Concept to Reality: xLab Expo Shows Off New Space Tech

October 29, 2020

A slingshot, flashlight, and shotglass all made an appearance at the first-ever xLab Engagement Expo last week.

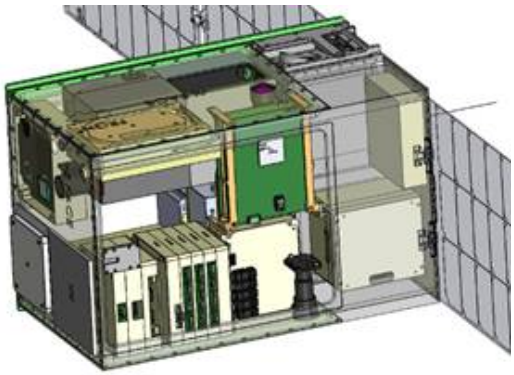
Aerospace's xLab designs and builds prototypes and instruments to meet the needs of a changing space enterprise, and the virtual expo featured presentations to explain some of these innovative efforts, many of which highlight the collaboration between xLab and other organizations across the enterprise.

"The goal of the xLab Engagement Expo is to create an opportunity for xLab staff to introduce themselves and their work to the rest of the Aerospace community and thereby promote further engagement through periodic exposition of their contributions to the advancement of space technology that is of greatest value to our customers," said Roy Nakagawa, an xLab Senior Project Engineer who helped coordinate the event.

The xLab Expo featured four presenters in a rapid-fire half-hour session. The almost-300 attendees were able to ask questions via the virtual chat to satisfy their curiosity about the various projects.

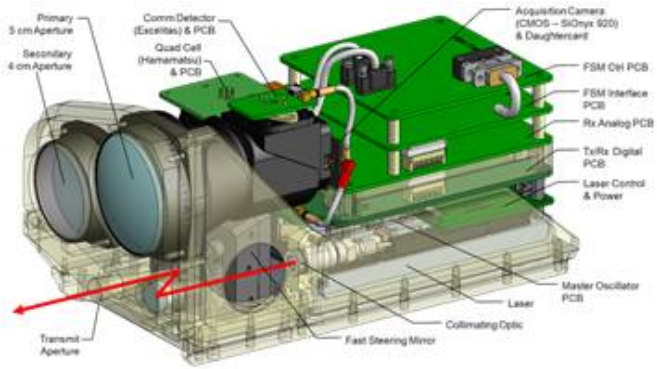
The four presentations were:

Slingshot Processor



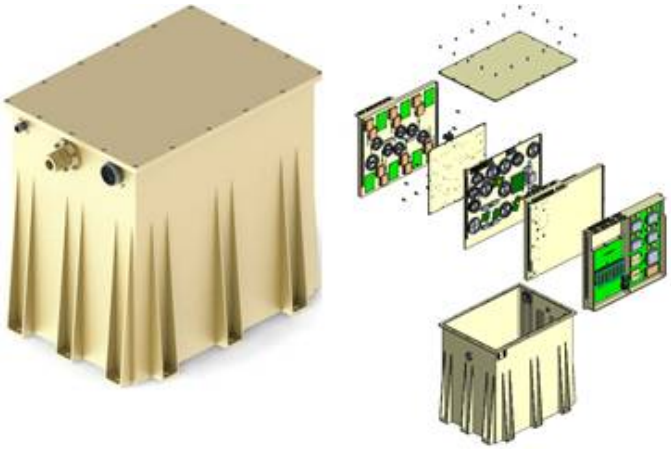
Mark Zakrzewski presented his work on the Spoon Processor for Slingshot. Satellites are supporting larger image sensors, which generate massive amounts of data. The terrestrial network, even with the latest technology, cannot meet projected data transfer requirements. Therefore, data must be reduced at the source. The goal of the Spoon Processor is to develop a flexible onboard processing system to enable high-speed data processing for different types of payloads. This processor will fly on Slingshot, which is an effort to integrate Aerospace space experiments on a commercial 12U CubeSat with a standard bus-to-payload interface.

Flashlight



Ariel Berman talked about Flashlight, which is two lasercomm payloads that will demonstrate an optical comm link between CubeSats in LEO orbit. The goal of this project, led by Principal Investigator Todd Rose in PSL's Electronics and Photonics Laboratory, is to transfer at least 50 Mbps of data while the two spacecraft are 500 km apart. The payloads should be no larger than 2U and less than 2kg, and will have independent mirror pointing with Fast-Steering Mirror to improve performance over body pointing. Flashlight will fly on AeroCube-16, a set of two 6U CubeSats that are scheduled to be done in FY21.

Shotglass



Bill Crain presented work on a project called Shotglass, a collaboration with PSL's Photonics Technology Department, to transform Aerospace's fiber laser technology into a future flight demonstration. Shotglass is a risk reduction program for hybrid fiber/bulk solid-state Master Oscillator Power Amplifier (MOPA) laser systems intended for future space and airborne lidar missions. The program focused on enhancing the hybrid architecture with the objective of a 200 W nanosecond pulsed laser. The embedded control system provides ultra-flexible timing and pulse repetition patterns, thermal stability, power level control and stabilization, and a failure interdiction/safety interlock system. This technology has applications for ground-based testing of on-orbit sensors, LIDAR, long-range optical communications, and more.

Mechanical Engineering Challenges

Rather than presenting a specific project, Geoff Maul discussed the process involved in going from concept to a product. He used two recent projects as examples: Monocle, which is a 24-hour telescope, and T-Case, which is a fever indicator for COVID purposes. For these types of products, xLab works with the concept creator to determine the scope, timeline and goals. The lab's electrical, mechanical, and fabrication staff work together to create the end product, incorporating upgrades and revisions as needed.

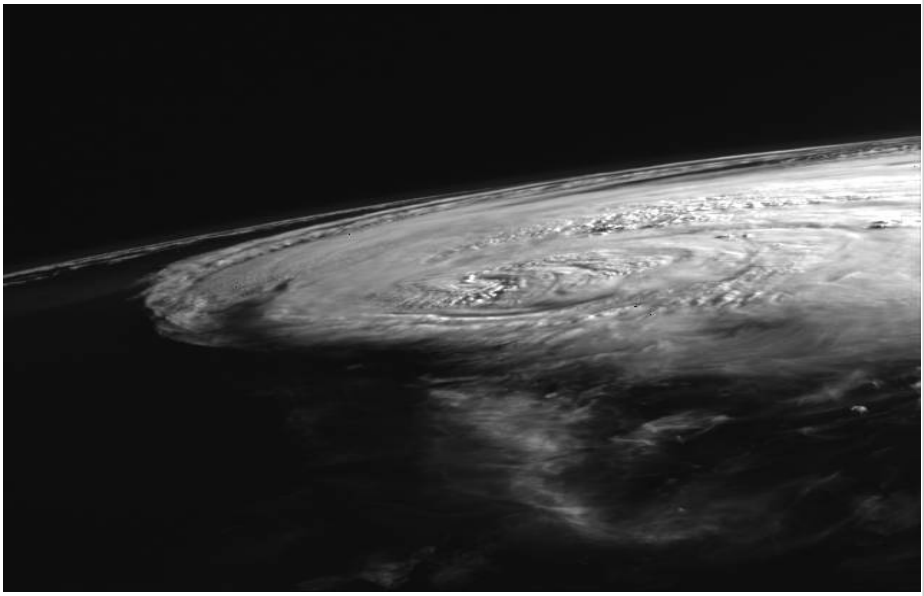
If reading these summaries has piqued your interest, the charts and a recording (coming soon) of the presentation are available on the xLab website. The team intends to make this Expo a monthly occurrence, so watch the Orbiter for announcements of future events.

"We've got a number of great topics coming up, including more overviews of current payload projects, software specific contributions, and innovative mechanical solutions to complex problems," said Mark Zakrzewski, an xLab Senior Engineer who came up with the concept for the series. "With presentations only 30 minutes long taking place during your lunch hour, don't miss out on discovering the amazing engineering that is taking place in the AGO Labs!"

Rogue Cubesats Eye Hurricane Sally From Space

October 22, 2020

When Hurricane Sally hit the Gulf Coast region of the United States, an AeroCube was laser-focused on the eye of the storm.

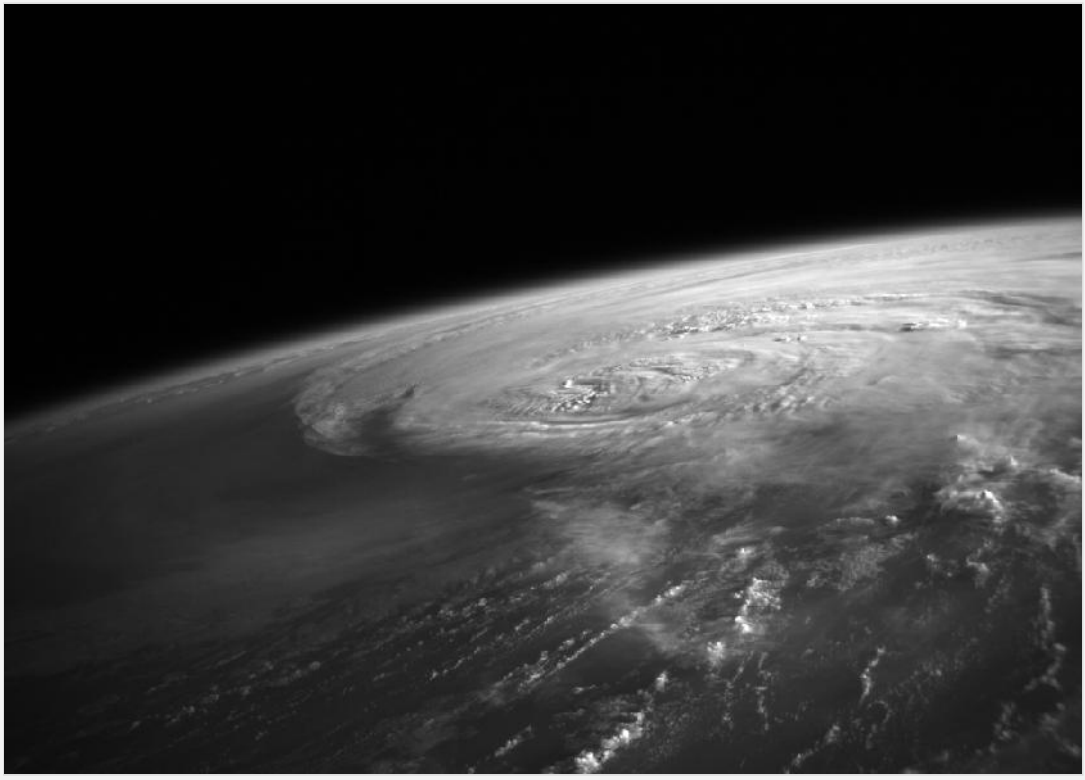


The Aerospace Rogue CubeSats took this wavelength infrared image of Hurricane Sally just after dawn, as the Category 2 storm made landfall on Wednesday, Sept. 16 over the Alabama-Florida border.

The Aerospace Corporation's Rogue Alpha/Beta CubeSats sent compelling imagery of the hurricane to Earth via laser communications, demonstrating how a small satellite can deliver large amounts of remote sensing data for weather and other research.

"Aerospace is excited to see another mission benefiting from the investments made in laser communications for small satellites," said Darren Rowen, Director of the xLab Small Satellite Department. "The ability to transmit at high speeds of 200 Mbits per second optically with a spacecraft-body-steered laser transmitter continues to push the state of the art and has the potential to reduce cost while meeting valuable mission needs."

More than 1 gigabyte of data was downloaded from the two CubeSats, a bandwidth improvement of 200 times that of a radio frequency downlink.



Visible image of Hurricane Sally taken by The Aerospace Rogue CubeSats just after dawn, as the Category 2 storm made landfall on Wednesday, Sept. 16 over the Alabama-Florida border.

The CubeSat was programmed to fly pointed at Earth's horizon and then point and stare at the forecast position of the eye of the storm as it came into view, demonstrating the ability of small satellites to execute agile weather imaging. This video shows 200 frames of raw short wavelength infrared images taken at 1-second intervals of Hurricane Sally.

This successful laser communications operation completes a key threshold objective and will enable the next phase of Rogue mission operations. Remote sensing data throughput can be increased, and longer and higher framerate collections over wider geographical regions will be enabled for cloud scene characterization and weather image processing.

One of the Rogue CubeSats was programmed to fly pointed at Earth's horizon and then point and stare at the forecast position of the eye of the storm as it came into view. This successfully demonstrated a typical "sideways-pointed wide field of view" collection mode, simulated a tip and cue of a trailing satellite, and showcased a potential new type of weather data collection.

"Using new prototype satellites, such as the Rogue Alpha/Beta constellation, we can obtain stereo observations from diverse orbital views, and image environmental events with new research-oriented spectral bands," said Dr. Dee Pack, Director of the Space Science Applications Laboratory.

*Read the **full article about Rogue CubeSats and Hurricane Sally** at Aerospace.org.*

Firefighters Battle to Save Mt. Wilson Observatory from California Wildfire

October 19, 2020

As the Bobcat Fire in California burned out of control across the San Gabriel Mountains in mid-September, the blaze nearly destroyed a crucial center of astronomy – the Mount Wilson Observatory.

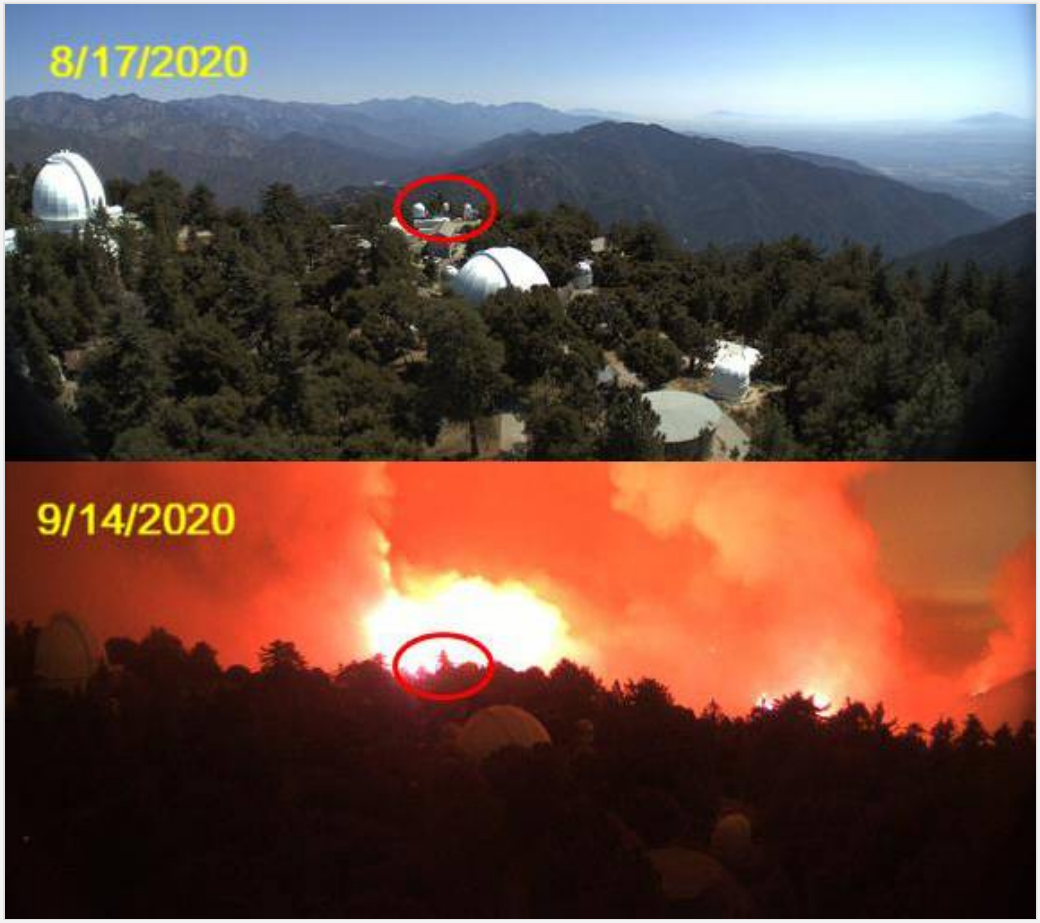
This important work nearly ended in the Bobcat Fire, which at times came within 100 yards of the Mt. Wilson Observatory and MAFIOT facility. Due to the heroic efforts by firefighting crews, the Observatory and MAFIOT structure survived.

“We are grateful to the firefighters who put their lives on the line to battle the fire around the facility,” said Dave Cardoza, the Principal Director of Aerospace’s Electronics and Photonics Laboratory. “The fact that the structures are still standing is a testament to the dedication that they put into their jobs. This will allow us to continue our important work on the mountain.”

Since the early 1900s, Southern California’s Mount Wilson has played a crucial role in astronomical activity, from early telescope-aided studies of the sun to the discovery of nebulae in faraway galaxies by the famed Edwin Hubble. Situated high above the Los Angeles basin with a clear view that spans from the Pacific Ocean to the Inland Empire, Mt. Wilson continues to play an important role in advancing our understanding of space and the technologies needed to observe it.

More recently, The Aerospace Corporation furthered these efforts through work at the Mt. Wilson Aerospace Facility for Integrated Optical Tests, known as MAFIOT, by providing a unique testbed to conduct experiments. The wide range of research includes atmospheric laser propagation, atmospheric scattering, laser communications, and other laser applications. MAFIOT is designed to augment Space Domain Awareness capabilities that combine different wavelength bands of light for passive and active tracking to better characterize space objects. The project has been a cross-enterprise development with staff from Aerospace’s Physical Science Laboratories, Vehicle Systems Division and xLab working together to develop a flexible testbed that allows customers to easily test new optical sensors, innovative laser techniques, and concepts of operation for space domain awareness.

“It’s designed to be a flexible testbed that can accommodate a number of types of experiments,” said Andrew Mollner, a Project Leader at Aerospace. “We’re evaluating evolving, emerging technologies.”



Photos of Mt. Wilson and MAFIOT in August, and during one of the most dangerous times of the Bobcat Fire. At times, the fire was as close as 100 yards from MAFIOT and the observatory. [Credit: HPWREN]

The core of MAFIOT is the modular suite of instruments that include a series of cameras and their associated optics, which together are capable of capturing everything from visible light through the longwave infrared band. Depending on the experiment, different cameras, detectors and software can be integrated into the testbed, allowing for evaluation with real targets.

The Mt. Wilson location provides several benefits, including serving as a cost-effective and convenient location for electronics and photonics work compared to off-shore facilities. In addition, it is a historically great site for astronomical seeing and it provides a vantage point close to Vandenberg Air Force Base and San Nicholas Island.

MAFIOT's flexible nature makes it a powerful tool for conducting tests for Aerospace customers. In addition to demonstrating and benchmarking technologies, Aerospace experts have also developed expertise in acquiring and analyzing the data sensors provide.

Recent work has included study of a state-of-the-art photon sensitive camera, capable of detecting single photons of light. This will be an enabling technology for optical communications. Lessons learned from Aerospace's integration of the camera into the MAFIOT testbed, including methods for extracting data, were transferred to industry partners, saving time and cost on future systems development.

“If you want people to be doing evaluations of technologies or techniques, having the objectivity and depth of expertise that comes with what Aerospace does with a facility like this is highly valuable,” Mollner said. “We’re not trying to sell anything. We’re trying to give honest evaluations of what can be done.”

While it remains to be seen what impact the heat and smoke from the Bobcat fire will have on the equipment, the Observatory is safe for the time being. The dedicated effort of the firefighting crews saved this historic site and have allowed Aerospace to continue to work on shaping the future of Space Domain Awareness.

This article has been published on Aerospace.org.

Value of Space Summit Brings Experts Together to Discuss What's at Stake

October 06, 2020

Aerospace will co-host a two-day virtual summit with the Space Information Sharing and Analysis Center to discuss the importance of space critical infrastructure today and in the future. The Value of Space Summit on Oct. 15 and 16 will convene government, industry and international stakeholders to create a rich dialogue around the most pressing challenges and opportunities for the global space sector.

The summit agenda will be largely informed by the Center for Space Policy and Strategy's recent Value of Space paper, which details present and future use cases for space infrastructure. Through colorful vignettes, the paper captures the immense breadth of satellite-enabled activities, from missile warning systems and natural disaster response to smarter farming and climate research.

"Aerospace is proud to be a founding member of Space ISAC and support its mission to bring the global space community together, to identify and respond to threats, and to provide timely, actionable information to the entire space sector," said Ed Swallow, senior vice president for the Civil Systems Group at Aerospace. "Our partnership with Space ISAC is a natural extension of our own mission to leverage 60 years of experience and insight to shape the future of space in collaboration with all organizations involved."

The Space ISAC was established in 2014 to facilitate collaboration across the global space industry to prepare for and respond to vulnerabilities, incidents, and threats and to disseminate timely and actionable information among member entities.

The Value of Space Summit will comprise two days of virtual discussions on the economic and societal role of space systems, as well as emerging threats to space assets and risk management approaches. Day 1 will include focused discussions about emerging threats to space, what space critical infrastructure needs protection and how other sectors are using space assets. The second day will focus on policies and legislation being pursued globally to secure the space mission and enterprise.

Visit Aerospace.org to learn more about Aerospace's work around ***The Value of Space****.*

Space Agenda 2021: Explore the Issues and Trends Shaping the Future of Space

October 05, 2020

From evolving adversary threats to game-changing technologies to emerging commercial capabilities, the space enterprise is in an era of rapid change. This shifting environment is increasing the importance of issues involving space security, development, and exploration as key elements of national policy and strategy.

This moment presents countless opportunities to shape the future of space. But there are also challenges that will have to be addressed, whether it's figuring out how to manage space traffic and orbital debris, integrating new commercial operators or preparing for a new era of contested space.

In the coming years, U.S. policy makers from the White House on down will need to engage with and ultimately make decisions on space-related issues.

To help inform these discussions, Aerospace's Center for Space Policy and Strategy has launched **Space Agenda 2021**, a series of papers highlighting issues that are already at the forefront of U.S. space policy or that are likely to emerge in the coming years. Each paper serves as a chapter in the full Space Agenda 2021 report, offering concise backgrounds, astute analyses, and potential options to aid government decisionmakers, industry leaders and other space stakeholders.

Below is a look at four Space Agenda 2021 chapters that have already been released. Be sure to check back for future releases scheduled for Oct. 6, Oct. 29, and Nov. 19 on topics like spacepower doctrine, space weapons, human spaceflight safety, and space-based solar power.

Space Traffic Management: The Challenges of Large Constellations and Orbital Debris by Marlon Sorge, Bill Ailor, Ted Muelhaupt

Defense Space Partnerships: A Strategic Priority by Sam Wilson, Colleen Stover, Steven Jordan Tomaszewski

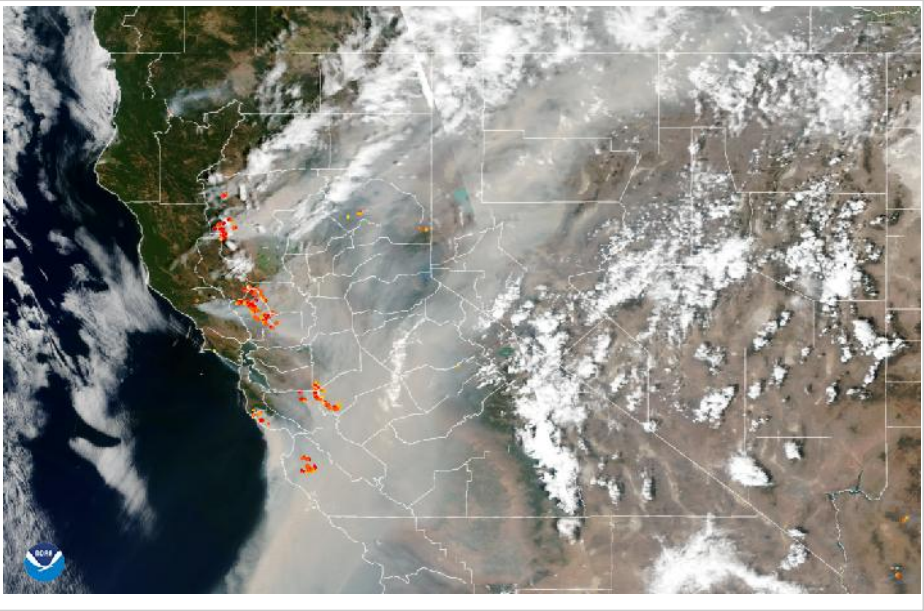
Emerging Issues in New Space Services: Technology, Law, and Regulatory Oversight by Josef Koller, Rebecca Reesman, Tyler Way

Continuous Production Agility (CPA): Future Proofing the National Security Space Enterprise by Karen Jones and Geoffrey Reber

For more information on Space Agenda 2021 and other pertinent CSPS policy papers, read the full version of ***Space Agenda 2021: Explore the Issues and Trends Shaping the Future of Space*** *on Aerospace.org.*

How Aerospace Supports the Satellites Helping Wildfire Responders Save Lives

October 01, 2020



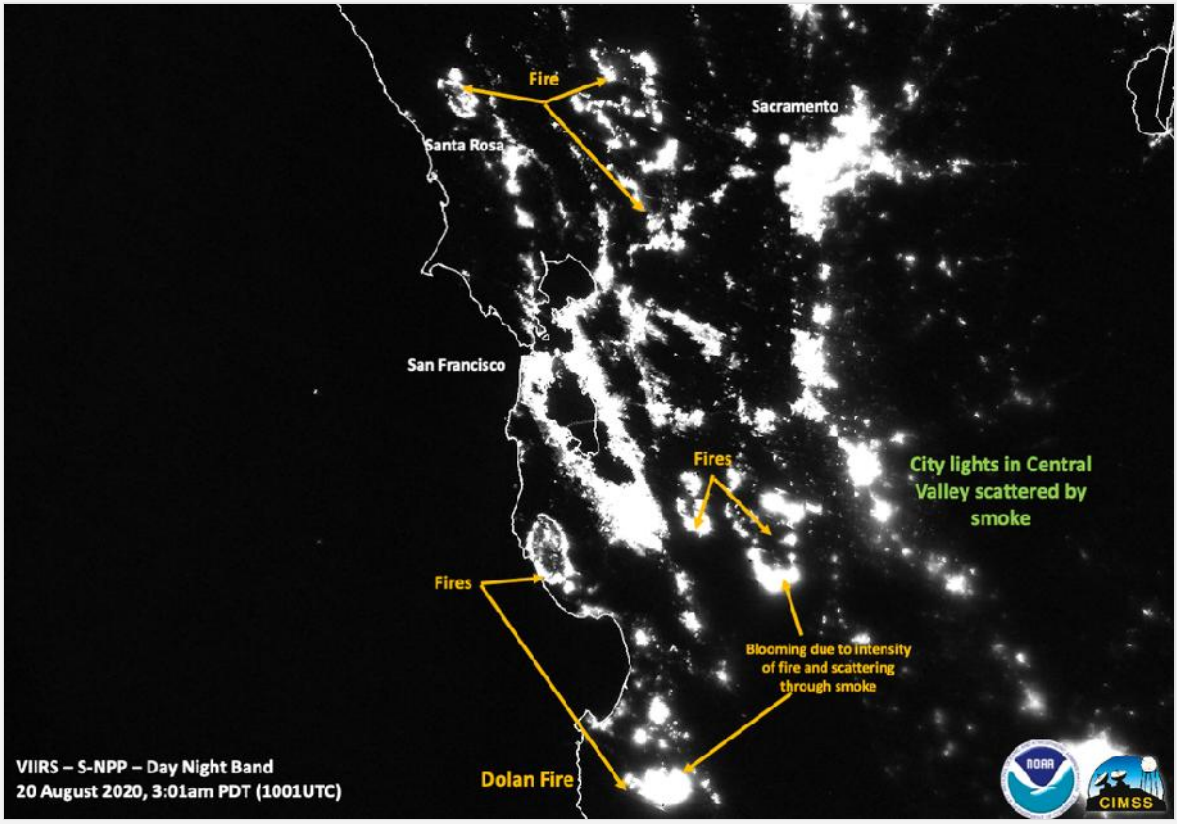
A single spark in remote wilderness can ignite massive fires that devastate surrounding communities, destroying homes and taking lives. Emergency personnel and the public rely on satellites high above the Earth to detect these fires early and track their spread.

When a lightning storm set Northern California ablaze in August, first responders turned to data from the Visible Infrared Imaging Radiometer Suite (VIIRS), a satellite sensor operated by the National Oceanic and Atmospheric Administration (NOAA) as part of a collaborative program with NASA. VIIRS is a primary sensor on the Suomi National Polar-orbiting Partnership (SNPP) weather satellite, which was launched on October 28, 2011.

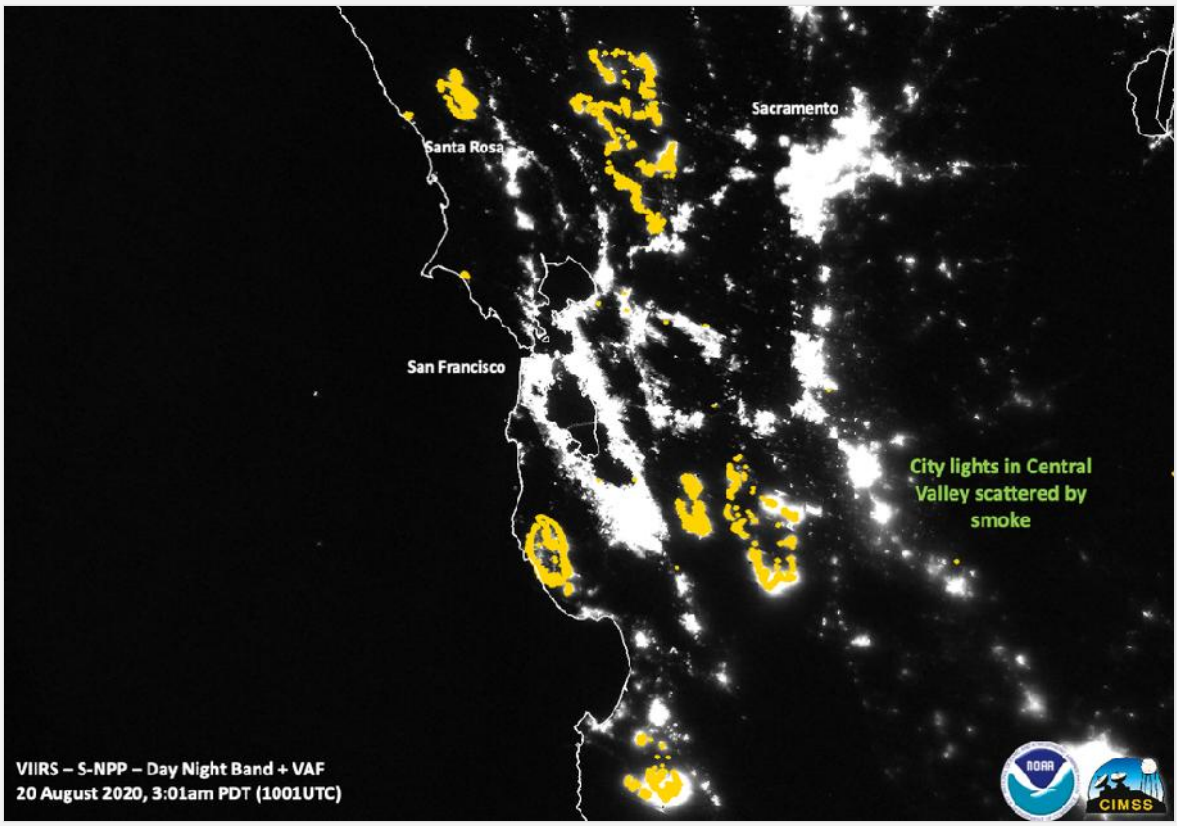
VIIRS instruments fly aboard two weather satellites, Suomi National Polar-orbiting Partnership and NOAA-20, as part of the Joint Polar Satellite System (JPSS). Each satellite captures new imagery of the entire Earth every 12 hours, allowing emergency workers to monitor fires day and night. A third VIIRS-carrying JPSS satellite will launch in early 2022.

This life-saving data hinges on spacecraft, sensors, ground systems and algorithms working in perfect harmony. Teams from across The Aerospace Corporation have supported VIIRS since its inception in each domain of the program.

“VIIRS has a unique nighttime imagery capability that enables users to anticipate a fire’s evolution based on temperature and smoke plume movement that other sensors aren’t capable of doing,” said David Moyer, a Project Leader at Aerospace.



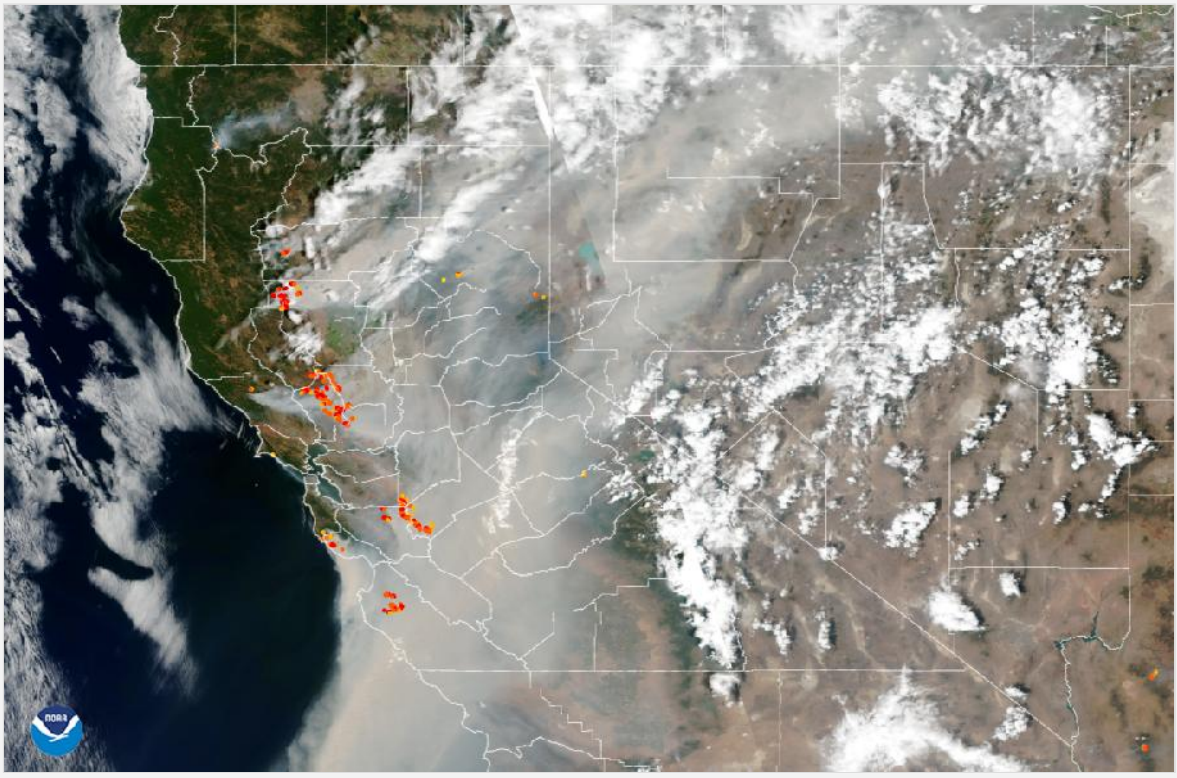
NOAA-NASA's Suomi NPP weather satellite, which is part of JPSS, was able to image this nighttime image of the California fires on Aug. 20, 2020. This image does not have the Visible Fire Product active showing the outline of the fires. City lights are scattered in this image by smoke. Fires are noted. Credits: NOAA/NASA/William Straka U of W-Madison/CIMSS/SSEC



NOAA-NASA's Suomi NPP was able to image this nighttime image of the California fires on Aug. 20, 2020. This image has the Visible Fire Product active fire outlines can be seen by the yellow lines. City lights are scattered in this image by smoke. Credits: NOAA/NASA/William Straka U of W-Madison/CIMSS/SSEC

Before the instrument can be deployed, it must pass a series of performance tests to demonstrate that it can read precise bands of visible and infrared light – even a small deviation in this capability could be the difference between saving or losing a home.

“In order to get data that’s useful to first responders, we need a radiometrically accurate sensor,” said Janna Feeley, an Engineering Manager at Aerospace. “We start in the pre-launch phase doing radiometric testing on the ground, as well as spectral and spatial characterization, to make sure VIIRS is meeting its requirements. In the on-orbit phase, we monitor its calibration stability and accuracy, so we have good radiance values for data exploitation.”



The VIIRS sensor onboard the NOAA-20 satellite captured this imagery of the smoke as it passed by the region on Aug. 19. The reddish points show the heat signature intensity of the fires. Red points are the hottest fires, followed by orange and yellow. Credits: NOAA.

Designed for operational environmental characterization and forecasting , VIIRS was built to measure a unique set of visible and infrared light bands that can isolate certain features of the Earth. Vegetation, clouds, sea ice and fires each reflect or emit specific spectral signatures, which VIIRS can detect.

“Visible and infrared band radiances and brightness temperatures are incorporated into VIIRS algorithms to generate environmental data records that users can exploit to study behaviors of the Earth,” Moyer explained.

Aerospace has leveraged its breadth of space systems experience to serve both NOAA and its acquisition agent NASA throughout the JPSS program, including in the acquisition and launch phases for the sensors, satellites and ground systems.

“We span the full lifecycle,” Feeley said. “We’re carrying forward the knowledge and expertise that we picked up supporting NASA’s prelaunch campaign, and that helps us be more effective in the post-launch phase with NOAA.”

With three more JPSS satellites in the pipeline, Aerospace continues to support the program through independent data analysis and evaluation in parallel with the VIIRS development contractor, Raytheon Intelligence & Space.

The team is also exploring potential synergies between VIIRS and other innovative technologies, such as Aerospace’s Near Infrared Airglow Camera (NIRAC), which can capture highly refined nighttime imagery from the International Space Station. Feeley said the team is evaluating collocated VIIRS and NIRAC imagery and developing a proof of concept to examine how NIRAC can augment the existing capabilities of VIIRS.

In the current environment, VIIRS provides a critical view from above on fast-moving wildfires and slow-melting sea ice, helping humanity respond to a changing climate.

“The impact of this program is easy to forget when you’re in the weeds with ground system-level or sensor issues,” Feeley said. “Aerospace is one of many contributors to VIIRS, but it’s gratifying to see our work enable first responders to save lives.”

This article has been published on Aerospace.org.

October 2020 Obituaries

Sincere sympathy is extended to the families of:

- **Charles Dolan**, member of administrative staff, hired Oct. 31, 1960, retired Aug. 1, 1981, died Aug. 29, 2020
- **Michael Ellis,** member of technical staff, hired April 9, 2007, died Sept. 17, 2020
- **Sharon Garst,** office of technical support, hired April 4, 1988, retired July 1, 2004, died Sept. 9, 2020
- **John Hamaker,** member of technical staff, hired March 4, 1963, retired April 1, 1982, died Sept. 13, 2020
- **Toru Iura,** member of technical staff, hired Nov. 3, 1960, retired Nov. 1, 1985, died Sept. 7, 2020
- **John Kane,** member of technical staff, hired Sept. 25, 1972, retired April 1, 2014, died Aug. 8, 2020
- **Todd Kawata,** member of technical staff, hired July 5, 1961, retired July 1, 1980, died Sept. 15, 2020
- **Howard Ludwig**, member of technical staff, hired April 2, 1973, retired March 1, 2003, died April 2, 2020
- **Maureen Miller,** office of technical support, hired May 19, 1980, retired Sept. 1, 2014, died Sept. 21, 2020
- **Elora Montgomery,** office of technical support, hired Oct. 22, 1979, retired Jan. 1, 2015, died Sept. 3, 2020
- **Alexander Polack,** member of technical staff, hired Oct. 28, 1985, died April 30, 2020
- **James Rogers,** member of technical staff, hired Jan. 15, 1990, retired June 1, 2012, died Sept. 10, 2020
- **Cheryl Ruddach,** office of technical support, hired Nov. 29, 1974, retired Feb. 1, 2013, died Sept. 7, 2020
- **John Sloan,** member of administrative staff, hired Nov. 9, 1992, retired May 1, 2000, died Aug. 20, 2020
- **Cora Sotack,** office of technical support, hired July 1, 1976, retired Jan. 1, 1985, died Sept. 5, 2020
- **David Taylor,** member of technical staff, hired June 30, 1997, retired April 4, 2017, died Sept. 7, 2020

To notify Aerospace of a death and have it included in the Orbiter, please contact People Operations at (310) 336-5107.

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