

## Uncovering the Auroras

May 29, 2019

It's hard to tell, but behind the beautiful, glimmering greens and blues of the Northern Lights hides a world of violence. The colorful glow of the Auroras (also known as the aurora borealis or polar lights) is the result of particles from the sun releasing energy as they bombard Earth's atmosphere. Most frequently seen in the skies of high-latitude regions around the Arctic and Antarctic, the auroras appear as a diffuse glow or as a luminous curtain-like shape, sometimes forming relatively static arcs or flowing, nebulous shapes known as "active aurora." These auroras have even been known to glow intensely enough to allow observers to read newsprint at night.

While this gorgeous light show includes a variety of colors, including greens, reds, and blues, the auroras also contain many types of ultraviolet and infrared auroral radiation that are invisible to the human eye. And while the phenomena of the auroras are attributed to disturbances in Earth's magnetosphere caused by solar wind, our understanding of the physical processes that lead to different types of auroras is still incomplete.

In an effort to shed light on these processes, scientists from the United States, Norway, Japan, Canada, and other countries launched [The Grand Challenge Initiative](#), a series of missions tasked with [studying the polar cusp](#). These missions will specifically study the flow of winds in Earth's upper atmosphere and the interactions of Earth's magnetic field with the protons and electrons that bombard our planet daily. The Auroral Zone Upwelling Release Experiment (AZURE) is one of the missions targeting the ionosphere, the electrically charged atmospheric layer that lies 46 to 621 miles above Earth.

On April 5, two rockets launched from Norway's Andøya Space Center, deploying chemical tracers that ionize in sunlight, enabling researchers to track the flow of neutral and charged particles in the auroral wind. These tracers (trimethylaluminum and a barium-strontium mixture) are helping NASA analyze the vertical winds that mix electrically charged particles and energy through the atmosphere and measure the winds' density and temperature.

The tracers were deliberately conspicuous: For half an hour, the northern Norway sky boasted an impressive lightshow of colorful clouds, dots, and plumes composed of ionized particles whose movement was tracked by NASA.

"Not a lot of the locals knew what was going on, and since it looked like an alien invasion there was a lot of publicity in the press," explains Dr. James Hecht from Aerospace's Ionospheric and Atmospheric Sciences Department.

For the complete story, [click here](#).



*AZURE, the Auroral Zone Upwelling Rocket Experiment, launched on April 5, 2019, from the Andøya Space Center in Norway. (Photo credit: NASA/Lee Wingfield)*

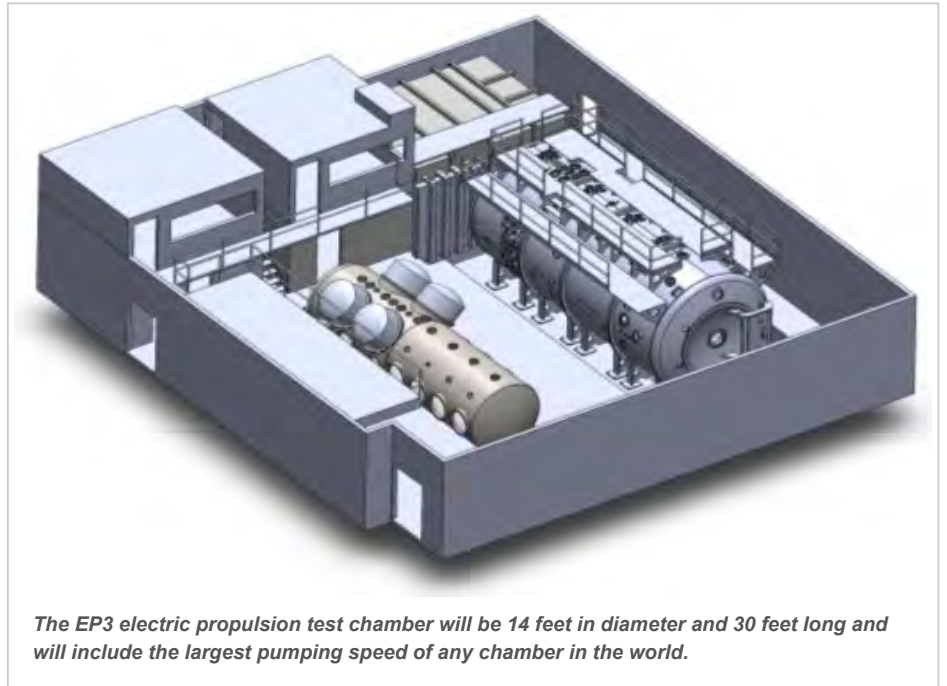
# Construction Begins on New Electric Propulsion Test Chamber in El Segundo

May 20, 2019

Electric propulsion is propelling the space industry forward. To tackle the increasing demand for research and diagnostics of electric propulsion devices, The Aerospace Corporation recently launched the construction of the EP3 Chamber in D1, a brand-new electric propulsion test chamber which will be the most powerful of its type in the world.

“EP3 is an ambitious project,” says Rostislav Spektor, Manager, Electric Propulsion and Plasma Science, who is helping oversee the project along with Propulsion Science Department Director Thomas Curtiss and the Aerospace Facilities Division. “Our ultimate goal is to create a national asset that allows for testing the new generation of electric propulsion thrusters for the next decade.”

The EP3 features electromagnetic interference (EMI) testing capability plus diagnostics for performance, plume, and plasma testing for Hall thrusters, ion engines and other types of electric propulsion thrusters. The completed chamber will be 14 feet in diameter and 30 feet long and will include the largest pumping speed of any chamber in the world.



*The EP3 electric propulsion test chamber will be 14 feet in diameter and 30 feet long and will include the largest pumping speed of any chamber in the world.*

Currently, the closest thing to the scale of the EP3 is the VF-5 facility at the NASA Glenn Research Center in Cleveland, which features a larger chamber but lacks the pumping speed and EMI testing capability. As such, the EP3's reputation precedes it.

“We already have a full slate of customers clamoring to use the facility,” says Spektor. “Many of them I cannot discuss due to proprietary nature, but I can mention NASA with their new 12.5kW AEPS Hall thruster that was originally designed for the ARRM mission.”

Construction is expected to be completed later this year. You can follow the progress on Spektor's internal SharePoint [blog here](#).

## Coast Guard Project Aims to Improve Arctic Rescue Efforts

by Eric Cheevers

May 09, 2019

For decades, the dense sea ice covering the Arctic Ocean has been shrinking and, in some regions, disappearing altogether. This environmental change is dramatically altering areas that were once blocked by ice and creating open water that is being turned into shipping lanes for an increasing number of vessels looking for a faster route between Asia, eastern North America and Europe. Expected increases in arctic vessel traffic have underscored the need for improved U.S. Coast Guard response to emergency distress signals in this area.

Polar Scout, a joint project of the [Department of Homeland Security \(DHS\)](#) Science and Technology Directorate and the [Coast Guard Research, Development, Test and Evaluation Program](#), will test the capabilities of small, inexpensive satellites to improve and expedite the reporting of search-and-rescue needs in remote and notoriously harsh Arctic regions, where timeliness is of utmost importance.

On December 3, Polar Scout launched from Vandenberg AFB, successfully deploying two 6U CubeSats (named Kodiak and Yukon) into a polar orbit. The Polar Scout CubeSats will fly over the North Pole roughly every 100 minutes and will be able to detect emergency position indicating radio beacon (EPIRB) signals from stranded vessels for around 12 minutes during each orbit. Because the CubeSats will orbit the earth 15 to 16 times a day, the Polar Scouts will provide more than three hours of Arctic coverage daily.

For complete story and featured video, click [here](#).



*Russian fuel tanker Renda sits in the ice while the Coast Guard Cutter Healy crew breaks ice around the tanker approximately 19 miles northwest of Nunivak Island. (Photo: U.S. Coast Guard Petty Officer 1st Class Sara Francis)*

## Students Show Off Innovative Ideas During 42nd Annual Herndon Science Competition

by **Conor Shine**  
May 28, 2019

The brightest STEM minds of tomorrow gathered at The Aerospace Corporation campuses on both coasts this month, with dozens of students showing off their innovative ideas for tackling the world's greatest challenges during the 42<sup>nd</sup> annual Robert H. Herndon Memorial Science Competition.

Across experimental and essay contests, middle and high schoolers explored a wide range of subjects and disciplines, from robotics and artificial intelligence to energy storage systems and the future of human space travel.

The competition, named in honor of former Aerospace engineer Robert Herndon, is aimed at promoting interest in engineering and STEM topics among underprivileged and underrepresented students.

Herndon was the first black engineer at North American Aviation at a time of profound technological change and progress in the industry. He joined the Aerospace Corporation as a structural engineer in 1961 and went on to serve as a group director of the Advanced Mission Analysis Directorate. His trailblazing ascent was cut short by his death in 1976, but his legacy of compassion, humility and willingness to share his knowledge lives on.

Students participating in the competition received help from Aerospace advisers. Those in the experimental portion got the opportunity to pitch their ideas via tabletop demonstrations to a group of judges that included representatives from Aerospace and the Air Force. Students in the essay contest participated in writing workshops and were given tours of Aerospace facilities as part of their day with Aerospace.



*Students show off their research during the 42nd Annual Robert H. Herndon Memorial Science Competition in El Segundo, Calif. on May 23, 2019.*

In Chantilly, students were welcomed on May 9 by Ed Swallow, senior vice president of the Civil Systems Group, who shared thoughts on the value of STEM and the importance of diversity to the future of innovation.

Dr. Christie Murray, co-founder and chief operating officer of Invest N Others LLC, and Russ Rumbaugh from the Aerospace Space Policy Office spoke with students participating in the essay workshops. The keynote address was delivered by Dr. Jarvis Sulcer, vice president at STEMBoard, who shared how he went from a 1.9 grade point average in his sophomore year of high school to receiving a PhD in nuclear engineering from Cornell University.

The El Segundo event took place May 23, with an introduction from iLAB general manager Dr. Randy Villahermosa. The keynote was delivered by Lt. Gen. John F. Thompson, commander of the Space and Missile Systems Center.

Thompson encouraged students to embrace the challenges presented by careers in science, engineering, mathematical and technology fields, even when they seem too difficult. In a changing world, the students gathered will have important roles to serve as future industry leaders, he said.

"I don't want anybody in here to be an engineer or be a scientist. I don't want anybody to be a mathematician. I don't want anybody to be a technologist. I want you to do it," Thompson said. "In order to make a difference you have to do it. And do does not imply a skill or an intellect. Do implies hard work and a mindset."



Lt. Gen. John F. Thompson, Commander of the Space and Missile Systems Center, speaks to students in El Segundo. (Photo: Elisa Haber)

## List of 2019 Student Winners

### Chantilly Experiment Competition



Award winners from the Chantilly edition of the Herndon Science Competition.

Mechanical Advantage in Arduino Based Robots"

### Chantilly Essay Competition

High School:

1. Sadhana Lolla (Poolesville), "Real-Time Collection and Classification of CSI Data for Motion Detection Using WiFi Waves"
2. Joy Block (Arlington Tech), "The Truth Hertz: The Effect of the Type of Material on Sound Reducing Capabilities"

Middle School:

1. Yabesra Ewnetu (Glasgow), "Air Pollution in the Chesapeake Bay"
2. Colin Sartori (Williamsburg), "The Effect of the Type of Plunger Spring on the Launch Velocity of a Pinball"

High School:

1. Grace Tang (Poolesville), "Finding Intra-cardiac Ablation Lesions with Hyperspectral/Multispectral Imaging and Machine Learning"
2. Om Desai, Aditi Gubba (Poolesville), "An AI-Powered Machine Learning Model with Sentiment Analysis and NLP to Predict Gun Violence Through Social Media Data"
3. Sadhana Lolla, Amy Zhao (Poolesville and River Hill), "Real-Time Collection and Classification of CSI Data for Motion Detection Using WiFi Waves"

Middle School:

1. Anjan Sesetty, Ishaan Jain (Roberto Clemente), "A Novel Prediction System for Detecting Wildfire Prone Areas: Unique Node-To-Node Fire Locating Algorithm with Machine-Learning Equipment"
2. Ritviik Ravi (Roberto Clemente), "Detecting Gun Shooting Source Within the School Premise Using Sound Triangulation"
3. Harini Ramaswamy (Swanson), "The Effect of Gear Ratio on"

## El Segundo Experiment Competition



*Award winners from the El Segundo edition of the Herndon Science Competition. (Photo: Elisa Haber)*

### High School:

1. Andrew Fahey, Ethan Sorensen, Trevor Lee, Luke Calimlim, Matathew Tritasavit (El Segundo), "NUBSat"
2. Ava Basillo, Laura Zapata, Nick Finta, Iram Sharif (Sherman Oaks Center for Enriched Studies), "Automatic Part Sorter"
3. Itzel Thomas Sanchez, Adrian Aceves, Jamajia Prince, Gonzalo Tiscareno, Israel Briseno Esparaza (Compton), "Robot at Your Service"

### Middle School:

1. Michael Consolazio, Joseph Beard, Logan Padilla, Adam Tittle, Matthew Banuelos (Dana), "Algae Bloom Detection Using Low Cost Underwater Robots"
2. Sofia Arancibia, Russell Miller, Zoe Ramirez, Darshana Zala, Vaidehi Zala (Sherman Oaks Center for Enriched Studies), "Electrical Storage System"
3. Samantha Jiao, Nipunika Bandara, Kaela Vilwock, Allison Tsai (Bert Lynn), "SNAX Chimney"

## El Segundo Essay Competition

### High School:

1. Pranit Mohnot (West Torrance), "Weighing Humanity's Options, Mars or Venus?"
2. Ivy Goodwin (California Academy of Mathematics and Science), "Organ-on-a-Chip: The Future of Drug Approval"
3. Zoe Storaasli (California Academy of Mathematics and Science), "The Future of Desalination"

### Middle School:

1. Arushi Bagchi (Bert Lynn), "Unlocking Secrets of the Brain Through Artificial Intelligence"
2. Matthew Banuelos (Dana), "Hydropower"
3. Harrison Fischer-Huber (Dana), "Effects of Space Travel on the Human Body"

# Asian Pacific American Association Heritage Festival Celebrates Diversity With Drums and Dance

by **Conor Shine**  
May 22, 2019

The sounds of drums and the smell of food permeated the first floor of A1 on the El Segundo campus Wednesday, as The Aerospace Corporation employees gathered to celebrate the Aerospace Asian Pacific American Association's Heritage Festival.

"The rich diversity and cohesiveness of all cultural groups working together are what make this country, and Aerospace, great," said James Liau, national president of the Aerospace Asian Pacific American Association and a systems director in the Space Based Sensing Division. "AAPAA's goal is to provide leadership development and promote diversity during this time of change to help the company increase the pipeline of high potential employees so that utilization of Asian Pacific American leaders happens to the maximum extent at all levels of the company."

The lunchtime event drew nearly 100 attendees who were treated to performances by a pair of lively entertainment groups. Employees in Chantilly, Va., and Colorado Springs, Colo., were able to participate via video teleconference.

First up was the internationally-renowned [TAIKOPROJECT](#), which brought a high-energy Japanese drum performance to the Aerospace campus.



*The performance by TAIKOPROJECT featured traditional Japanese drums. (Photo: Elisa Haber)*

The AAPAA will host its next major event — the Dr. Alexander C. Liang Asian Pacific American Award ceremony — on Aug. 8. Nominations for the awards are open now through June 14.



*Members of Lan Narthasin Thai Dance Group perform at The Aerospace Corporation in El Segundo on May 22. (Photo: Elisa Haber)*

They were followed by a series of traditional dances performed by members of the [Lan Narthasin Thai Dance Group](#). The performers wore authentic outfits and presented dances from a variety of regions in Thailand.

[Asian Pacific American Heritage](#) is celebrated around the country during the month of May each year. This year's national theme is to "Unite our mission by engaging each other," the latest in a series of annual themes that emphasize the importance of Asian Pacific American communities with diverse experiences working together to advance leadership and engagement.

"Engaging each other requires effort. It starts with a recognition that we all have differences, but that in these differences lies a tremendous bond of strength. If we can learn to embrace them, we will find our common humanity," John Fujita, principal director in the Space Systems Architect Division, said Wednesday.

# Bike To Work Week Kicks Off

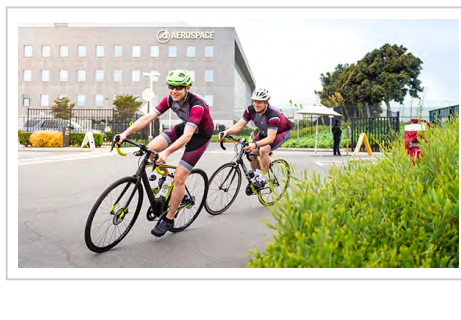
May 14, 2019

Overcast skies and a bit of morning fog didn't stop The Aerospace Corporation's cycling fanatics from pedaling their way to the El Segundo campus Tuesday as part of the kick off to a week of Bike to Work events.

Cyclists arriving at Aerospace were greeted with a spread of coffee, bagels, fruit, and other snacks. There was also a station for bike tune-ups and plenty of AEA Cycling Club swag.

The week of events continues with a bike fair at 11 a.m. on Wednesday on the El Segundo campus and a pit-stop at the El Segundo/Nash Green Line Station on Thursday to celebrate the 24th annual Bike to Work Day.

For more information about the events, [click here](#).



# Press Release: Aerospace's CUMULOS Zooms In and Takes Nighttime Images of Major Global Cities

May 23, 2019

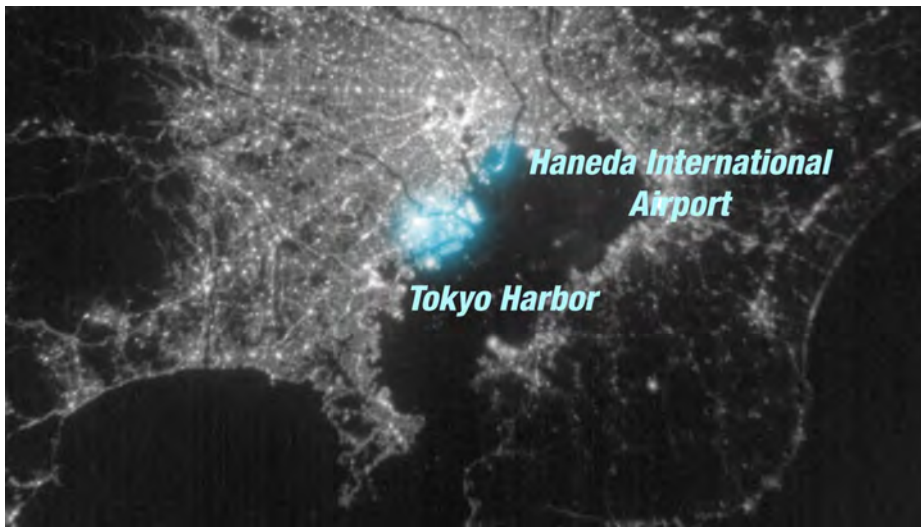
**EL SEGUNDO, Calif., May 23, 2019** – Small enough to fit inside a satellite the size of a breadbox, **The Aerospace Corporation's** CubeSat Multispectral Observing System (CUMULOS) has reached another major milestone—taking calibrated nighttime images from 280 miles above several major cities worldwide. To achieve significant improvement in nighttime imaging, CUMULOS uses point-and-stare imaging to keep pixels on target for up to one-half of a second to achieve excellent light sensitivity and focuses on selected scenes with a telephoto lens to deliver over five times the spatial resolution of current scanning polar-orbiting satellites.

“CUMULOS has proven that CubeSats can provide good-quality, higher-resolution nighttime images of city lights and other bright targets at a fraction of the cost of larger satellites by using inexpensive commercial cameras and their increasingly advanced focal plane arrays,” said Dee Pack, principal investigator for the CUMULOS mission and director of Aerospace's Remote Sensing Department. “By trading wide area coverage for higher resolution, a CubeSat platform can be a real game changer for urban geographers and for nighttime remote sensing research.”

CUMULOS' on-orbit calibration techniques allow comprehensive analysis of light patterns, which can be used to measure urban growth and energy usage, and detect wildfires and the spread of power grids in developing countries. Other applications are currently being explored.







Progress on the CUMULOS data visible camera pipeline is near completion. Aerospace scientists and engineers successfully gathered calibration data from bright stars for nighttime imagery of weather, boat light data, and the world's major cities.

"It's amazing to see that the infrastructure of bridges, roads, airports, rail networks, and refinery flares stand out in the nighttime lighting patterns," said Pack. "We're also able to view subtler lights from ships moored in the Tokyo Harbor and off the coast of Los Angeles, as well as dimmer lights in more remote areas."

CUMULOS was designed as a compact payload for testing low-cost commercial cameras for weather and Earth environmental monitoring. It can measure surface temperature, detect fires and other environmental hotspots, take cloud cover pictures, and provide nighttime lights imaging by using three compact cameras: a visible wavelength camera, a short-wavelength infrared camera, and a long-wavelength infrared system microbolometer camera.

Flown as part of Aerospace's AeroCube program, CUMULOS has the first infrared sensors that allow infrared weather imagery to be studied by a small satellite. Currently, it flies as a secondary payload on NASA's Integrated Solar Array and Reflectarray Antenna (ISARA) CubeSat mission.

### **About Aerospace CubeSats**

Aerospace was an early pioneer in the development of nanosatellites (1 to 10 kilograms; 4 to 12 inches) and picosatellites (0.1 to 1 kilograms; under 4 inches). Company researchers continue to conduct pathfinding research in the field by developing new technologies for smallsats that have not been previously demonstrated. Since 1999, Aerospace has flown 33 nano- and picosatellites, plus 6 reentry breakup recorders. Today, Aerospace is one of the leading private operators of satellite constellations worldwide with 19 AeroCubes currently operating on orbit on a variety of missions.

### **About The Aerospace Corporation**

The Aerospace Corporation is a national nonprofit corporation that operates a federally funded research and development center and has approximately 4,000 employees. With major locations in El Segundo, Calif., Colorado Springs, Colo., and Washington, D.C.,

Aerospace addresses complex problems with agility, innovation and objective technical leadership across the space enterprise and other areas of national significance. For more information, visit [www.aerospace.org](http://www.aerospace.org). Follow us on Twitter: @AerospaceCorp.

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## **May 2019 Obituaries**

by **Christine T Kato**  
May 01, 2019

*Sincere sympathy is extended to the families of:*

**Robert Beck**, member of technical staff, hired March 13, 1967, retired Oct. 1, 1985, died March 27, 2019  
**Marice Burks**, member of administrative staff, hired May 31, 1977, retired Dec. 1, 2017, died April 3, 2019  
**Caron Davison**, office of technical support, hired Feb. 4, 1971, retired April 1, 1989, died April 11, 2019  
**John Grantham**, member of administrative staff, hired Dec. 28, 1992, retired Aug. 1, 2005, died Aug. 14, 2017  
**Richard Labonski**, member of technical staff, hired Aug. 29, 1977, retired Feb. 1, 1994, died March 25, 2019  
**Charles Lewis**, member of administrative staff, hired May 7, 1981, retired Oct. 1, 1990, died April 8, 2019  
**Richard Ludlow**, member of administrative staff, hired Sept. 15, 1962, retired Nov. 1, 1991, died April 8, 2019  
**Frederick Morse**, member of technical staff, hired Aug. 17, 1964, retired Aug. 1, 1998, died April 12, 2019  
**Darryl Newton**, office of technical support, hired June 11, 1973, retired June 1, 2000, died April 2, 2019  
**Janice Riley**, office of technical support, hired Nov. 14, 1960, retired Dec. 1, 2002, died April 11, 2019  
**Michael Russi**, member of technical staff, hired Feb. 21, 1961, retired March 1, 1990, died April 1, 2019  
**Floyd Sabin**, member of technical staff, hired Jan. 8, 1962, retired July 1, 1993, died March 31, 2019  
**Richard Schoolar**, member of technical staff, hired Feb. 26, 1979, retired March 1, 2000, died April 14, 2019  
**William Stinger**, member of technical staff, hired Oct. 16, 1972, retired June 1, 2012, died March 29, 2019  
**Charles Sve**, member of technical staff, hired July 17, 1968, retired March 1, 2010, died April 9, 2019

*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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