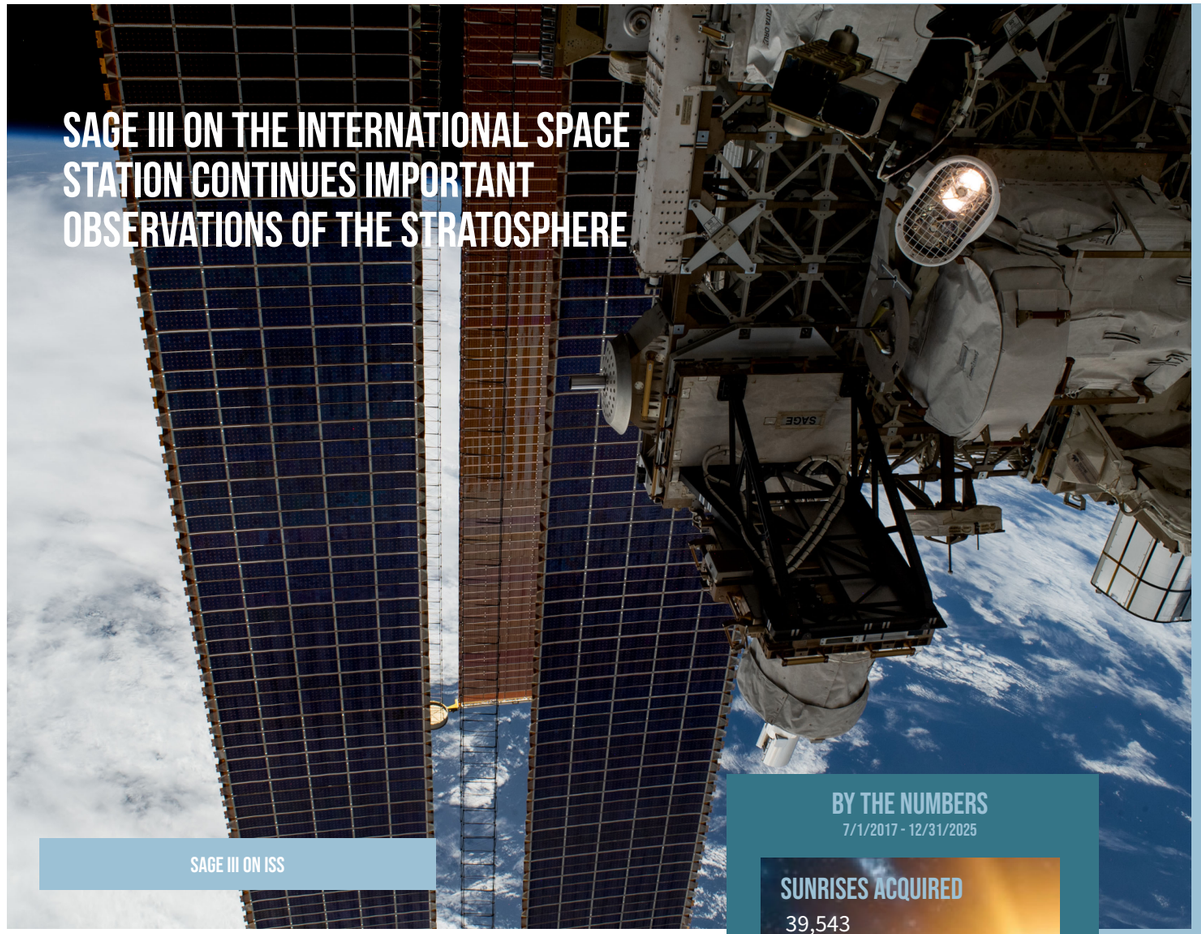
A new study was published in PNAS, the flagship peer-reviewed journal of the National Academy of Sciences (NAS). While both hemispheres are darkening (reflecting less light), the Northern Hemisphere is doing so faster than the Southern. Contrary to previous assumptions, changes in cloud cover are not effectively compensating for this shift in radiative balance. This imbalance challenges existing climate models and suggests future impacts on atmospheric circulation and interhemispheric heat transport.



DISCOVER

EARTH SCIENCE: SPACE-BASED

THE SAGE FAMILY OF INSTRUMENTS PROVIDES INDISPENSABLE, BENCHMARK DATA FOR UNDERSTANDING ATMOSPHERIC CHANGES AND THEIR IMPACT ON THE PLANET.



The Stratospheric Aerosol and Gas Experiment (SAGE) is a series of instruments designed by NASA to observe stratospheric ozone, aerosols, and water vapor from space. Over the past four decades, the SAGE family of instruments has been critical in making accurate measurements of global ozone loss and the very gradual recovery in Earth's atmosphere.

SAGE III is the newest and most advanced addition to the SAGE family, and NASA scientists sent the third generation of the instrument into space on February 19, 2017.

Instead of flying on an unmanned satellite, SAGE III is mounted to the International Space Station (ISS) where it operates alongside experiments from all over the world in the space-based laboratory. It was robotically installed on the outside of the ISS and is now taking important measurements of gases and aerosols over 70% of the planet.

SAGE III takes measurements across the globe using a technique called occultation. Every time the sun, or moon, rises and sets, SAGE uses the light that passes through the atmosphere to measure gases and particles in that region of the atmosphere. From the ISS, this happens over 30 times per day.

BY THE NUMBERS

7/1/2017 - 12/31/2025

SUNRISES ACQUIRED
39,543

SUNSETS ACQUIRED
37,462

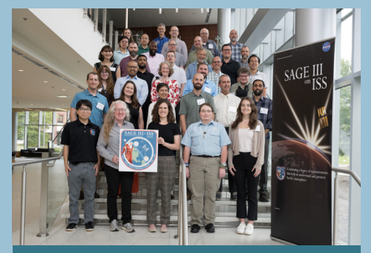
MOONRISES ACQUIRED
2,018

MOONSETS ACQUIRED
3,388

TOTAL OCCULTATIONS
82,411

In 2025, the SAGE III Science Team hosted a successful eighth annual science team meeting at NASA Langley Research Center.

Presentations from the science team, the mission team, and invited speakers covered SAGE III/ISS mission and data product status, research findings, synergy with other NASA and partner missions, and preliminary results of new SAGE products. One presentation highlighted the new aerosol and gas products from SAGE lunar measurements that increase the available data coverage by about 10-15%, shedding light on atmospheric composition changes in the upper troposphere/lower stratosphere resulting from natural disasters like wildfires and volcanic eruptions.

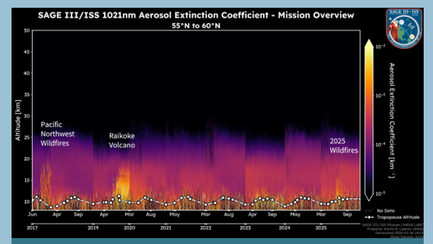


The eighth annual Science Team Meeting was held as a hybrid event with more than 50 participants.

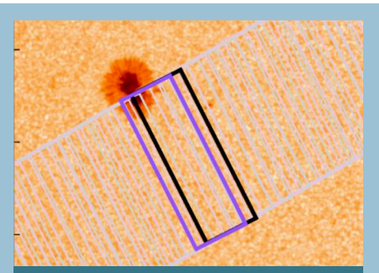
SAGE III/ISS observes a long, widespread wildfire season in Canada in 2025.

The 2025 wildfire season in Canada has been long and widespread with over 6.8 million hectares burned as of August 6, 2025, placing this year in the top 5 seasons, but less than half the size of the devastating 2023 season, according to the Canadian Wildfire Information System. Smoke from the fires traveled to the USA, Europe and beyond.

The June 2025 release of SAGE III/ISS multi-wavelength aerosol extinction coefficient profiles allows scientists to see what smoke was transported into the stratosphere. Each wildfire event is unique and continued measurements of stratospheric aerosol is the only reliable means to know to what extent an extreme fire has perturbed the stratosphere and altered the Earth's energy budget and ozone chemistry.



Aerosol enhancement can be seen below 15 km in June 2025. Other notable enhancements were produced by the Pacific Northwest fires in 2017 (up to 19 km) and the Raikoke volcanic eruption in mid 2019 (up to 20 km).



SAGE III field of view mapped to the sun as it scans the edge of a sunspot.

In 2025, the SAGE III/ISS Version 6.0 enhanced data product was released.

Major product enhancements include: filling transmission gaps, Level 1 uncertainty improvement, changes of ozone absorption cross-sections, and covariance in solar aerosol uncertainty.

One illustration of improved data collection efficiency involves sunspots, which are filtered out of SAGE data as part of regular processing. An increase in frequency and size of sunspots led to discarding enough scans to cause some solar occultation events to yield no science products. To address this loss of science products, in v6 the algorithm team implemented a gap filling technique for small gaps (< 4 points) in the fundamental data. This capability gained 103 events with accuracy similar to the non-sunspot cases.

Information about v6, including data availability, user documentation and quality statements, relevant links, and tools for working with the data can be found at the ASDC.

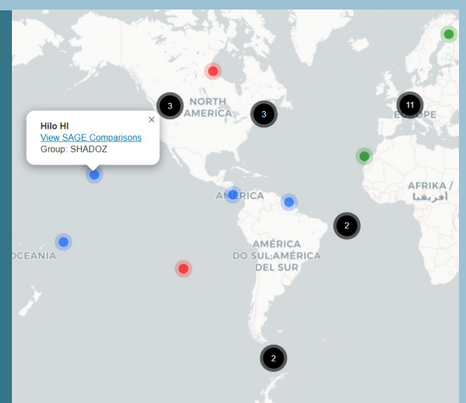
The mission will continue to provide plots of the scientific products on the browse portal: Quicklook (1 month lag) and Expedited (24 hr. lag).

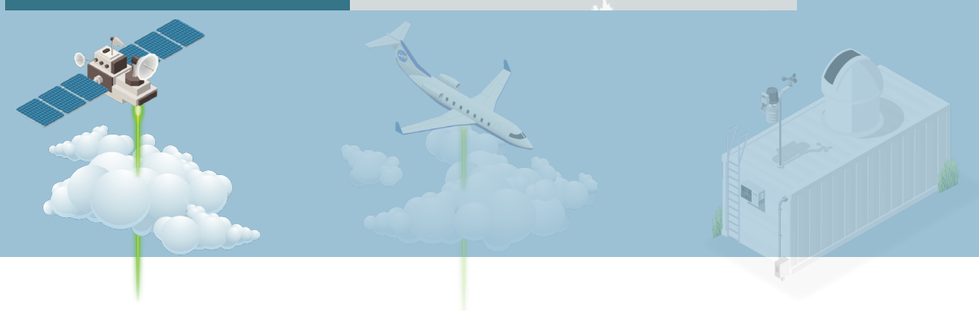
QUICKLOOK

EXPEDITED

A PUBLIC AVENUE TO VIEW SAGE DATA AND COMPARISONS

The SAGE III/ISS Validation Team recently deployed a portal displaying comparisons of mission data products against available data from the Network for the Detection of Atmospheric Composition Change (NDACC) repository. Focusing first on trace gas profiles, the team created summary plots for ozone and water vapor from sonde measurements, and earlier this year expanded to lidar profiles. These can be seen by navigating to the Quicklook page and then selecting the Comparisons tab. NDACC data are archived at the ASDC.





CALIPSO SPACEBORNE LIDAR MEASUREMENTS ENABLE PIONEERING RESEARCH THAT EXTENDS FAR BEYOND MISSION OBJECTIVES

The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) mission was a pioneering international partnership between NASA and the French Space Agency, CNES. The mission provided valuable, first-of-their-kind vertical profile measurements of clouds and atmospheric aerosols over the globe that are needed to understand their role on climate, weather, and air quality.

The CALIPSO mission included a sophisticated multi-wavelength backscatter lidar, an imaging infrared radiometer, and a visible imaging camera. CALIPSO was launched together with the CloudSat cloud radar mission in 2006 into orbit with other satellites known as the A-Train constellation. CALIPSO performed beyond expectations and surpassed its 3-year nominal mission with 17 years of on-orbit observations before concluding its science operations in 2023.

CALIPSO's long-term record was crucial for helping to answer basic questions about how clouds warm or cool the Earth's atmosphere, what fraction of clouds contain ice, water, or some combination of both phases, and what are the primary sources of natural and human-made aerosols and how are they regionally and/or globally transported.

CALIPSO opened many doors of discovery that continue today. CALIPSO's lidar observations extended and improved upon long-term records on the vertical structure and evolution of volcanic stratospheric aerosols and polar stratospheric clouds — the latter being an essential pathway for the formation of the ozone hole. In addition, new and exciting information on the marine phytoplankton distributions and their seasonal behavior was revealed from the lidar signals that penetrate the ocean surface. New techniques for estimating snow depth from space were also identified using the CALIPSO's lidar observations.

CALIPSO's highly sensitive profile observations were highly valued by operational weather centers. These observations helped to evaluate the skill of daily forecasts and helped to improve representation of clouds in the forecast models. Moreover, CALIPSO's observations also provided a unique reference for conventional satellite observations to assess their accuracy and seek improvements. The CALIPSO observations were further recognized as an essential resource by world aviation flight planning centers for detecting the location and altitude of hazardous volcanic plumes.

The mission also demonstrated that lasers could operate in space for long periods and that the measurement technique is stable and resilient. Lessons learned from this pioneering mission will pave the way for future spaceborne lidar missions.

The CALIPSO data products are available via NASA's Earthdata and Atmospheric Sciences Data Center data portals.

CALIPSO Final Report

The CALIPSO final report provides a summary of the mission from its origin through its completion.

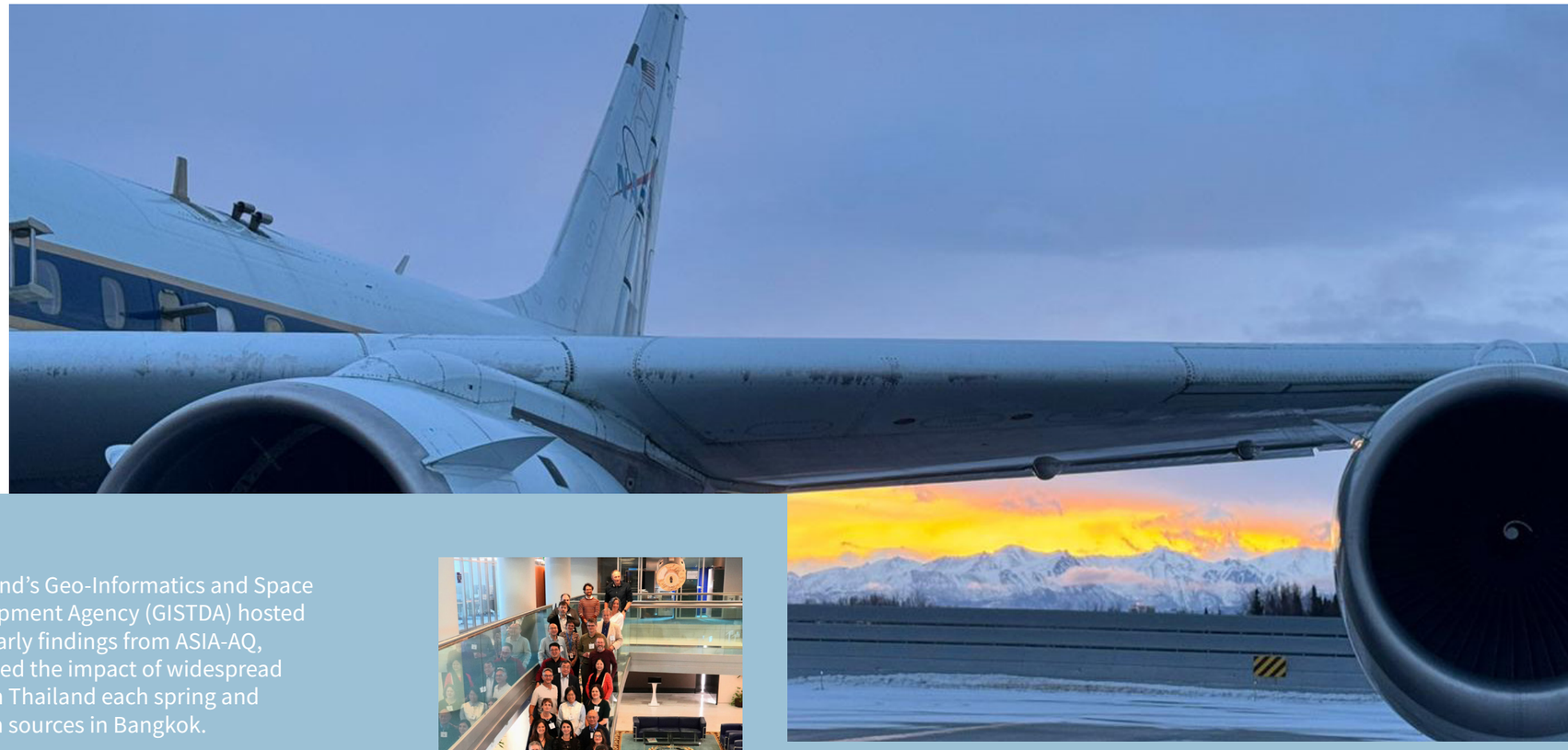
VIEW CALIPSO REPORT (.pdf)

CALIPSO evolved directly from the Langley-developed Lidar In-space Technology Experiment (LITE) instrument, the first Lidar in Earth Orbit. LITE was a three-color laser system used for atmospheric studies onboard the Space Shuttle STS-64.

DISCOVER

EARTH SCIENCE: AIRBORNE

We conduct airborne science research to provide high-resolution, local measurements to study Earth's systems, calibrate and validate satellite data, and test new instruments and sensors before space deployment.

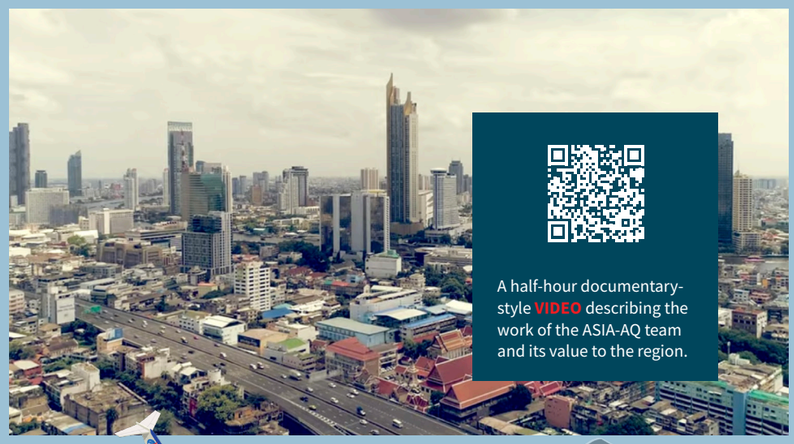


ASIA-AQ provides a significant opportunity for international collaboration by partnering with local stakeholders to apply a unified strategy of multi-perspective observations across several Asian countries. The project aims to enhance understanding of localized air quality issues and the shared challenges in interpreting satellite observations and modeling air quality

NASA's Airborne and Satellite investigation of Air Quality (ASIA-AQ) team conducted observations in Thailand during late March 2024 that are providing important insights for air quality management and expectations for Clean Air legislation currently being considered by the Thai government. ASIA-AQ also promotes the integration of satellite observations into air quality management and forecasting. This year, NASA provided a training seminar on early results from ASIA-AQ for air quality managers from the Bangkok Metropolitan Area.

Also in 2025, Thailand's Geo-Informatics and Space Technology Development Agency (GISTDA) hosted an event to share early findings from ASIA-AQ, The event highlighted the impact of widespread burning in northern Thailand each spring and persistent pollution sources in Bangkok.

Scientists convened at the World Meteorological Organization in Geneva, Switzerland in 2025 to discuss streamlining urban-related activities within the Global Atmospheric Watch (GAW) Programme. NASA Langley proposed air quality model evaluation data from NASA airborne field programs. ASIA-AQ provides unique data for the Philippines, South Korea, Thailand, and Taiwan.



A half-hour documentary-style **VIDEO** describing the work of the ASIA-AQ team and its value to the region.

FIRESENSE IGNITES NEW POSSIBILITIES THROUGH COORDINATED STUDIES

In 2025, NASA's FireSense partnered with the National Interagency Fire Center Incident Awareness and Assessment program and the Alabama Forestry Commission to collect simultaneous airborne science measurements from crewed and uncrewed aircraft platforms over active wildfires and prescribed fires across several states.

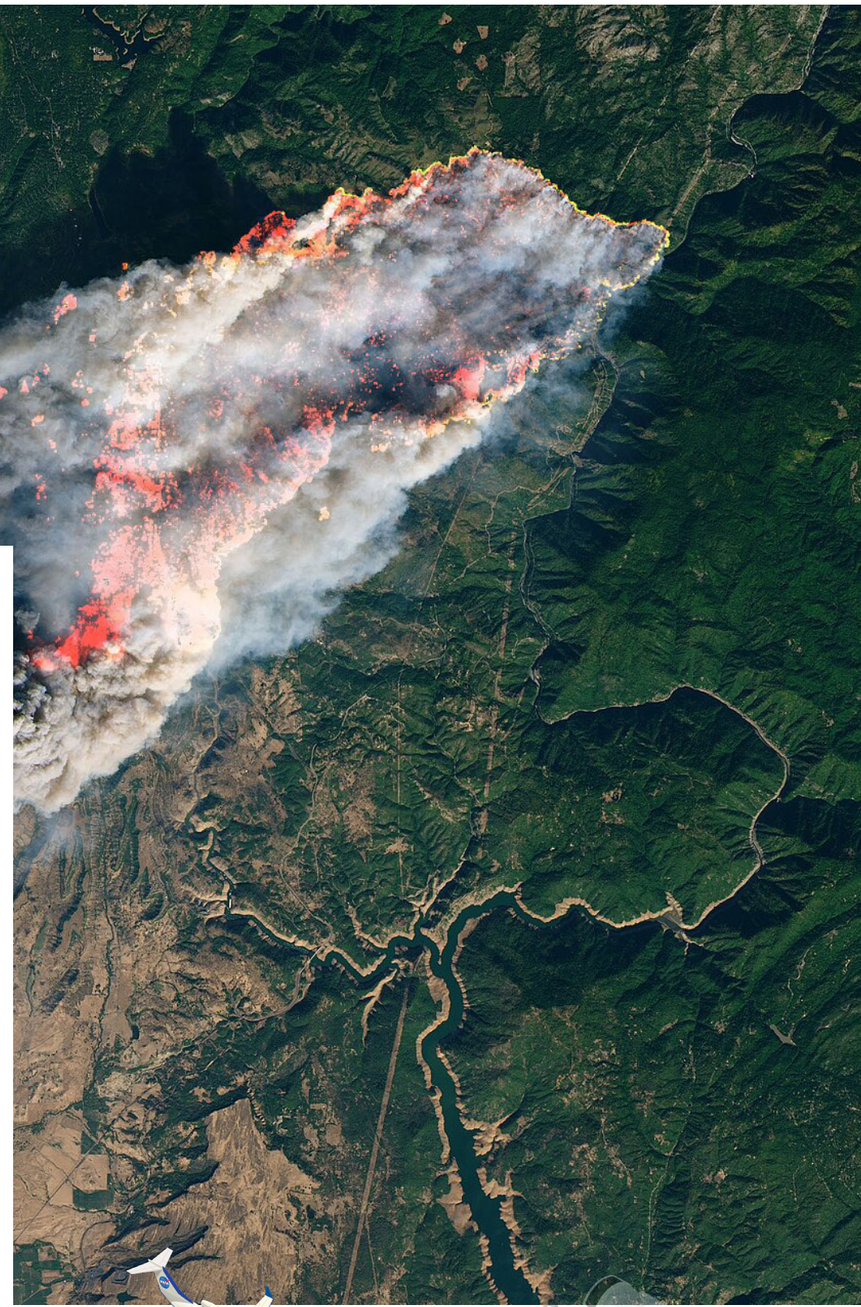
This information is critical for decision makers on the ground as they make real-time calls about how to inform and protect affected communities, deploy firefighting personnel and technology, and calculate long-term effects.

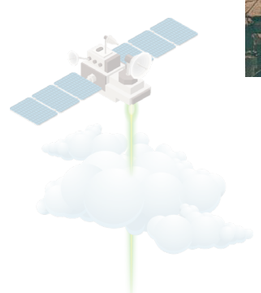
A Desert Research Institute Alta-X Uncrewed Aircraft System (UAS) carried a NASA Langley sensor payload consisting of a combined longwave infrared camera with integrated calibration for increased radiometric accuracy paired with a multispectral camera for prefire, active fire, and post fire imagery.

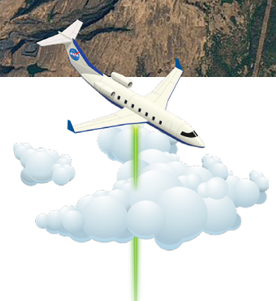
In a collaboration between NASA, the Department of War, and wildland experts, NASA FireSense demonstrates how cutting-edge satellite and airborne technology is revolutionizing fire detection, prescribed fire, and ecosystem management — bringing real-time data to wildland fire managers.

NASA Coordinated Flight of the Pickett Fire

In 2025, the NASA Acres Consortium, NASA Langley, and the Health and Air Quality Applied Sciences Team (HAQAST) and FireSense projects coordinated a flight of the Jet Propulsion Laboratory's Airborne Visible/Infrared Imaging Spectrometer-3 (AVIRIS-3) to test vineyard smoke exposure in Napa Valley, California, and evaluate the perimeter of the nearby Pickett Fire. The mission, planned directly with vineyard stakeholders and CAL FIRE operations, highlights the importance of integrating NASA science with local decision-making during wildfire events.







ARCSIX ANALYZES ARCTIC SEA ICE LOSS

ARCTIC RADIATION-CLOUD-AEROSOL-SURFACE INTERACTION EXPERIMENT

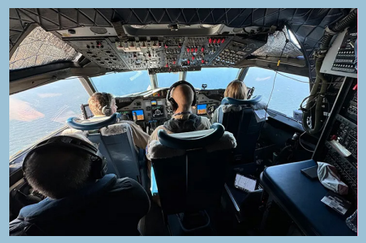
The Arctic has lost about 12 percent of its ice every decade since satellite records began in 1979, equaling about 1.16 million square miles of ice (3 million square kilometers) — an area bigger than Alaska, Texas, California and Montana combined — and the pace appears to be visibly accelerating, with Arctic sea ice now shrinking at a rate of 12.2% per decade, six times as fast as the 1990s. NASA launched the the Arctic Radiation-Cloud-Aerosol-Surface Interaction Experiment (ARCSIX) airborne project to try to find out how long the sea ice in the Arctic had left.

As part of the 2024 field campaign, three NASA aircraft—the low-flying P-3 Orion and the high-flying Gulfstream III and Learjet 35—deployed for three weeks in May and June and again for a month in July and August. Scientists from several institutions, including the University of Colorado Boulder, the University of Michigan, Washington University in St. Louis, the University of Arizona, and Colorado State University, participated.

ARCSIX FLIGHT MEASUREMENTS HAVE YIELDED THE MOST COMPREHENSIVE SET OF SEA ICE, CLOUD, RADIATION AND AEROSOL MEASUREMENTS EVER COLLECTED IN THE ARCTIC.

NASA scientists are still studying the data collected in 2024, but it's already clear that dust from Greenland's increasingly exposed landmass is melting vulnerable sea ice toward northern parts of the globe by darkening the ice and increasing the amount of sunlight it absorbs.

NASA scientists hypothesize that as the ice



retreats, more of Greenland's exposed landmass is shedding dust, which is then carried north by heavy winds to form ice particles in the clouds above. These dust-heavy clouds then disappear more quickly and leave more Arctic ice exposed, hastening the melt.

Results from the ARCSIX mission are expected to reveal far higher dust concentrations than were previously predicted by scientists. Understanding why there is so much ice in Arctic clouds, can help scientists to determine why the Arctic is melting at an alarming rate.

Prior to ARCSIX, a 'New Arctic' has been uncharted territory for weather forecast, seasonal predictions, and climate projections

Climate model projections indicate that the

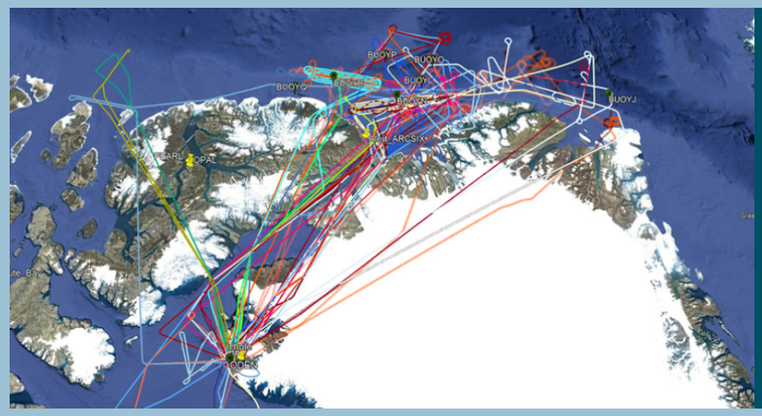
Arctic Ocean is likely to become ice-free by mid-century, and potentially as early as the 2030s. As a consequence, Arctic sea ice is transitioning from a state dominated by thick, multi-year ice to one dominated by thinner, seasonal, first-year ice. The question is no longer whether, but when this transition will occur. As a consequence, a "New Arctic" with only seasonal sea ice will soon be the norm.

ARCSIX provides the critical data to synergistically leverage process and large-scale

models to advance our understanding of these key processes and improve cloud, aerosol, and sea ice parameterizations.

Among the most important data that the scientists collected in Greenland were detailed measurements of low, thin, clouds that surprisingly contained ice at "warm" temperatures (> -10oC), such as those seen in the photo above, that can be challenging to identify and interpret with satellite imagery alone.

"We've gotten a really good look at these clouds for the first time, and it's possible they may have a much stronger influence on Arctic surfaces and sea ice cover than we realized," said Patrick Taylor, the ARCSIX deputy mission science lead and a research scientist at NASA Langley. "I can't wait to dig into the data to try to understand their role better."



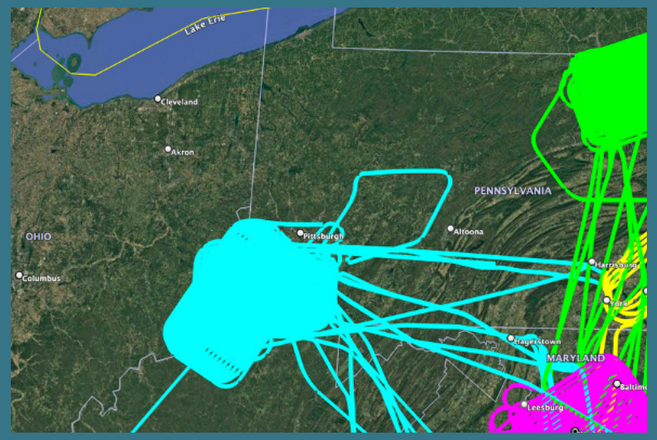
ARCSIX LARC G-III HALO DATASET RELEASED

In 2025, NASA's ASDC released High Altitude Lidar Observatory (HALO) data collected onboard the LaRC G-III aircraft during the Arctic Radiation-Cloud-Aerosol-Surface Interaction EXperiment (ARCSIX) campaign.

LANGLEY INSTRUMENT TEAMS SUPPORT MAGEQ, APMAC AND SARP CAMPAIGN FLIGHTS

NASA's Student Airborne Research Program (SARP) completed flights out of Wallops Flight Facility and Ontario, CA. The 6-7 week 2025 SARP program consists of approximately 45 college rising seniors who fly on NASA aircraft with NASA and university instrument scientists to collect data for their capstone presentation, gaining experience with real life data collection, analysis, coding, and assimilation. Langley's Differential Absorption Carbon Monoxide Measurement-Diode Laser Hygrometer (DACOM DLH) team, the NASA Langley Aerosol Research Group Experiment (LARGE) team, and the Turbulent Air Motion Measurement System (TAMMS) team, flew instruments on the WFF P-3 aircraft and Dynamic Aviation King Air. Langley teams engaged with students in flight and on the ground and provided measurements of in situ trace gases, aerosol properties, humidity, and 3D winds.

Flights continued through summer 2025 as part of the Mid Atlantic Gas Emissions Quantification (MAGEQ) project, a multiagency initiative focused on providing stakeholders in the Mid-Atlantic states with vital information on gas emission sources.



The Appalachian Active Passive Methane Constraints (APMAC) Campaign, funded by NASA's Earth Science Division (ESD), is a field campaign that took place during 2025 as a part of the broader Mid-Atlantic Gas Emissions Quantification (MAGEQ) project. The goal of APMAC is to create remote sensing data sets at regional scale that directly constrain methane emissions for important source regions. Over the course of 32 days the APMAC project flew 28 research flights on the NASA Langley Gulfstream-III spanning ~130 hours. The team coordinated with four other aircraft (NASA P3, NOAA Twin Otter, B200 Flux, B200 AVIRIS) as well as satellite overpasses of Tanager- 1 to sample emissions across the Mid-Atlantic.

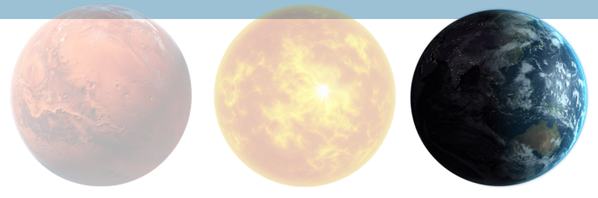
Joint High-Altitude Lidar Observatory (HALO) lidar and MethaneAIR spectometer observations became the first-ever systematically measured day and night variations in column methane concentrations. This innovative measurement approach combines the HALO lidar's unique ability to 'see' at night and measure planetary boundary layer (PBL) height with the broad area coverage of MethaneAIR.

HALO's diurnal distributions of Planetary Boundary Layer (PBL) height collected during APMAC will serve as a benchmark dataset for the Decadal Survey PBL Incubation Program, as well as providing a critical constraint on PBL heights used for deriving emissions from point and regional sources.

Image right: Langley's LARGE team installs an instrument rack on the NASA Wallops P-3 for SARP 2025 and MAGEQ airborne field campaigns. LARGE instruments made measurements of particle microphysical, optical, and composition properties over the Mid-Atlantic region during 2025 flights.

About SARP: The Student Airborne Research Program (SARP) is an eight-week summer internship for rising-senior undergraduates, held annually on the East and West coasts of the United States.

VISIT SARP WEBSITE



LANGLEY INSTRUMENTS EVALUATE, VALIDATE EMERGING TECHNOLOGY AND CREATE BENCHMARK DATASETS

The Westcoast & Heartland Hyperspectral Microwave Sensor Intensive Experiment (WHyMSIE) was a field campaign conducted by NASA and NOAA. It examined the thermodynamics and development of the planetary boundary layer (PBL) to improve PBL observations and advance the establishment of a comprehensive PBL observing system.

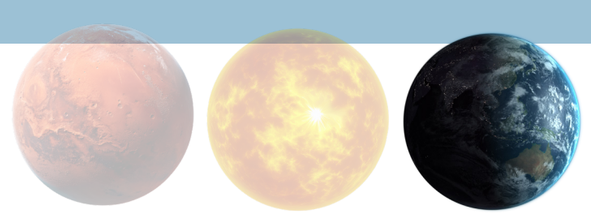
WHyMSIE took place across the western United States and the Great Plains. The NASA ER-2 was equipped with instruments to collect profiles of temperature, water vapor, and cloud properties. A complementary validation experiment, the Active and Passive Profiling EXperiment (APEX), deployed the High Altitude Lidar Observatory (HALO) and the Aerosol Doppler Wind Profiler (AWP) aboard the G-III aircraft.

The Active Passive PBL Profiling EXperiment (APEX) was supported through the NASA Decadal Survey Incubation program and the Office of Naval Research (ONR) Code 322 through the US Naval Research Laboratory (NRL). The APEX team successfully completed their airborne validation and instrument synergy campaign in coordination with the Westcoast & Heartland Hyperspectral Microwave Sensor Intensive Experiment (WH2YMSIE) and 4-dimensional evolution of the marine boundary layer in coordination jointly with the ONR Moisture and Aerosol Gradients/Physics Inversion Evolution (MAGPIE) campaigns forming the APEX-MAGPIE Plus Up (AMP-Up).

Over 19 flight days and approximately 63 flight hours between October 28-November 15, 2024, the APEX team completed 11 science flights on the LaRC G-III, six in coordination with the ER-2, four in coordination with the Naval Postgraduate School (NPS) CIRPAS Twin Otter, and one solo science flight on the return transit. The flights were based out of Santa-Maria and Ames/Moffet Field Sunnyvale California. Coordination with the ER-2 targeted different atmospheric conditions over the Eastern Pacific and western U.S. for evaluation and validation of emerging passive microwave technology and to create a benchmark dataset for joint active (DIAL) / passive (infrared and microwave sounders) retrievals of temperature and moisture for future development under the Decadal Survey Planetary Boundary Layer Incubation program. Instrument teams on the G-III included the HALO water vapor DIAL and High Spectral Resolution Lidar (HSRL), the Aerosol Wind Profiler (AWP) Doppler wind lidar, and the Advanced Vertical Atmospheric Profiling System (AVAPS) dropsondes, all from NASA Langley Research Center.

Image above: NASA's G-III aircraft in the hangar at NASA's Langley Research Center as science and flight crews install remote sensing instruments inside and onto the body of the plane.

Image right: Software and instrument checks for instruments like HALO take place pre-deployment on board the G-III aircraft.



LANGLEY LIDAR UNDERFLIGHTS

NIGHTBLUE

The Atmospheric Lidar (ATLID) on the European Space Agency (ESA) EarthCARE (Cloud, Aerosol, and Radiation Explorer) mission launched and became operational in May 2024. ATLID provides global, high-resolution profiles of aerosols and clouds. The NASA Langley High Spectral Resolution Lidar (HSRL-2) and the High Altitude Lidar Observatory (HALO) instruments were deployed on the NASA G-III and NASA ER-2 for underflights of the EarthCARE satellite to provide validation measurements for the ATLID data products.

LIDAR TECHNOLOGY REQUIRES UNDERFLIGHTS — SPECIFICALLY, LOW-ALTITUDE AIRCRAFT FLYING BENEATH SATELLITES OR HIGHER-ALTITUDE PLANES—PRIMARILY TO CALIBRATE INSTRUMENTS, VALIDATE DATA ACCURACY, AND PROVIDE HIGHER-RESOLUTION MEASUREMENTS THAT ORBITAL SENSORS CANNOT ACHIEVE.

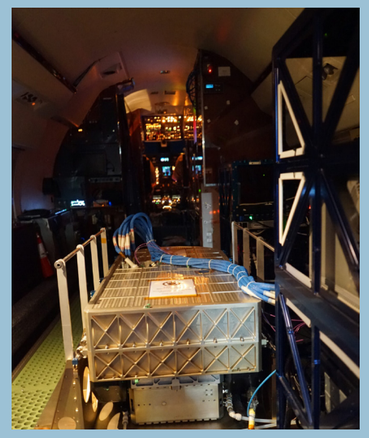
100 EARTHCARE UNDERFLIGHTS ACHIEVED IN 2025

NightBLUE – a collaboration involving ESA, NASA and the EarthCARE Data, Innovation and Science Cluster – achieved a huge milestone: the 100th underflight of EarthCARE.

The lidar underflights of EarthCARE took place from Bermuda in the North Atlantic Ocean in September 2025. Most flights took place at night, when the signal-to-noise ratio is best for lidar instruments.

LEARN MORE ABOUT NIGHTBLUE

During the NightBLUE aircraft validation campaign, an ideal comparison setup for ATLID featured NASA Langley's High Spectral Resolution Lidar-2 (HSRL-2) instrument onboard the NASA G-III aircraft, which measures the atmosphere and near-surface ocean just like ATLID.



Langley scientists built upon experience from validation of CALIOP onboard CALIPSO, and previous EarthCARE

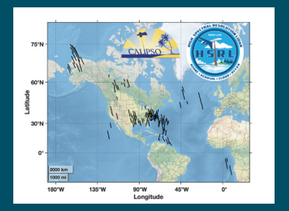
validation during the ARCSIX and PACE-PAX aircraft campaigns in summer 2024.

The EarthCARE team measured a range of conditions: marine, smoke and pollution aerosols likely originating from North America and even dust from the Sahara transported over the Atlantic Ocean by tropical storms, as well as low-altitude

water clouds and high-altitude ice clouds. Near Bermuda, an overpass back and forth is flown over the underwater track of an ocean glider instrument from the University of Delaware enabled comparison of the oceanic measurements with lidar ocean returns in the future.

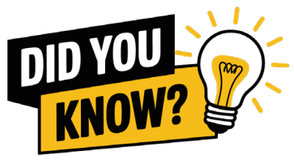
In total, the NightBLUE campaign contained eleven nighttime underflights, and five daytime underflights.

147 UNDERFLIGHTS OF CALIPSO CALIOP



NASA Langley's High Spectral Resolution Lidar (HSRL) has also been deployed on several NASA aircraft for a total of 147 underpasses of the CALIPSO satellite to provide validation measurements for the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) data products.

For 17 years, the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) instrument on the Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) spacecraft provided global, first-of-their-kind high-resolution profiles of aerosols and clouds.

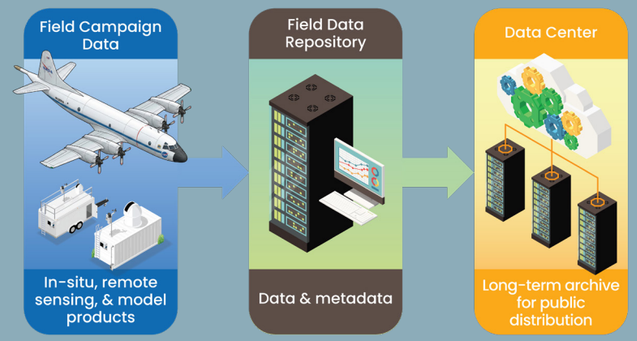


THE NASA LANGLEY HIGH SPECTRAL RESOLUTION LIDAR (HSRL)-2 IS A PREMIER, WORLD-LEADING TECHNOLOGY FOR CHARACTERIZING ATMOSPHERIC AEROSOLS AND CLOUDS, MEASUREMENTS OF THE NEAR-SURFACE OCEAN, AND SATELLITE VALIDATION. WHEN CONFIGURED TO UTILIZE THE DIFFERENTIAL ABSORPTION (DIAL) TECHNIQUE, IT CAN ALSO MEASURE PROFILES OF OZONE CONCENTRATIONS.

FIELD CAMPAIGN DATA

NASA Langley's research and data scientists have proven experience supporting atmospheric composition missions via data and website management. This includes:

- Ingesting and archiving data
- Developing an online instrument specific HDF/ netCDF checker
- Maintaining the Atmospheric Composition Variable Standard Names Best Practice Guide
- Adopting unit notation standard
- Generating metadata records for discovery tools (e.g., EarthData Search, Worldview)
- Registering DOIs and providing citation guidance to support science team publication process



ACTIVATE Flight Tracks

The ASDC Suborbital team successfully added Aerosol Cloud meTeorology Interactions oVer the western ATlantic Experiment (ACTIVATE) in NASA Worldview. Flight tracks are available for NASA's King Air, and Ozone data and flight tracks are available for NASA's HU-25. Flight tracks are available for all 6 ACTIVATE deployments occurring from 2020 through 2022.

Field Data Repository

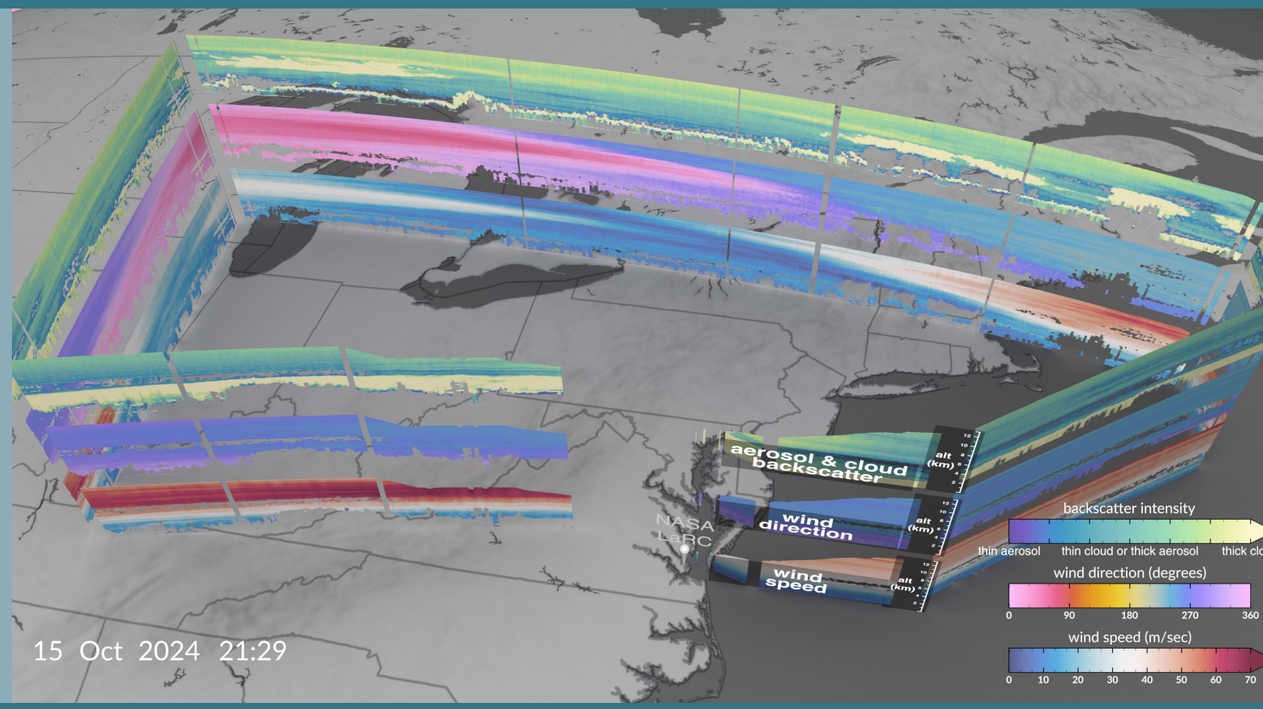
The field data repository is managed by a specialized Langley team whose web-based repository provides the infrastructure for science teams to efficiently generate FAIR (Findable, Accessible, Interoperable, and Reusable) data products pivotal to Earth science. By developing and improving tools, best practices and community standards, and ensuring compliance with formatting and metadata standards, the team ensures NASA's suborbital research is optimized for scientific use within the global scientific community.

Atmospheric Science Data Center Suborbital Support Team

The Atmospheric Science Data Center (ASDC) Suborbital Support (SUBS) team is responsible for the ingest, curation, and publication of NASA suborbital field campaign data products. Data ingest and curation of suborbital data are critical steps to make data FAIR (particularly Findable and Accessible). The SUBS team has developed a set of guidelines to handle the complex data products from suborbital campaigns, making the data publication process more efficient. The SUBS team also proactively supports science teams' publication efforts. In 2025, the SUBS team was awarded a NASA Group Achievement Medal. View the Langley Science 2025 NASA Honor Awards on pages 74-75.

IN 2025, NASA LANGLEY PROVIDED STATE-OF-THE-ART SUBORBITAL ATMOSPHERIC COMPOSITION DATA MANAGEMENT FOR EARTHCARE UNDERFLIGHTS, PACE-PAX, ARCSIX, APMAC, FIRESENSE, SCOAPE, WH2YMSIE AND SARP.

Aerosol Wind Profiler (AWP) Demonstrates High-Resolution and Precision 3-D Wind Profile Retrievals



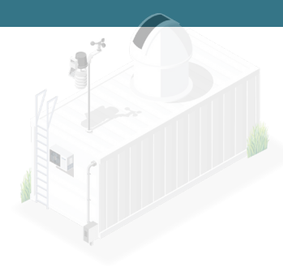
NASA Langley's Aerosol Wind Profiler (AWP) collected nearly 150 hours of 3-D wind profiles aboard the DC-8 and LaRC Gulfstream-III, NOAA's 3-D Wind Demostration and NASA's WH2YMSIE/APEX. These were AWPs first-ever science campaigns, and set the stage for impactful operations in future AWP campaigns like NURTURE.

After extensive analysis, the NOAA Data Evaluation and Value Assessment (DEEVA) team found that AWP "over-exceeded NOAA's maximum requirements regarding measurement uncertainty" and that if launched into space, "AWP-like observations have the potential to significantly improve numerical weather prediction model performance based on initial data assimilation experiments."

Read More: NASA 3D Wind Measuring Laser Aims to Improve Forecasts from Air, Space (NASA.gov)

STAQS User Guide

The ASDC Suborbital Support (SUBS) team published a User Guide for the Synergistic TEMPO Air Quality Science (STAQS) campaign. This user guide provides an overview of the mission, data collections, and how to access and use STAQS data.



LOOK AHEAD

NASA Langley prepares the way for upcoming airborne campaigns.

NURTURE

The North American Upstream Feature-Resolving and Tropopause Uncertainty Reconnaissance Experiment (NURTURE) is a NASA-funded large-scale aircraft field campaign.

It will advance knowledge of the processes that lead to extreme high-impact weather (HIW) events during the winter, such as severe cold air outbreaks, windstorms and hazardous seas, snow and ice storms, sea ice breakup, and extreme precipitation. HIW events have significant socioeconomic costs and threaten national security (e.g., destabilizing supply chains and damaging infrastructure).

The findings of NURTURE will be instrumental in improving the accuracy of numerical weather models and predicting high-impact weather events, thereby enhancing our ability to prepare for and respond to such events.

TOKYO-FC

The Tokyo Field Campaign (T - FC) is an international, multi-platform satellite validation mission scheduled for early 2026.

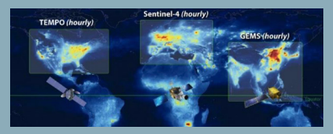
The primary objective is the post-launch calibration and validation of geophysical data products from the Global Observing Satellite for Greenhouse gases and Water Cycle (GOSAT-GW), which was launched in June 2025.

This campaign is a collaborative effort between NASA and key Japanese scientific institutions including the National Institute for Environmental Studies (NIES), and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC).

Tokyo-FC will conduct intensive, correlative observations to assess the accuracy and precision of GOSAT-GW's retrieved data. The campaign will focus on measurements within the complex atmospheric and environmental conditions in and near the greater Tokyo metropolitan area.

To achieve its validation goals, the mission will deploy a coordinated suite of observational assets, including airborne, oceanographic, and ground based platforms.

HAMAQ - NORTH AMERICA



Hemispheric Airborne Measurements of Air Quality (HAMAQ) will employ the integrated observing system for air quality to explore diversity in geography, meteorology, emissions, and other factors that can inform models used to demonstrate how decisions affect air quality and evaluate the role of geostationary observations to expand interpretation of these diverse factors to other regions.

Current plans include two deployments in 2028 over the Mexico City megalopolis and Atlanta, GA. The effort will include two aircraft, NASA's B777 for remote sensing sampling and P-3B for in-situ sampling.

These aircraft will be used to complete the integrated observing system, combining satellite observations, ground-based monitoring, research observations, and air quality modeling to assess factors controlling local air quality in each location sampled.

FARMFLUX

FarmFlux is an airborne mission to study the cycling of nitrogen between agricultural systems and the atmosphere. Minimizing agricultural nitrogen losses maximizes agricultural efficiency while improving air quality, thereby protecting both food security and environmental health.

Airborne sampling of atmospheric gases and particulate matter will support research related to both animal and crop systems. FarmFlux is part of the NASA Earth Venture Suborbital program (EVS-4).

Nitrogen is essential to plant growth and animal production. Large quantities of fertilizer are needed to produce the main crops in the United States, including corn, soybeans and wheat. Many of these crops provide essential feed for animals. Much of the nitrogen consumed by animals is excreted, and the manure can be used to fertilize crops. However, large losses of nitrogen occur during this cycling. While the loss of nitrogen is difficult to quantify because it occurs through both the air and water, a full understanding of nitrogen loss is needed to ensure U.S. agriculture is resilient to changing weather patterns and economic pressures.

FarmFlux will quantify the loss of nitrogen to the atmosphere and track its downwind fate. The agricultural economy is also highly sensitive to air quality.

INSPYRE

The INjected Smoke and PYRocumulonimbus Experiment (INSPYRE) Science Team will constrain the role of pyrocumulonimbus (pyroCb) in the earth system and characterize their physical links to extreme wildfire behavior.

INSPYRE will test the hypothesis that an increase in wildfire size and intensity will amplify pyroCb-driven smoke injection into the stratosphere and induce measurable changes to Earth's radiative balance.

PyroCbs are a poorly understood and inadequately-predicted severe weather phenomenon driven by large and intense fires and unique meteorological conditions. These fire-generated clouds are linked to extreme fire behavior that impedes firefighting efforts and can devastate communities.

PyroCbs can also inject volcanic-scale smoke plumes into the stratosphere that encircle the globe, reside for more than a year, alter stratospheric circulations, extend the lifetime and size of the Antarctic ozone hole, and affect Earth's radiative balance. Given the ongoing and projected increases in fire activity and severity, there is an urgent need to better understand and predict global and fire-scale impacts from pyroCb activity.

2025 NURTURE Science Team Meeting

NURTURE science team members learn more about airborne science at NASA's Langley Research Center.

DID YOU KNOW?

NASA'S LANGLEY RESEARCH CENTER IS UNIQUELY POSITIONED TO COORDINATE AIRBORNE FLIGHTS FROM THE U.S. EAST COAST.

THE NEXT GENERATION OF AIRBORNE RESEARCH

A Boeing 777 was acquired to replace and extend the capabilities of the NASA DC-8, which is retiring this year. Originally a passenger airliner, it's being prepared for its next mission — carrying instruments instead of passengers. First operations are planned for FY2027 from NASA Langley Research Center.

DISCOVER

EARTH SCIENCE: GROUND-BASED

Ground data are crucial for calibration and validation, comparing with space-based data, and providing direct, localized information that satellites cannot fully capture, such as detailed temperature readings and the physical properties of precipitation.

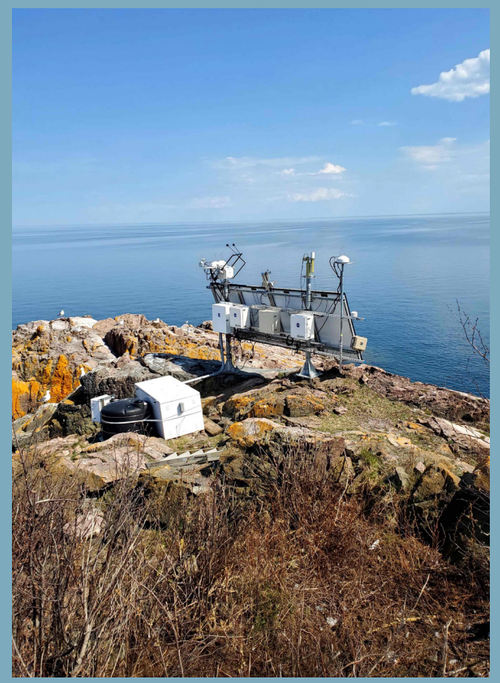
NASA's CERES (Clouds and the Earth's Radiant Energy System) Radiation Validation Experiment (CRAVE) provides continuous world-class surface radiation measurements and validation of CERES and other satellite products. CRAVE consists of two active sites at Granite Island in Lake Superior and at NASA's Langley Research Center.

Operational since 2018, the CRAVE site at Granite Island was fully optimized in 2025. New instruments were installed including new spectral filters and sensors for temperature and Relative Humidity.

CRAVE sites include dozens of instruments that produce multiple datasets and sky images.

VISIT CRAVE WEBSITE

PUBLICATION HIGHLIGHT: The Component Summation Technique for Measuring Upwelling Longwave Irradiance in the Presence of an Obstruction



The Langley Mobile Ozone Lidar is a highly versatile, flexible system that can be deployed on remote campaigns, and has proven to be extremely useful for air quality, modeling, and satellite studies.

Several updates were made that improved data acquisition, and expanded the system's operational capability.

LMOL measurements are necessary to assess the evolution of tropospheric composition in complex situations for understanding the atmosphere and will continue to be critical for understanding relationships to satellite columnar observations such as TROPOMI and TEMPO.

OVERVIEW & STATUS OF LMOL

NASA'S CRAVE SITES BELONG TO THE BASELINE SURFACE RADIATION NETWORK (BSRN), THE GOLD STANDARD FOR SURFACE RADIATION MEASUREMENTS. THE ACTIVE SITES ARE 2 OF ONLY 43 BSRN SITES OPERATIONAL IN THE WORLD.

LANGLEY SCIENCE A Year in Review 2025

NASA, FAA, AND EMBRY-RIDDLE TEST EMISSIONS TO IMPROVE GENERAL AVIATION AIR QUALITY

Combined with FAA engine performance metrics, NASA Langley utilized a ground lab to test and measure fuel, enabling industry to evaluate which fuels are most promising for future investment and deployment across the national airspace. Getting the lead out of AvGas promises important gains for U.S air quality and the health of communities near general aviation airports.

SCIENCE DATA

At the root of our discoveries, we connect and engage communities through transparent, open data as we enable solutions, societal value and public understanding and exchange.

ASDC Data and User Services Tutorials and Resources

Access a comprehensive resource for end users seeking guidance and instructions on working with data from select missions archived and distributed by ASDC: Data and User Services GitHub Repository.

1. Explore collections.
2. Earthdata Search
3. Direct Data Download

In 2025, 64 data systems were upgraded, and 69 were retired, resulting in enhanced cybersecurity compliance.

INSTALLED CYBERSECURITY TOOLS ON 180 SYSTEMS

In 2025, efforts to install and configure new tools for enhanced cybersecurity and Agency compliance.

TOTAL SAVINGS LIKELY IN THE ORDER OF $100K

Due to 2025 efforts to migrate systems to the Computational Research Facility (CRF) and reduce operational costs.

EARTH SCIENCE DATA AND INFORMATION SYSTEM

The Earth Science Data and Information System (ESDIS) Project at NASA's Langley Research Center manages the Atmospheric Science Data Center (ASDC), which archives and distributes key NASA data on Earth's radiation budget, clouds, aerosols, and tropospheric composition. It is a critical component of NASA's Earth Observation System Data and Information System (EOSDIS) program, which comprises elements including Distributed Active Archive Centers, Science Investigator-led Processing Systems, and web infrastructure.

ATMOSPHERIC SCIENCE DATA CENTER

NASA's Atmospheric Science Data Center (ASDC) is a leading provider of atmospheric science data products and services to the science community. Data products translate discoveries into meaningful knowledge that inspires action by scientists, educators, decision makers, and the public.

The ASDC supports more than 100 projects and provides access to more than 1,000 archived collections. These data sets were created from satellite measurements, field experiments, and modeled data products.

ASDC customers include scientists, researchers, federal, state, and local governments, educational and commercial professionals, data application users, the commercial remote sensing community, and the general public.

All ASDC data are available to the public from the Explore Collections page. Detailed information about the data products, including documentation, ordering tools, and tools for working with the data, are available for each project ASDC supports. Some of the data products include web interfaces that allow direct access to the data holdings for immediate downloading.

ATMOSPHERIC SCIENCE DATA CENTER
2025 METRICS

- IN 2025, **8,331** TERABYTES OF DATA WERE DISTRIBUTED TO 35,303 CUSTOMERS IN 128 COUNTRIES.
- MORE THAN **22,417,217** FILES (1,589 TERABYTES) STORED ON HIGH-SPEED DISK FOR QUICK ACCESS.
- AS OF DECEMBER 2025, MORE THAN **10.75** PETABYTES ARE IN THE ARCHIVE.
- ASDC PROVIDES DATA SERVICES FOR MORE THAN **119** SCIENCE PROJECTS.
- ASDC DISTRIBUTES MORE THAN **1,703** UNIQUE SCIENCE PRODUCTS.

SCIENCE DATA IN ACTION

Langley supports Global CEOS Leadership with Bold Priorities and Cloud-Native Innovation

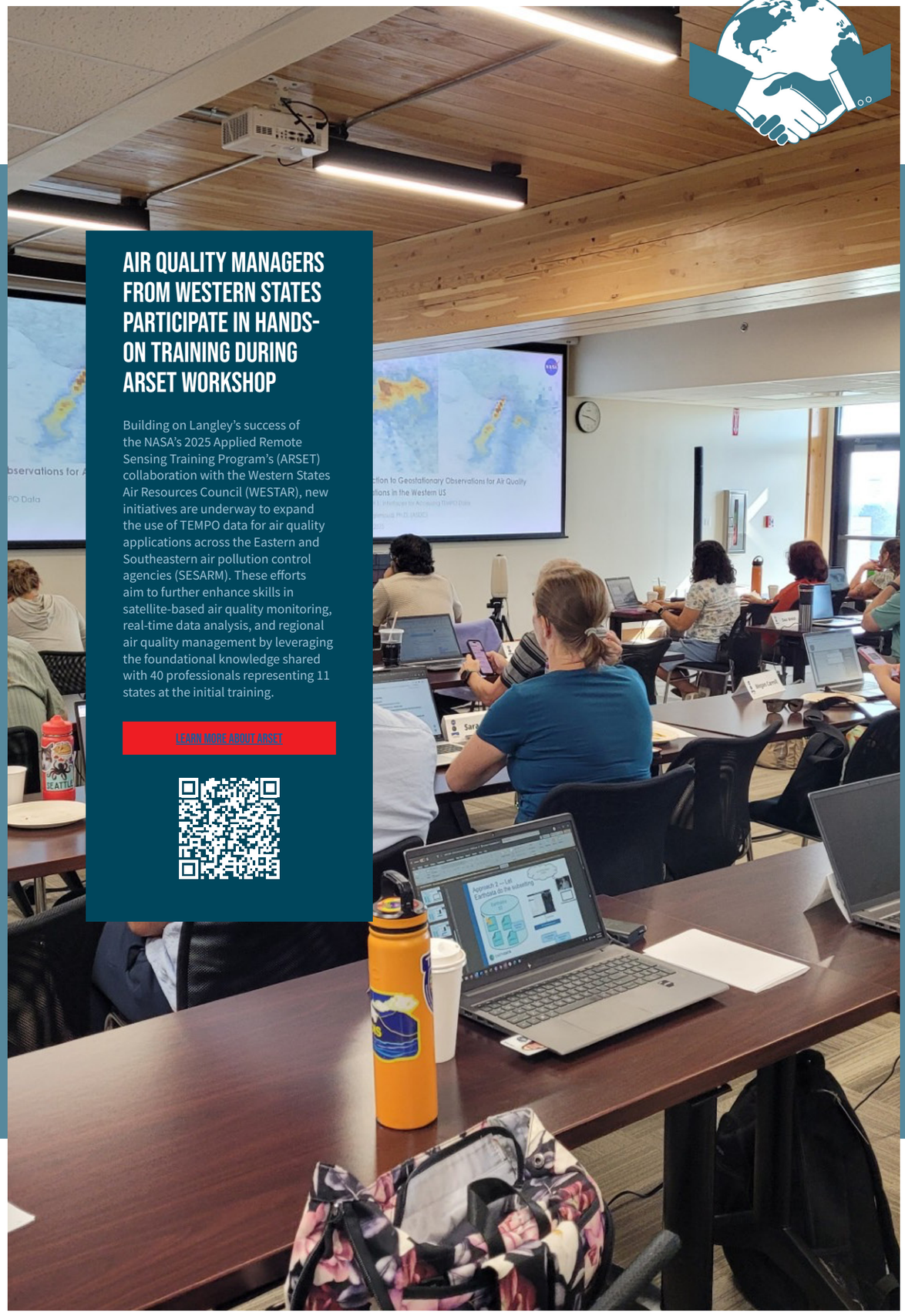
NASA's upcoming leadership of the Committee on Earth Observation Satellites (CEOS) as the Strategic Implementation Team (SIT) Chair (2026-2027) will significantly shape global Earth observation efforts by aligning international priorities with U.S. Administration goals and NASA's Gold Standard Science. NASA Langley played a central role in developing and articulating NASA's two SIT Chair Priorities: 1) 'Water Planet – Seeing Earth's Water from Space,' aimed at integrating multiplatform, multispectral data for enhanced water variables and decision-support solutions, and 2) 'Connected Data for Community Resilience,' focused on enhancing user-driven, actionable EO data delivery. Langley will also lead formal governance of the CEOS Organizational GitHub to advance open-source science, and the CEOS Analytics Lab (CAL), which showcases cloud-native EO processing.

Langley Leads Effort to Develop Best Practices and Advance FAIR Data Principles

Langley takes a lead on efforts to develop best practices and advance Findable, Accessible, Interoperable, and Reusable (FAIR) data principles for suborbital atmospheric composition data with agency, national, and international partners. In 2025, Langley attended a workshop with international partners to improve aspects of FAIR principles and provide insights to enhance the FAIRness of future NASA field campaign data products. We developed best practices and variable-level metadata standards, and Langley led the effort to adopt the WIGOS Metadata Representation (WMDR) measurement unit code list as a new NASA ESCO standard for unit notations to improve guidance to data providers and increase the usability of NASA Earth Science data.

NDACC WEBSITE DEVELOPMENT & MAINTENANCE

NASA Langley maintained and secured the NDACC (Network for the Detection of Atmospheric Composition Change) website as part of NASA's contribution to this international effort. Learn more about NDACC: https://ndacc.larc.nasa.gov/



AIR QUALITY MANAGERS FROM WESTERN STATES PARTICIPATE IN HANDS-ON TRAINING DURING ARSET WORKSHOP

Building on Langley's success of the NASA's 2025 Applied Remote Sensing Training Program's (ARSET) collaboration with the Western States Air Resources Council (WESTAR), new initiatives are underway to expand the use of TEMPO data for air quality applications across the Eastern and Southeastern air pollution control agencies (SESARM). These efforts aim to further enhance skills in satellite-based air quality monitoring, real-time data analysis, and regional air quality management by leveraging the foundational knowledge shared with 40 professionals representing 11 states at the initial training.

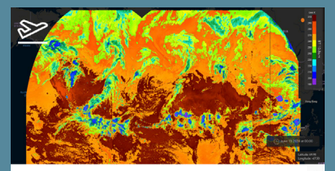
LEARN MORE ABOUT ASSET

SCIENCE DATA IN ACTION

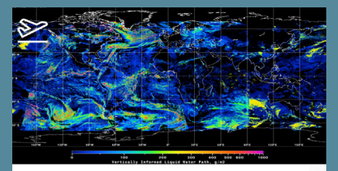
SatCORPS Delivers World-Class Global Datasets and Products with In-House Algorithms for a Variety of Scientific and Operational Needs

SatCORPS is the only system capable of producing hourly global information on clouds, atmospheric thermodynamics and radiation from satellites that are both precise enough for scientific use while fast enough for applications and operations. In 2025, the SatCORPS team completed a new system for creating operational, hourly, 3-km resolution Global Cloud Composites (GCC). This critical data is used by the National Laboratory for the Rockies (previously National Renewable Energy Laboratory) for building solar radiation databases for the United States, the entire Arctic, and other parts of the world. The SatCORPS team is also delivering a global cloud analysis system to support U.S. military operations. In addition, cloud analyses are delivered daily to the National Centers for Environmental Prediction (NCEP) for use in creating national weather forecasts for America. The SatCORPS Ground Station Observation Network (GSON) was demonstrated to accelerate the availability of a VIIRS Flooding product when integrated into the NASA Disaster Response Coordination System (DRCS) GIS data portal.

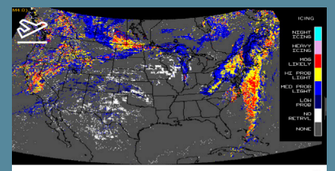
Explore the collection of SatCORPS's powerful satellite products.



GCC
Global Cloud Composite
Active | NRT | GIS
NRT hourly Global Cloud Composites (GCC) of cloud properties and radiative fluxes from operational GEO and LEO satellite imager on a 3km grid.



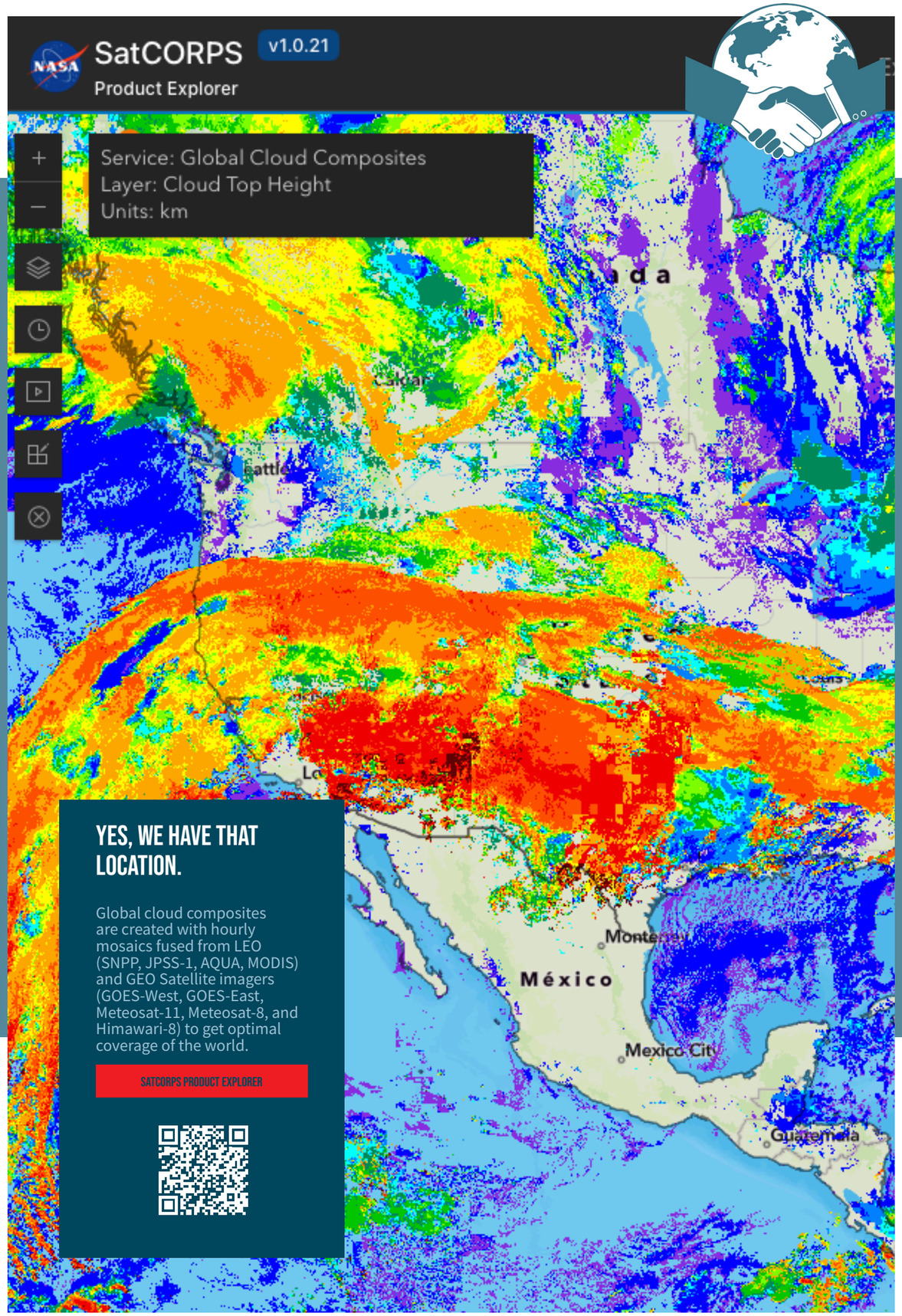
RCC
Regional Cloud Composite
Active | NRT | GIS
Lower latency NRT hourly Regional Cloud Composites (RCC) of cloud properties and radiative fluxes from each of the operational GEO (full disk) satellite imager on a 3km grid.



ICING
Aircraft Icing (Non-GIS)
Active | NRT
Non-GIS enabled Aircraft Icing Products

Open Science Meets Open Data

The SatCORPS algorithms are state-of-the-art theoretical and empirical inversion methods for estimating atmospheric characteristics from polar-orbiting, geostationary, and precessing-orbit satellite measurements with account for satellite-specific spectral response and cross-platform calibration.

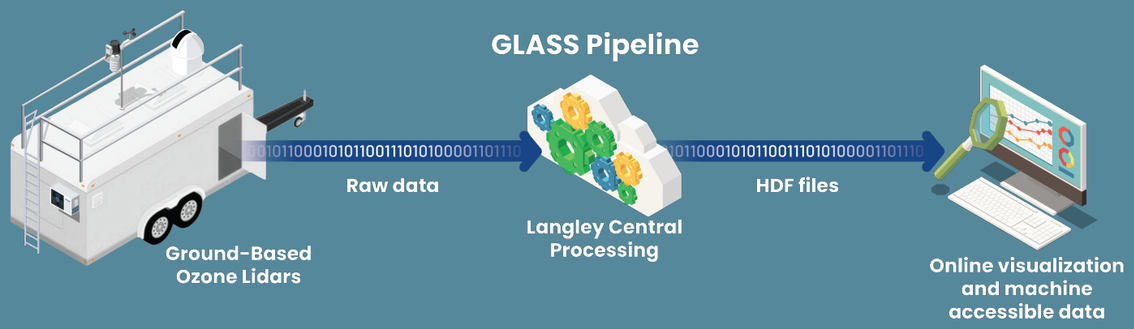


SCIENCE DATA IN ACTION

Global Lidar Analysis Software Suite (GLASS) Pipeline Generates Science Data with Enhanced Consistency and Integrity

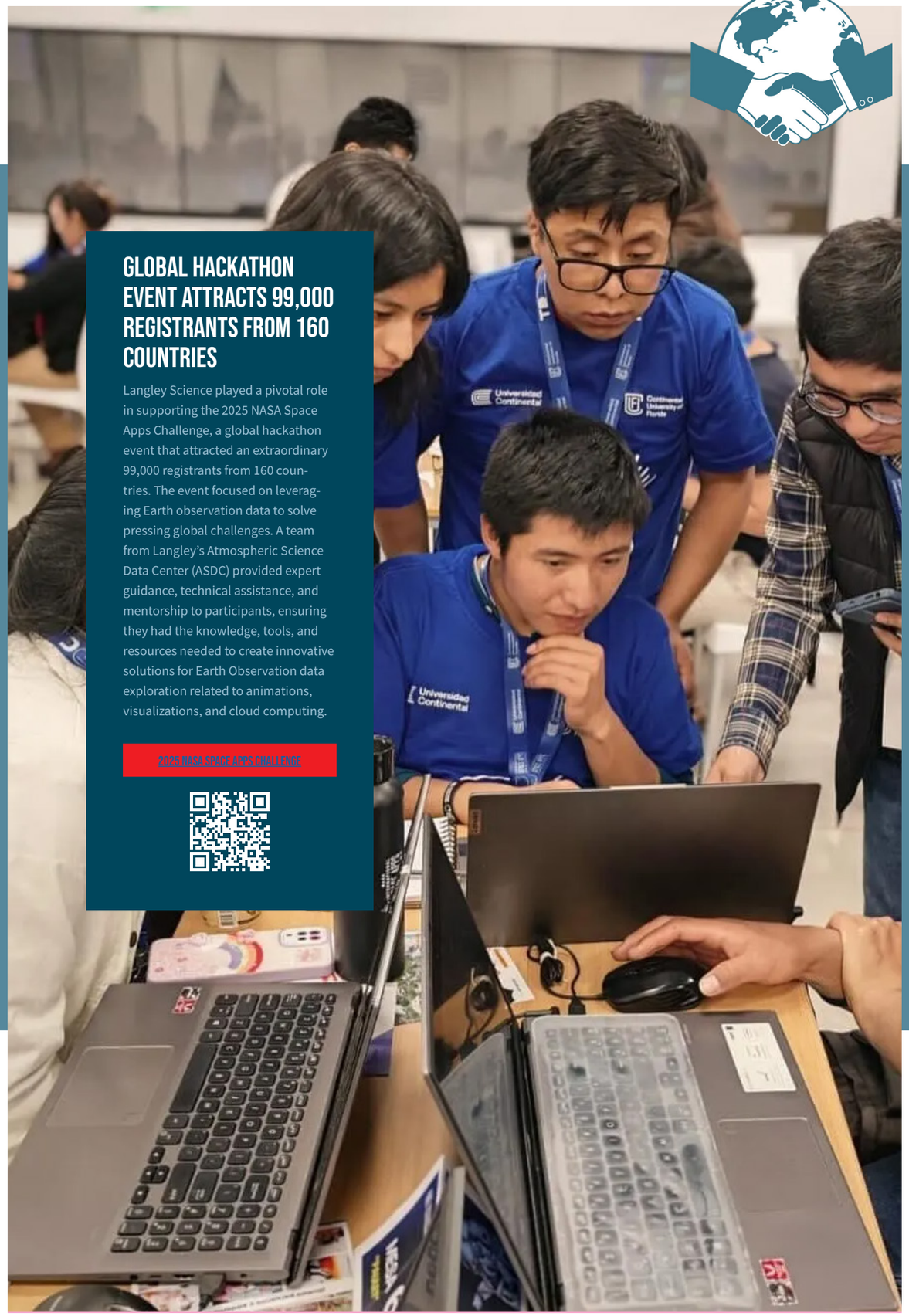
In 2025, the Global Lidar Analysis Software (GLASS) pipeline became operational at Tropospheric Ozone Lidar Network (TOLNet) field data repository located at Langley. This provides TOLNet with automated central processing capability which helps the science team to generate science data with high degrees of consistency and integrity. The TOLNet science team can readily use the GLASS pipeline to perform data QA/QC procedures. Finaly, the GLASS pipeline at Langley will enable TOLNet to distribute high quality data from the network stations near real time, which will benefit research communities at large.

The Maryland Department of the Environment is now using the Near Real Time graphs produced by AMA-developed software in their Air Quality Outlook alerts.



NEW AGAGE website and API Goes Live, Includes Graphing Capabilities

In 2025, the first-Ever AGAGE API implementation introduced well-documented API access for AGAGE data, enabling streamlined machine-to-machine communication. Langley developed a multi-faceted search capability for the site, which includes a new data webpage with advanced filtering options by species, stations, and data products. This effort also introduced interactive data visualization, which added powerful graphing capabilities that allow users to visualize AGAGE data directly on the digital platform.



GLOBAL HACKATHON EVENT ATTRACTS 99,000 REGISTRANTS FROM 160 COUNTRIES

Langley Science played a pivotal role in supporting the 2025 NASA Space Apps Challenge, a global hackathon event that attracted an extraordinary 99,000 registrants from 160 countries. The event focused on leveraging Earth observation data to solve pressing global challenges. A team from Langley's Atmospheric Science Data Center (ASDC) provided expert guidance, technical assistance, and mentorship to participants, ensuring they had the knowledge, tools, and resources needed to create innovative solutions for Earth Observation data exploration related to animations, visualizations, and cloud computing.

2025 NASA SPACE APPS CHALLENGE

NEW NUBE GAME BRINGS WEATHER SCIENCE TO LIFE

In a live interview on The Weather Channel on September 12, 2025, NASA Langley's Jessica Taylor highlighted the educational impact of the new GLOBE Clouds card game, NUBE, which helps players learn to identify cloud types and sky colors through interactive play.

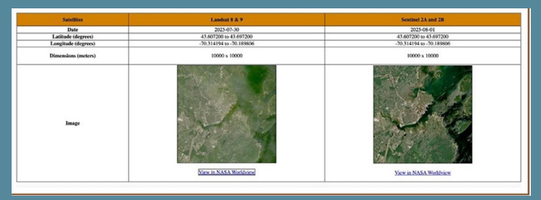
DOWNLOAD NUBE GAME AND PLAY!

INSPIRE

SCIENCE DATA IN ACTION

Civil Air Patrol Cadets Help Scientists Study the Atmosphere with GLOBE Clouds

The Science Activation Program's NASA Earth Science Education Collaborative (NESEC) is working alongside the Civil Air Patrol (CAP) to launch the 2025 Aviation Weather Mission. The mission will engage cadets (students ages 11-20) and senior members to collect aviation-relevant observations including airport conditions, Global Learning and Observations to Benefit the Environment (GLOBE) Cloud observations, commercial aircraft information (including registration number and altitude), and satellite collocations provided by the NASA GLOBE Clouds team at NASA Langley Research Center. The 2025 Aviation Weather Mission took place from April through July, collecting observations over two 4-hour periods while practicing additional skills, such as flight tracking, orienteering, and data management. So far, over 3,000 cadets in 46 wings (states) have signed up to participate.



Satellites	Landsat 8 & 9	Sentinel 2A and 2B
Date	2025-05-31	2025-08-01
Latitude (degrees)	43.607200 to 43.697200	43.607200 to 43.697200
Longitude (degrees)	-70.514194 to -70.189606	-70.514194 to -70.189606
Dimensions (meters)	10000 x 10000	10000 x 10000
Image	View in NASA Worldview	View in NASA Worldview

NASA and GLOBE Connect Real Science to People, Land and Space

GLOBE volunteers of all ages love getting an email from NASA that compares satellite data with their cloud observations. In 2025, GLOBE announced that, in addition to sending emails about satellite data that align with the cloud observations made by learners, they will now also be sending emails that compare the GLOBE Observer Land Cover observations made by learners with satellite data. The new satellite comparison for land cover builds on the system used to create cloud comparisons at NASA Langley Research Center. These new collocated land cover observations are expected to raise greater awareness of how NASA and its interagency partners observe our changing home planet from space in order to inform societal needs. They will help every GLOBE volunteer see how their observations of the land fit in with the wider space-based view and how they are participating in the process of science.

GLOBE Clouds By the Numbers: FY25

TOTAL OBSERVATIONS RECEIVED	TOTAL SATELLITE MATCHES	TOTAL MATCH EMAILS SENT	PERCENT MATCH TO SATELLITES
189,306	189,644	77,253	86%

THE GLOBAL LEARNING AND OBSERVATIONS TO BENEFIT THE ENVIRONMENT (GLOBE) PROGRAM FOCUSES ON ADVANCING EARTH SYSTEMS SCIENCE THROUGH DATA COLLECTION AND ANALYSIS BY VOLUNTEERS.

Learn more about NASA's GLOBE Program

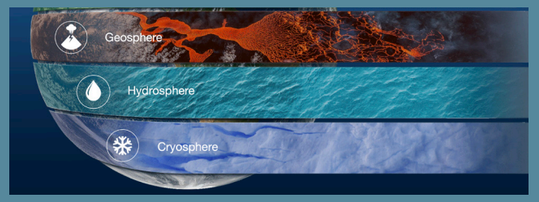
BRINGING HANDS-ON NASA SCIENCE INTO VIRGINIA CLASSROOMS

Twenty-four educators from eight school districts in the Hampton Roads region of southeastern Virginia converged at the National Institute of Aerospace (NIA) in Hampton, Va. for a professional development workshop led by GLOBE and My NASA Data experts from NASA Langley. Through this training, the educators participated in K-20 classroom-friendly sample lessons, hands-on activities, and explored the GLOBE Observer app, ultimately qualifying them as GLOBE Certified Educators.

READ MORE ON NASA.GOV

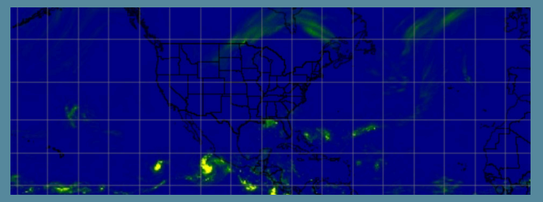
INSPIRE

SCIENCE DATA IN ACTION



My NASA Data Makes Authentic NASA Data Accessible and User-Friendly for Teachers and Learners

My NASA Data hosted a five-part webinar Series for 144 educators with an in-depth exploration of NASA data resources and their classroom applications. The webinars covered My NASA Data's Earth System Data Explorer, Data Literacy Cubes, Story Maps, Mini Lessons, and Lesson Plans. Each session featured practical insights and hands-on demonstrations to equip educators with effective strategies to integrate NASA data into their Earth and environmental science teaching. Also in 2025, My NASA Data presented to mathematics educators at the Virginia Data Science Summer Institute Teacher Professional Development program organized by the Virginia Department of Education. The team also presented to 65 attendees of the NASA Earth Science Special Interest Group Meeting at the 2025 Esri FedGIS Conference.



My NASA Data Helps Educators Discover the Newly Enhanced Earth System Data Explorer (ESDE)

My NASA Data provided 76 educators representing 24 U.S. states and 9 international countries with a webinar titled, "Discover the Newly Enhanced Earth System Data Explorer (ESDE). Participants received an in-depth tour of ESDE's updated features, highlighting new tools such as double line plots for comparative data analysis, side-by-side map visualizations for spatial reasoning, and accessible color palettes to support diverse learners. The event combined live demonstrations and hands-on activities, equipping attendees with the knowledge to build custom visualizations and integrate real-world NASA Earth science data into their classrooms. The session helped to foster scientific literacy, strengthen data literacy skills, and enhance environmental education through authentic NASA Data.

My NASA Data Digital Engagement By the Numbers: FY25

PAGE VIEWS	STORYMAPS & INTERACTIVES	EARTH SYSTEM DATA EXPLORER MAPS LOADED AND ACTIVITY	TOTAL DIGITAL ENGAGEMENTS
1,292,583	189,662	153,807	1,636,052

MY NASA DATA (MND), A NASA LANGLEY RESEARCH CENTER SCIENCE DIRECTORATE PROJECT, SUPPORTS THE USE OF AUTHENTIC NASA EARTH DATA FOR EDUCATORS AND LEARNERS IN GRADES 3-12.

Learn more about My NASA Data.

INSPIRE

LANGLEY SCIENCE **A Year in Review** 2025

NASA Data, Tools, Expertise

Activation in Coordination with Response Orgs

Assessment to Improve Future Response Coordination

DISASTERS RESPONSE COORDINATION

When disasters threaten, the perspective from space offers more than a dramatic view – it holds the key to enhanced response, resilience and recovery.

Incorporate Our Data Into Your Work

Discover resources you can use that take advantage of NASA's vast and robust record of historical data, and discover innovative platforms that feature near real-time data that can increase your understanding of our planet and its changing conditions right now.

Work With Us

We strive to build strong relationships with partner organizations during blue-sky periods so that when disasters strike, we can quickly provide valuable information to aid decision-making. This two-way information exchange allows us to learn about each partner's specific needs, while they learn about our capabilities and how we can most effectively collaborate during times of crisis.

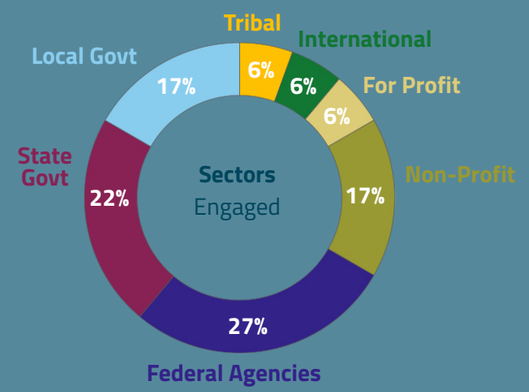
If you are a member of a disaster management organization, we encourage you to reach out to our team at drcs@nasa.gov to let us know more about your organization and your community's disaster response needs.

Email NASA's DRCS

Launched in June 2024, NASA's Disasters Response Coordination System (DRCS) is already demonstrating its value and strengthening disaster response efforts worldwide.

Emergency responders and community leaders need to quickly make life-saving decisions with limited information. NASA's timely and actionable information from a constellation of Earth-observing satellites vigilantly captures critical data for operational efficacy during crises to aid agencies and organizations tasked with operational disaster preparedness and response. The system's structure includes a central project office at NASA's Langley Research Center and Center Response Coordinators across six NASA centers, ensuring robust representation and use of NASA's collective capabilities. DRCS is an initiative of NASA's Earth Science Division's Disasters Program that turns science into action and data into decisions.

ACTIVATION ENGAGEMENT



As a request-driven organization, the DRCS engages directly with emergency managers and secondary organizations involved in disaster response.

34 ORGANIZATIONS ENGAGED IN 9 ACTIVATIONS IN 2025

Examples of organizations engaged during activations in 2025 include:

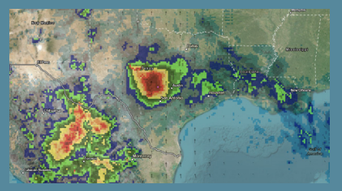
- American Red Cross
- California Governor's Office of Emergency Services
- Federal Emergency Management Agency Region 4
- GiveDirectly
- National Weather Service's Southern Region
- Texas Division of Emergency Management
- Charleston County Emergency Management Department

ACTIVATION HIGHLIGHTS

The DRCS team operates through a monitoring-to-activation cycle to support disaster response and recovery efforts worldwide.

Southern California Wildfires (January 2025)

As wildfires blazed in Los Angeles County, the DRCS supported response efforts by the California Governor's Office of Emergency Services (CalOES) and responders with data products to understand burn extent, ash coverage, poor air quality, and damage detections.



Texas Floods (July 2025)

When destructive flooding impacted the Texas Hill Country region, the Texas Division of Emergency Management (TDEM) requested DRCS support with satellite and airborne imagery to assess flood impacts and guide response efforts.

Hurricane Melissa (October 2025)

When Hurricane Melissa made landfall in western Jamaica as a Category 5 storm, the DRCS worked with the U.S. Department of State to support Jamaica's emergency operations through use of nighttime lights products that helped map power outages across the island.

CY25 DRCS BY THE NUMBERS:

SYSTEM ACTIVATIONS	HAZARD TYPES ADDRESSED	AVERAGE ACTIVATION LENGTH (IN DAYS)	ORGANIZATIONS ENGAGED	U.S. STATES RESPONDED TO	NUMBER OF SERVICES PROVIDED
9	7	14.4	177	14	106

ENERGY, INFRASTRUCTURE & AGROCLIMATOLOGY

NASA POWER Summit Showcases Real-World Impact and Expands Global User Engagement

The 2025 NASA POWER Global Community Summit held September 9-10, 2025, strengthened global collaboration and showcased the real-world impact of NASA POWER data across diverse sectors including energy, infrastructure, and agriculture. The event featured tool updates from the POWER team and user presentations demonstrating applications ranging from designing solar-powered unmanned aerial vehicles (UAVs) and developing agriculture modeling solutions for grapevines in data-limited environments., to developing AI/ML tools and affordable, resilient energy solutions for off-grid coastal, remote, and island communities. Now in its fifth year, the summit continues to foster user engagement, gather feedback, and expand the reach of NASA POWER's capabilities worldwide.

LEARN MORE ABOUT POWER'S GLOBAL COMMUNITY SUMMIT

NASA POWER Enables Decisions for Resilient Energy Solutions

NASA's POWER project is strengthening national energy resilience by enabling data driven decisions that ensure U.S. homes and businesses maintain reliable energy. ACES, a U.S. energy management company, utilized NASA POWER data to analyze "dark calms" across the country – rare but high impact periods when both solar and wind generation drop sharply coinciding with peak demand. Through POWER's accessible, long-term solar irradiance and 100-meter wind speed datasets, ACES conducted a comprehensive 20-year analysis to help the Platte River Power Authority understand when and where dark calms are most likely to occur, enabling the utility to design a more reliable power supply portfolio and plan for backup generation during critical weather events. By integrating NASA Earth observation data into its market research and risk modeling, ACES demonstrated how accurate, dependable historical records can safeguard communities, inform pricing and operational decisions, and ultimately ensure that homes and businesses remain powered.

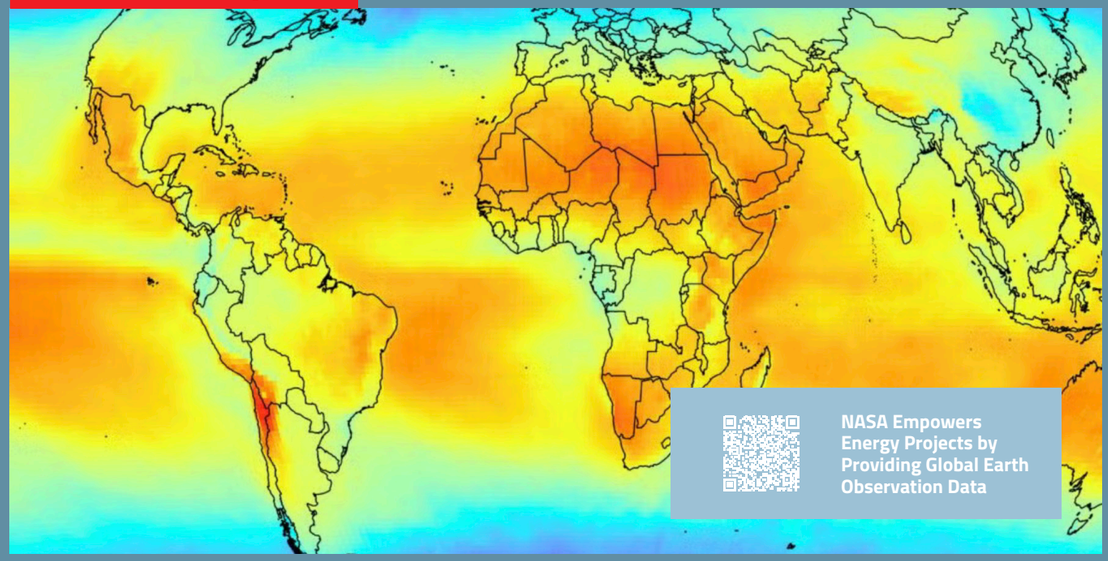
POWER BY THE NUMBERS CY25

DATA REQUESTS 271.3 MILLION

UNIQUE USERS 542K

DATA VOLUME SERVED 26 TB

IN THE NEWS: POWER Magazine



NASA Empowers Energy Projects by Providing Global Earth Observation Data

NASA POWER Breakthrough Broadens Clean-Energy Impact Through Hydropower Outreach

NASA's POWER project is making a significant leap into the hydrology and water resource sector, expanding its reach beyond solar and wind energy by providing data that directly supports hydropower planning and operations. An interview in Hydro Leader magazine with Langley's Dr. Paul Stackhouse highlights real-world applications—from floating solar and hybrid hydro-solar systems to reservoir management—while underscoring the importance of user feedback and new data integrations such as Integrated Multi-satellitE Retrievals for Global Precipitation Measurement (IMERG) precipitation and Global Water Measurements (GWM) reservoir height information. This outreach effort strengthens NASA's Earth Science to Action initiative and enhances POWER's role in enabling resilient, data-driven decisions across the clean-energy landscape.

POWER IMPACT STORIES

NASA'S POWER PROJECT ENABLES NASA EARTH OBSERVATIONS, MODELING, AND ANALYSIS FOR DECISION-MAKERS WORLDWIDE TO ADDRESS THE MOST PRESSING CHALLENGES POSED BY OUR ENVIRONMENT AND MAKE DECISIONS THAT ENHANCE SOCIETAL WELL-BEING.

NASA POWER'S DEPENDABLE DATA ENSURES DEPENDABLE ENERGY FOR U.S. UTILITY COMPANY

Xcel Energy began using POWER data to monitor performance of their community solar gardens, allowing them to optimize resources and funds while minimizing costs that can occur in times of peak demand.

NASA POWER HELPING SCIENTIFIC EXPEDITIONS SAIL THE OCEANS

In 2022, Saildrone began using NASA POWER's hourly solar data to optimize its solar powered ocean missions by improving energy forecasts and boosting drone efficiency.

NASA POWER ALIGNS DATA OFFERINGS WITH EVOLVING RESILIENT INFRASTRUCTURE NEEDS

NASA POWER expanded its support to the infrastructure industry through the co-development of a new psychrometric report with HGA, an architecture and engineering design firm, making its global climate data more accessible and directly supporting the design of more efficient, resilient buildings worldwide.

POWER DATA FUELS RESILIENT FARMING AND RICHER HARVESTS

Between 2019 and 2025, POWER fulfilled more than 466 million data requests from agriculture users through the POWER application programming interface (API), averaging more than 185,000 requests a day as data-backed solutions informed farmers' decisions.

COASTAL RESILIENCE

We're using NASA satellite data and state-of-the-art prediction models to help Hampton Roads communities prepare for storms, flooding, and heat waves. Our work supports Virginia's resilience plans and provides tools for our communities to protect residents, ecosystems, and infrastructure. While centered on Hampton Roads, this project is also designed to serve as a national model for using NASA Earth science to help coastal and flood-prone cities reduce disaster risk, strengthen hurricane preparedness, and build long-term resilience.

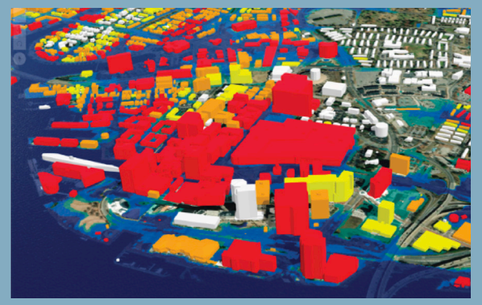
WHY HAMPTON ROADS NEEDS THIS PROJECT

Hampton Roads faces the fastest sea level rise on the East Coast – up to 5 inches per decade from rising oceans and sinking land. Current flood maps only show coastal flooding and miss the full picture: what happens when high tides,rainstorms, and coastal flooding all hit at once? This is one question we're going to answer.

Compound (storm-surge, tidal, and rainfall) flooding at Langley Air Force Base during Hurricane Isabel produced an 8-foot peak-storm tide on September 18, 2003.

HOW WE ARE HELPING

We are creating detailed local flood predictions for different storm scenarios to improve stormwater systems and inform future drainage improvement projects. We are also providing heat stress data fromNASA's Risk Analysis and Solutions Innovators (RASI) program to support public health planning, ecosystem protection, and building energy efficiency.



Visualization of building vulnerability to minor (yellow), moderate (orange), and major (red) flooding thresholds in Norfolk, VA (Sweet et al., 2017)

Norfolk Naval Station is one of many critical facilities in Hampton Roads benefiting from NASA's advanced modeling and planning tools designed to reduce flood risk and strengthen coastal resilience.

WHO WE ARE WORKING WITH

This project is a partnership between NASA Langley Research Center, Hampton Roads Planning District Commission, the cities of Hampton, Norfolk, and Virginia Beach, five universities (Hampton University, Old Dominion University, William & Mary VIMS, Florida International University, and Columbia University), Tidewater Sentinel Landscape, Sustainability Solutions Group and Institute/Center for Sustainable Communities.

Together, they are using satellite data, historical storm reconstructions, and advanced models to assess flood risks and co-develop practical, locally relevant solutions. A key part of the project is a new geo-visualization and information hub, which will integrate near real-time Earth observation data, predictive flood modeling, and social vulnerability indicators into a user-friendly dashboard. This resource will help city leaders prioritize infrastructure upgrades, optimize stormwater management, and guide future land use and emergency planning based on site-specific risks.

BUILDING RESILIENCE IN COASTAL COMMUNITIES WITH NASA EARTH SCIENCE

From Virginia to the Caribbean, NASA's Disasters Program and its partners are developing cutting-edge tools to help communities withstand the growing impacts of hurricanes, floods, and other hazards.

WORKFORCE BUILDING

NASA's DEVELOP Program, headquartered at NASA Langley, provides 10-week research opportunities for participants to address environmental and policy concerns through the practical application of NASA Earth science information and geospatial data. Working in interdisciplinary teams and with the support of science advisors and mentors, DEVELOP participants build research and science communication skills that help them succeed in the workforce.

RECORD SETTING – OVER 1,300 APPLICATIONS RECEIVED FOR SUMMER 2025

DEVELOP received a record 1,337 participant applications for the summer 2025 term. Interest in the program has continued to increase, as the number of submitted applications for the summer term has doubled since 2018.

SPACE WEATHER PILOT PROJECTS

DEVELOP partnered with NASA's Heliophysics Division and Langley's Space Weather Program Office to conduct two space weather applications projects. The project teams partnered with The Polar Adventure Company to detect auroral phenomena and estimate future auroral trends in cruise ports in Alaska. They also partnered the Allied Pilots Association to observe and visualize the radiation environments on transatlantic routes during significant solar energetic particle events.

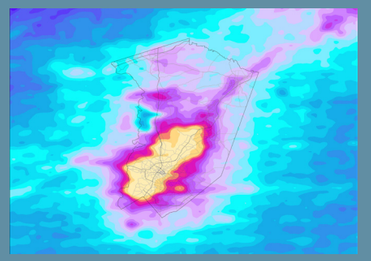
2025 DEVELOP DAY AT NASA HEADQUARTERS

DEVELOPers traveled to NASA Headquarters where 25 summer project representatives participated in poster sessions, flash talks, and highlight presentations. The day also included highlights from DEVELOP alumni, current partners, and NASA leadership.

DEVELOP BY THE NUMBERS: CY25

- Awarded 263 Participant Opportunities
- Conducted 66 Projects
- Received 2,869 Applications
- Impacted 38 States and 5 Countries

2025 PROJECT HIGHLIGHTS



Davidson Health & Air Quality

The rapidly growing Charlotte, North Carolina metropolitan area has faced an increase in urban activity and vehicular traffic, impacting the air quality of the region. DEVELOP partnered with the Town of Davidson and CleanAIRE NC to evaluate air quality indicators associated with vehicle emissions, including nitrogen dioxide and particulate matter. The team used data from TEMPO, TROPOMI, and MODIS alongside ground sensors to identify vulnerable areas across the region.

Eastern Shore Agriculture

Maryland's Eastern Shore is responsible for 74% of agricultural sales in the state. Recently, stakeholders have raised concerns over the loss of agricultural land to solar installations and the downstream economic impacts of decreased grain output and risks to food supply. Partnering with the Maryland Department of Agriculture, the team quantified land conversion and assessed the potential economic and land use impacts of solar installations replacing prime farmland.

Priest Lake Water Resources

Warming temperatures and changes in lake ice seasonality threaten the cold-water fish population in Priest Lake, Idaho. Federal, tribal, and non-profit partners, including the Idaho Conservation League, were interested in obtaining multi-decadal observations of water surface temperature and lake ice seasonality to help inform watershed management practices. This project evaluated trends in water surface temperature and synthetic aperture radar sensors to evaluate ice duration and extent.

INTRODUCING EARTHRISE DEVELOPERS ACADEMY

EarthRISE Developers Academy builds the next generation of science and technology leaders through an immersive, experiential model applying NASA Earth observations to real-world challenges. Building upon Langley Research Center's 25+ years of workforce development expertise, EarthRISE Developers Academy engages application developers to create innovative applied science solutions, utilizing NASA mission data, that boost efficiency and resilience for key partners and support the demands of an actively growing geospatial workforce. Through collaborative projects, professional development, and state, local, tribal, territorial, and private partnerships, the Academy equips participants with the skills to accelerate innovation and bridge Earth science with the future of space exploration.

EARTHRISE DEVELOPERS ACADEMY

Learn more about the EarthRISE Developers Academy

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INSPIRING SCIENTIFIC EXCHANGE

Our shared science knowledge through peer-reviewed publications, presentations, technical documents, ensures accuracy and credibility by subjecting it to critical evaluation by other experts in the field, thus upholding the integrity of scientific knowledge and advancing the field through robust research findings.

Sharing results and scientific understanding is essential for accelerating innovation, ensuring research credibility, and fostering collaboration. Publications provide a permanent, peer-reviewed record of detailed findings, while posters allow for rapid, informal sharing of preliminary data and face-to-face feedback at conferences. Together, they enable validation, prevent redundant research, and facilitate scientific progress.

FY25 METRICS

73

Peer-reviewed Journal Publications

Langley science authors and co-authors reported contributions to 73 peer-reviewed journal publications.

89

Conference Papers

Langley Science authors reported 89 conference papers.

210

Science Presentations

Langley scientists gave 210 presentations at meetings, conferences and other events.

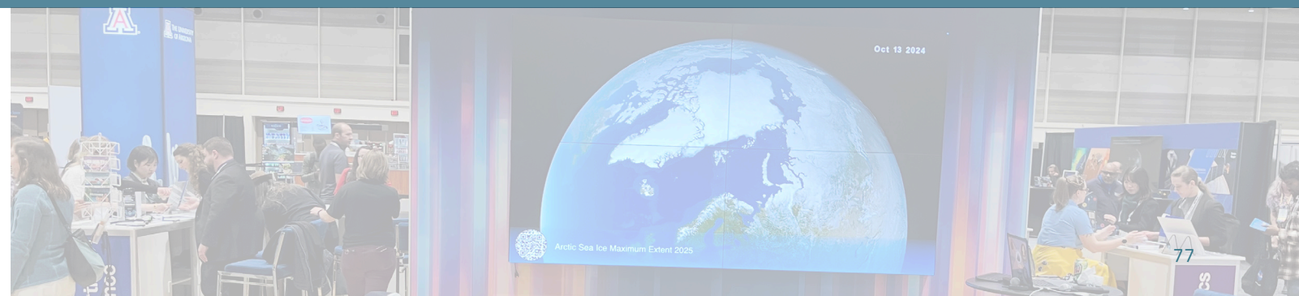
169

Conference Posters

Langley science authors reported 169 science conference posters.

Building on Knowledge

By publishing and presenting, researchers share their findings, allowing others to build upon their work, which drives scientific advancement.



SCIENCE LEADERSHIP IN ACTION

NASA HONOR AWARDS

NASA's most prestigious honor awards are approved by the Administrator and presented to individuals and groups who have distinguished themselves by making outstanding contributions to the Agency's mission. NASA medals and/or certificates are presented by the Agency's highest officials at the annual awards ceremonies held at NASA Headquarters and at each NASA center.

Distinguished Service Medal

Glenn Diskin for sustained technical excellence and exceptional contributions to suborbital in situ trace gas measurement of atmospheric chemistry and composition.

Outstanding Leadership Medal

John Hair for outstanding leadership in the execution of the Aerosol Cloud meTeorology Interactions oVer the western Atlantic Experiment Earth Venture Suborbital mission.

Paul Stackhouse for exceptional leadership in the development and advancement of reliable POWER data services that support clean energy, infrastructure and agriculture decisions worldwide.

Exceptional Scientific Achievement Medal

Richard Ferrare for exceptional achievement in lidar retrievals of aerosols relevant to human health.

Exceptional Technology Achievement Medal

John Smith for exceptional achievements on the design and demonstration of the CALIGOLA Lidar Detector System.

Exceptional Achievement Medal

Seiji Kato for exceptional achievement in the development and validation of the CERES EBAF Surface Radiation Budget climate data record.

Silver Group Achievement Medal

Disaster Response Coordination System Launch Team for exceptional contributions to the establishment of NASA's Disaster Response Coordination System.

Exceptional Service Medal

Lauren Childs Gleason for exceptional service in support of the DEVELOP National Program.

Kenton Ross for exceptional and sustained service to the DEVELOP National Program.

Brian Getzewich for extended exemplary service as the CALIPSO Data Manager and masterful stewardship of the data products, leading to their use in more than 4,500 peer-reviewed publications.

Exceptional Public Service Medal

Denise Cooper for sustained and exceptional contributions in the development and evolution of the CERES data system and climate data record.

Janet Daniels for exceptional public service and dedication to ensuring the operational continuity of the Clouds and Earth's Radiant Energy Systems (CERES) instruments.

James Collins for sustained outstanding achievements in the integration, test, deployment and analysis of airborne lidar systems for atmospheric profiling of key constituents.

Group Achievement Award

NASA DEVELOP Kingdom of Bhutan Team for exceptional achievement applying the NASA DEVELOP model to build capacity in visiting scholars from the Kingdom of Bhutan.

ASDC Suborbital Support Team for exceptional effort in ingesting and curating NASA suborbital field campaign data products and making data more discoverable and accessible.

ARCSTONE Payload Team for outstanding achievement in the design, build, and test of ARCSTONE Payload, enabling the collection of high accuracy Moon spectral irradiance data.

REAS and BraVo Balloon-borne Missions Team for outstanding achievement of coordinated international partnerships to study the REAS and BraVo ballon-borne missions.

Boeing ecoDemonstrator SAF Emissions Flight Test Team for outstanding achievement in conducting the first in-flight measurements of aircraft particle emissions and contrails formed by a 737 MAX burning sustainable aviation fuel.

Group Achievement Award

Aerosol Wind Profiler Team Group for successful demonstration of the Aerosol Wind Profiler instrument and executing the NOAA 3-D wind measurement campaign

Exceptional Public Achievement Medal

Morgan Silverman for exceptional effort in leading the development of the Atmospheric Composition Variables Standard Name Convention and its implementation in NASA airborne field campaigns.

Steven Baughcum (Boeing) for outstanding achievement in advancing the understanding of aviation emissions and contrails through the Boeing ecoDemonstrator SAF Emissions Tests.

Marian Clayton for outstanding development of advanced satellite lidar aerosol profiles and the careful and comprehensive assessments of these profiles using coincident airborne lidar data.

William Griffin (Boeing) for outstanding achievement in advancing the understanding of aviation emissions and contrails through the Boeing ecoDemonstrator SAF Emissions Tests.

Desiray Wilson for outstanding public achievement advancing innovation and next generation engagement of data visualization.

Early Career Achievement Medal

Katherine Travis for exceptional research contributing to the understanding of atmospheric chemistry and air quality.

Rory Barton-Grimley for exceptional achievement in development and application of lidar data and systems in support of NASA Airborne and Spaceborne Science Missions.

Silver Achievement Medal

Sean McCartney for exceptional achievement as a DEVELOP National Program Science Advisor and Project Manager.

Joshua Digangi for outstanding scientific support of the NASA Airborne Science ASIA-AQ campaign, the final mission of the NASA's DC-8 flying laboratory.

SCIENCE LEADERSHIP IN ACTION

IAEM TECHNOLOGY AND INNOVATION AWARD

The International Association of Emergency Managers (IAEM) awarded the DRCS - the only federal agency to win - their 2025 Technology and Innovation Award during their annual conference in Louisville, Ky., in November 2025. The award recognizes the development of technology and innovation to improve emergency management operations, public education, and the emergency management/homeland security field.

In an IAEM press release the DRCS is described as, "... redefining how advanced science supports emergency management." The press release goes on to say, "... DRCS exemplifies a transformative 'One-NASA' approach unifying expertise, data, and technology from across NASA's centers to provide reliable, timely, and actionable disaster insights."

In 2025, the DRCS activated in response to at least eight disaster events across the United States and abroad, including flooding in Washington state, wildfires in New Mexico, and Hurricane Melissa in Jamaica.

AMS DISTINGUISHED SCIENTIFIC ACCOMPLISHMENT AWARD

Yolanda Shea is the recipient of an American Meteorological Society (AMS) 2025 Scientific and Technological Activities Commission (STAC) Distinguished Scientific/Technological Accomplishment Award, bestowed by the AMS Atmospheric Radiation Committee. The citation reads: "For exceptional contributions to the measurement of shortwave spectral radiation and leadership of CLARREO Pathfinder." Dr. Shea is the CLARREO Pathfinder Project Scientist.

NASA selects Senior Technologists with decades of experience and a high-level technical expertise to guide, develop, and implement cutting-edge, mission-critical technologies.

CHRIS HOSTETLER

NASA's Senior Technologist for Lidar Science

JIM CRAWFORD

NASA's Senior Technologist for Atmospheric Composition

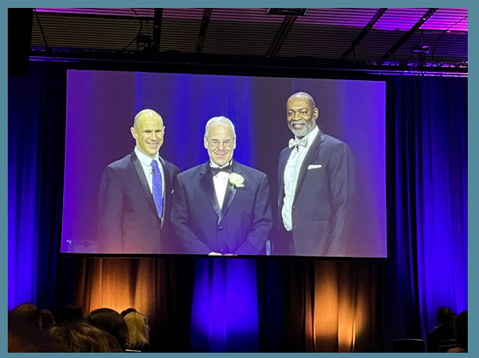
NORMAN LOEB

NASA's Senior Technologist for Radiation Sciences

2025 AGU AWARDS

Each year, American Geophysical Union (AGU) celebrates individuals who have made significant contributions to the Earth and space sciences.

Jim Crawford was awarded AGU's Ambassador Award at the Honors ceremony in New Orleans, LA. He also received the Yoram J. Kaufman Outstanding and Unselfish Cooperation in Research Award.

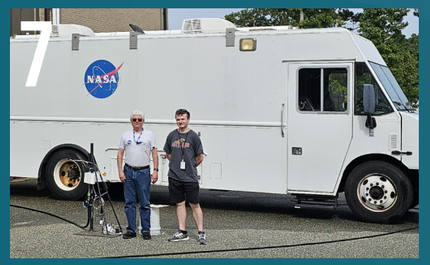


Norman Loeb was elected Fellow of the American Geophysical Union at the Fall 2025 AGU meeting in New Orleans, LA. His citation reads: "For exceptional contributions to and leadership in studying Earth's radiation budget"

LANGLEY SCIENCE STORYTELLING KIT

Visit the digital Langley Science Storytelling Kit for the latest science highlights, awards, impacts stories, news and multimedia.

2025 Langley science SNAPSHOTS



1: (L-R) Dave Eckberg, Johnny Mao, Glenn Diskin, and Josh DiGangi preparing to ship equipment to NASA WFF for the SARP and MAGEQ field campaigns

2: (L-R) Francesca Gallo and Susan Mathai servicing instruments on the NASA P-3 during the MAGEQ field campaign.

3: Dr. James Crawford and Dr. Norman G. Loeb received several awards and elections at AGU 2025 for their scientific leadership.

4: The 2025 ARCSIX Science Team Meeting held in Boulder, Colorado at the University of Colorado.

5: Dr. Patrick Taylor receives the CLC Technical Excellence Award for his briefing on the ARCSIX campaign.

6: Langley's Integrating Multiple Perspectives of Air Quality Team (IMPAQT) team attends the TEMPO/GeoXO ACX Joint Science Team Workshop.

7: Eddie Winstead and Seth Thompson installing equipment at the FAA William J. Hughes Technical Center to study emissions from aviation gasoline.

8: Michael Shook, Francesca Gallo, Luke Ziemba, and Eddie Winstead pack equipment following the final P3 research flights from Wallops Flight Facility.

9: Members from the Proposal Development Office have a Friendsgiving lunch at NASA Langley's cafeteria.

10: In support of the Artemis crew, the ASDC team participated in NASA's Artemis II global mission coverage with a video submission.

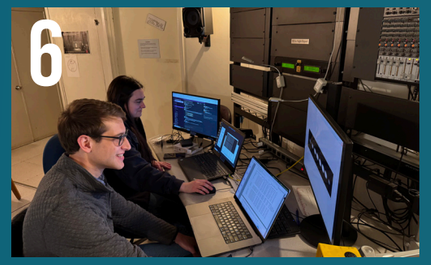
11: The Aurora Space Weather DEVELOP Team and their advisors present their findings.

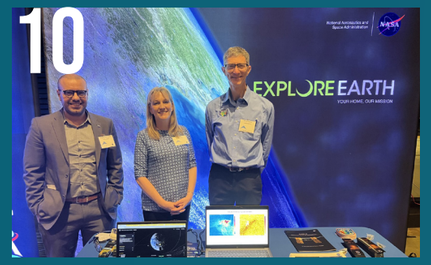
12: Chantee Davis spreads joy at the Science Directorate holiday party.

13: Teresa Nieves-Chinchilla, NASA's director of the Moon to Mars Space Weather Analysis Office, visited Langley and stopped by the Space Weather Program Office.

14: Matt, Tamika and Xia gather to take a selfie before the Langley Science Directorate holiday party.

2025 Langley Science SNAPSHOTS





1: POWER team members at NASA Langley for the 2025 Global Community (GloCo) Summit.

2: Katie Picchione from NASA's Disasters Response Coordination System team gives the keynote address at FedGeo 2025.

3: The research team for the Greenland flight to study radiation doses in high latitudes and altitudes is pictured in front of the B200 King Airplane that was used for the transport and research.

4: POWER team member, Jason Barnett, made connections with Ohio businesses, non-profits, policymakers, and industry experts at a NASA booth at the Ohio Energy Conference.

5: The spring 2025 DEVELOP team met with Dr. Nicky Fox, the associate administrator for NASA's Science Mission Directorate, during her visit to NASA Langley.

6: Langley scientist William Saunders and Texas A&M University research assistant Erika Cook in the control room of the McDonald Observatory's Otto Struve Telescope during the Uranus stellar occultation.

7: NASA Langley scientists with the P-3 aircraft during the Student Airborne Research Program (SARP) 2025.

8: Science Directorate employees fill up their plates at the 2025 holiday party.

9: Attendees at the VSGC Student Research Conference included Congressman Bobby Scott, Delegate Shelly Simonds, University presidents Langley Center leadership, and keynote speaker Ali Omar.

10: Hazem Mahmoud, Susan Kizer and David Flittner staff an exhibit at the Virginia Aerospace Day reception.

11: J.D. Reeves and Walter Miller enjoy some fun competition at the 2025 Science Directorate holiday party.

12: Jessica Taylor was invited to virtually visit a group of 2nd and 3rd graders at Sayéik: Gastineau Community School in Douglas, Alaska near Juneau.

13: Hazem Mahmoud and Laura Judd with the Health and Air Quality Team at the AMS Conference in New Orleans, LA. Collaborating to advance atmospheric science and public health insights.

14: Susan Mathai and Michael Shook operating the LARGE instrument supporting MAGEQ (Mid-Atlantic Gas Emissions Quantification) flights on the P3 aircraft.

PROPOSAL DEVELOPMENT OFFICE

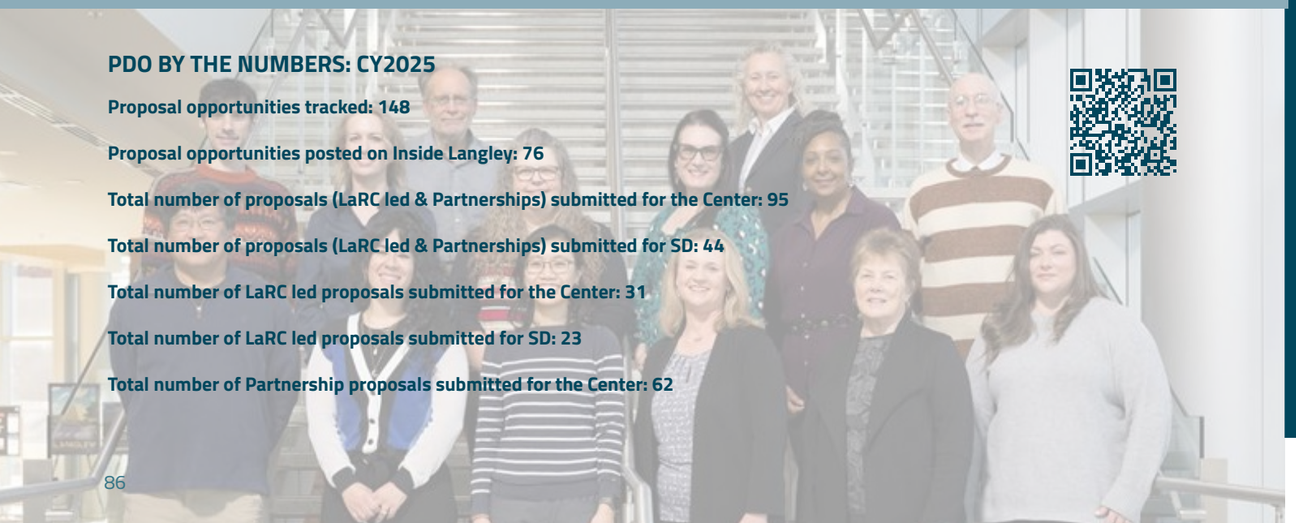
SERVING THE NASA LANGLEY PROPOSAL COMMUNITY SINCE 2012

NASA Langley's Proposal Development Office (PDO) supports NASA Langley teams as they prepare for, develop, and submit winning proposals and cost estimates across all disciplines and Directorates. PDO's goal is to make the proposal process as straightforward and efficient as possible while delivering accurate cost projections. Langley's cost estimating team provides comprehensive cost estimating services, budget development, and cost modeling for formal proposals, reimbursable agreements, and non-reimbursable collaborations.

SERVICES & PRODUCTS OFFERED

- Funding Opportunities
- Proposal Development and Business Capture
- Cost Estimation, Schedule & Tool Development
- Team SharePoint Sites

PDO WEBSITE (Internal to NASA) LEARN MORE ABOUT NASA LANGLEY'S PROPOSAL DEVELOPMENT OFFICE



PDO BY THE NUMBERS: CY2025

Proposal opportunities tracked: 148

Proposal opportunities posted on Inside Langley: 76

Total number of proposals (LaRC led & Partnerships) submitted for the Center: 95

Total number of proposals (LaRC led & Partnerships) submitted for SD: 44

Total number of LaRC led proposals submitted for the Center: 31

Total number of LaRC led proposals submitted for SD: 23

Total number of Partnership proposals submitted for the Center: 62

Step Inside Nasa Langley Partnerships

FIND OUT HOW WE DO BUSINESS

NASA LANGLEY FRONT DOOR

INDEX

AGAGE API, p. **62**
APMAC, p. **45**
Arcstone, p. **14**
ARCSIX, p. **42**, **43**
Artemis, p. **20**
ARSET workshop, p. **59**
ASDC, p. **56**, **57**
ASIA-AQ, p. **38**, **39**
Athena, p. **15**
ATLID, p. **48**
ATMOCIAD, p. **11**
AWP, p. **46**, **51**
B777 aircraft, p. **52**
Blue lidar, p. **10**
CALIOP, p. **49**
CALIPSO, p. **36**, **37**
CEOS SEO, p. **58**
CERES, p. **32**, **33**
Coastal Resilience, **72**, **73**
CRAVE, p. **32**, **54**
DEMETER, p. **10**
DEVELOP, p. **74**, **75**
DIAL, p. **10**
Dragonfly, p. **16**, **17**
DRCS, p. **68**, **69**
EarthCare, p. **48**
EarthRISE Developers Academy, p. **75**
End-to-end approach, p. **5**
ESDIS, p. **57**
FAIR data, p. **58**
FarmFLUX, p. **53**
Field campaign data, p. **50**
FireSense, p. **40**, **41**
Flight Projects, p. **13**
Focus areas, p. **5**
Fuel Emissions Testing, p. **55**
GLASS Pipeline, p. **62**
GLOBE, p. **65**
Global Hackathon, p. **63**
GRAM Suite, p. **11**
HAMAQ, p. **52**
HALO, p. **43**, **46**, **48**
HSRL-2, p. **48**, **49**
HyperPIX, p. **18**
INSPYRE, p. **53**
Lidar capabilities for planetary science, p. **9**
Lidar technology for atmospheres and oceans, p. **7**, **8**
LITE, p. **36**
LMOL, p. **55**
MAGEQ, p. **44**
My NASA Data, p. **67**
NAIRAS, p. **26**
NDACC, p. **58**
NUBE, p. **64**
NURTURE, p. **52**
PDO, p. **86**
Plume-Surface Interaction, p. **20**
PolCube, p. **19**
POWER, p. **32**, **70**, **71**
SAGE III/ISS, p. **34**, **35**
SAGE IV, p. **19**
SatCORPS, p. **11**, **60**, **61**
SARP, p. **44**
SCALPSS, p. **23**
Scientific exchange, p. **76**
Scientific leadership, p. **80**, **81**
Severe thunderstorm detection tool, p. **11**
Shields-1, p. **28**, **29**
Snapshots, **82-85**
Space Weather Program Office, p. **25**
Space Weather research, p. **27**
SPECIES, p. **10**
STAQS user guide, p. **51**
SUCR, p. **18**
Sunlight denoising technique, p. **10**
SWXRAD, p. **24**
Teacher training, p. **66**
TEMPO, p. **30**, **31**
TOKYO-FC, p. **52**
Uranus stellar occultation, p. **22**
Viking, p. **23**
WHyMSIE, p. **46**

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Science at NASA's Langley Research Center

Langley Research Center

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