National Aeronautics and Space Administration

Cutting edge

Goddard's Emerging Technologies

Volume 17 | Issue 1 | Fall 2020

Innovator of the Year: Eftyhia Zesta

Better Understanding Earth's Magnetic Field

www.nasa.gov

Volume 17 • Issue 1 • Fall 2020

Office of the Chief Technologist Announces FY20 IRAD Innovator of the Year:

Heliophysicist Eftyhia Zesta

Goddard's Office of the Chief Technologist has named heliophysicist Eftyhia Zesta as this year's FY20 Internal Research and Development (IRAD) Innovator of the Year, an honor the office bestows annually on individuals who demonstrate the best in innovation.

The office also awarded a special team award to a collection of Goddard scientists and engineers who recently won or are completing a handful of small heliophysics missions that will help scientists better understand the Sun-Earth connection (Page 5).

An expert in measuring magnetic fields, Zesta pioneered the development of smaller, cheaper, and less power-hungry magnetometers. These instruments are ideal for small and mid-sized missions and in areas where magnetic background noise can render more-specialized sensors impractical.

Magnetometry is a basic measurement of space environments, so much so that almost every NASA mission flies some means of measuring the local magnetic field. Smaller, cheaper magnetometers make it possible to monitor local and global fluctuations in Earth's magnetic fields and poles through distributed networks of CubeSats. The information gleaned will be valuable to NASA for the protection of astronauts and satellites in orbit, as well as other government agencies and operators of private satellites in low-Earth orbit. ❖

Photo Credit: NASA

in this issue:

Fall 2020

About the Cover

Heliophysicist Eftyhia Zesta was named Innovator of the Year for her groundbreaking work advancing the technologies we use to track our Sun's effects on Earth's magnetic fields. Her innovations in magnetometry hold the power to transform humanity's exploration of space.

(Photo Credit: NASA/Goddard/Rebecca Roth)

SHARE this Issue Now!

You can now share this issue with your friends and colleagues via your own social-media channels. Click the Share button to begin.

Volume 17 • Issue 1 • Fall 2020

Meet the Innovator: From a 'PhD in Digging' to Fleets of Orbiting Magnetometers


Photo Credit: NASA/W. Hrybyk

Eftyhia Zesta shows a mini electron spectrometer, part of the Dual ElectroStatic Analyzer she developed for the Dione mission that will measure auroral electrons.

Has anyone seen our magnetic North Pole lately?

It turns out that it moves.

The magnetic North Pole is a few degrees off true north now, but over the eons, the planet's magnetic poles have indeed switched places, and at some point could flip again. This year's Innovator of the Year, Eftyhia Zesta, is providing NASA new and improved tools to monitor these changes, refining how NASA measures magnetic fields anywhere humans dare to explore.

Zesta, whom Goddard's Office of the Chief Technologist named as its FY20 Innovator of the Year, is an expert in magnetometry. She earned the office's top honor for her pioneering work miniaturizing magnetometers: ubiquitously used instruments that measure magnetic fields.

Since leaving the Air Force in 2012, Zesta has shepherded a series of advancements in magnetometry — innovations that could revolutionize how NASA monitors Earth's magnetic field as well as how the solar wind affects Earth and the planet's protective magnetosphere. In FY20, her team won significant flight opportunities she says wouldn't have been possible without strategic support from Goddard's Internal Research and Development (IRAD) program (*CuttingEdge*, Spring 2020, Page 13).

"It is exciting to finally see the fruits of our long efforts from all these past years," she said. "We are, I believe, the poster child for our IRAD program. Every single aspect of what we are building for the lunar Gateway, from the sensor and electronics fabrication to the testing procedures and the software, we've worked through IRADs."

One key instrument is a three-axis, miniaturized fluxgate magnetometer, a particular technology for electromagnetic sensors that uses low power, provides good relative accuracy, and can cover a big range, Zesta said.

"If you're going to explore any area of space," she said, "measuring the magnetic field is one of the

Continued on page 4

first measurements you are going to want to make to characterize conditions in that area of space."

That explains why these versatile sensors are among the most widely used instruments in exploratory and observational satellites. Through miniaturization, Zesta, Todd Bonalsky, and her team dramatically expanded their use on smaller platforms, including small satellites and orbiting outposts, thus enabling simultaneous, multipoint measurements of important physical processes affecting space weather. The instruments may not yield the same accuracy and precision in their data as the more complex magnetometers used in planetary exploration, but the flexible approach can maximize the number of observing points by adding small sensors to multiple platforms without difficult requirements like long booms.

"We can do everything: spacecraft body-mounted, using multiple distributed sensors, or small booms when possible," Zesta said. "And the really effective part is when we use sophisticated algorithms with the data from distributed sensors. You can clean up a lot of the magnetic noise from the spacecraft itself."

Groundwork Laid

Zesta conducted ground magnetometry in her graduate work at Boston University, creating a data-capture system on magnetometers installed at high latitudes. "That was a lot of fun," she said. "Up in the Arctic, there are a lot of interesting people."

As a young researcher at the University of California, Los Angeles, Zesta started her own ground magnetometer array along the Chilean coast and in the Antarctica peninsula. "We'd set the magnetometer sensor," she said. "Then we'd have to run the cables to an outpost where our computers were housed — maybe up to 60 or 100 feet — and we had to bury them in hard, rocky soil. I used to joke that I got my PhD and postdoc in digging."

"During my years at the Air Force Research Lab," Zesta said. "I started working on algorithms for cleaning up magnetometer data from body-mounted sensors to filter out the magnetic noise created by the satellite itself," she said. "National agencies are very much interested in the situational awareness of the space environment provided by the use of distributed space weather sensors, and the magnetic field is a fundamental measurement of that." ❖

Team Achievement:

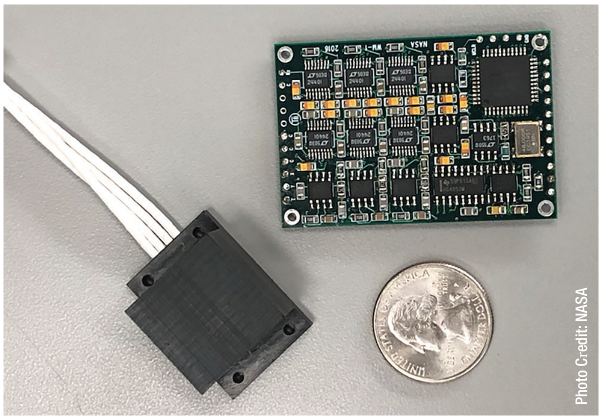
Heliophysics Investigations in Small Packages

Understanding Earth's place in space means getting to know the Sun better than ever before. This year's special IRAD (Internal Research and Development) team award goes to a collection of Goddard scientists and engineers working to better understand this dynamic.

These individuals worked together to develop faster, smaller, cheaper, and more versatile flight magnetometers, mass spectrometers, and other instruments for exploring the Sun-Earth environment. These compact sensors, being leveraged for use on many missions, are revolutionizing scientists' ability to understand conditions in low-Earth orbit out to the edges of the planet's magnetic field, where it interacts with the solar wind.

Dione

NASA's Heliophysics Technology and Instrument Development for Science (H-TIDeS) program awarded Eftyhia Zesta and co-Principal Investigator Marilia Samara $6.4 million to develop Dione, a pathfinding CubeSat mission to gather data on plasma interactions between the ionosphere and magnetosphere

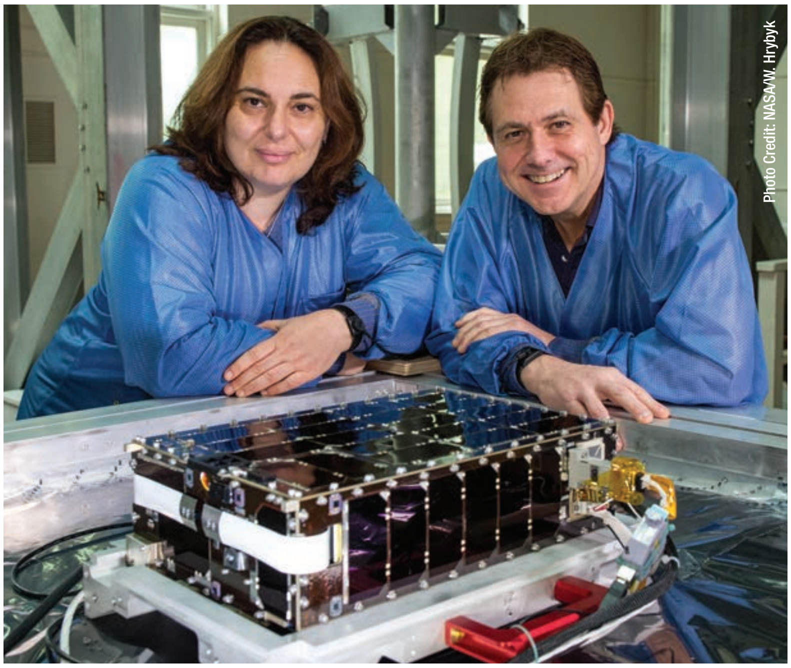


This miniaturized fluxgate magnetometer can measure many aspects of magnetic fields.

Continued on page 5

(CuttingEdge, Spring 2020, Page 13).

In addition to a fluxgate magnetometer, developed by technologist Todd Bonalsky for the Goddard-developed Dellingr mission, Dione will carry two other IRAD-funded instruments: the Ion-Neutral Mass Spectrometer being led by Sarah Jones and Nick Paschalidis, and the Dual Electrostatic Analyzer, also developed with IRAD support. Development of the spacecraft bus is led by Chuck Clagett. As a pathfinder, Dione will complement the conceptual Geospace Dynamics Explorer.



Principal Investigator Efthyia Zesta (left) and her team will study how Earth's upper atmosphere reacts to the ever-changing flow of solar energy during the Dione mission. Todd Bonalsky (right) is building the magnetometer.

The goal is to show that Dione can gather data from multiple instruments to reveal how Earth's atmospheric layers react to the changing flow of solar energy into the magnetosphere — where most low-Earth-orbiting satellites operate — and provide data needed to improve space weather forecasts.

petitSat

Jeffrey Klenzing and Alexa Halford lead a team preparing to launch the Plasma Enhancements in The Ionosphere-Thermosphere Satellite, or petitSat, from the International Space Station as early as the fall of 2021.

The mission is a precursor to a possible Explorer-class mission and leverages several R&D-supported technologies, including a bus adapted by Luis Santos from Dellingr. petitSat also uses a version of the Ion-Neutral Mass Spectrometer — the world's smallest mass spectrometer (CuttingEdge, Fall 2015, Page 18).

"We're basically trying to provide the link between the gravity waves observed from sources in the lower altitudes and show how these waves propagate outward through the ionosphere," Klenzing said. To do this, petitSat will measure the movement of neutral particles in the ionosphere.

The team will also fly the Gridded Retarding Ion Drift Sensor, or GRIDS, provided by Utah State University and Virginia Tech.

GTOSat

Also preparing to launch in 2021, the Geosynchronous Transfer Orbit Satellite, or GTOSat, seeks to pick up investigations started by the Van Allen Probes about energetic particles trapped in Earth's radiation belts (CuttingEdge, Spring 2018, Page 11).

The H-TIDeS-funded satellite, built on the Modular Architecture for a Resilient Extensible Smallsat (MARES) bus (CuttingEdge, Winter 2020, Page 10), will gather measurements from a highly elliptical Earth orbit traditionally used as a standard transfer orbit for communications satellites heading towards geostationary orbit, about 22,000 miles from Earth.

"GTOSat will use its two onboard instruments to measure how and where these high-energy particles are accelerated," said Principal Investigator and scientist Larry Kepko, who took over from GTOSat's initial Principal Investigator Lauren Blum. The spacecraft will fly a Relativistic Electron Magnetic Spectrometer (REMS) and a boom-mounted fluxgate magnetometer.

Kepko and Co-Investigator Shri Kanekal, believe understanding these potentially dangerous particles will help develop an early-warning system for astronauts in orbit and asset managers on the ground.

Continued on page 7

Volume 17 • Issue 1 • Fall 2020

Dennis Andrucyk: Nurturing Diversity to Deliver the Future, on Schedule

Photo Credit: NASA

Goddard's newest center director, Dennis Andrucyk, has a reputation for fostering engineering excellence and workforce diversity. To him, the two are inseparable and crucial to realizing NASA's goals of exploring the universe.

"In science we don't build the same thing over and over again," Andrucyk said. "So, it's a diversity of ideas that helps make future science missions happen, and the diversity of ideas really needs to come from a diverse population of personnel in executing these directions."

Andrucyk took the helm in January 2020 after serving as deputy associate administrator for NASA's Science Mission Directorate. Before that, he was both NASA's acting chief technologist as well as Goddard's chief technologist. He also served as head of Goddard's Engineering and Technology Directorate, among other roles. Through it all, he has championed and supported NASA's diversity and inclusion efforts.

Andrucyk spoke with the CuttingEdge about how these passions informed his vision for the center, and on Goddard's role in supporting space exploration.

How is Goddard positioned to advance NASA's exploration and science goals?

Goddard is one of the biggest NASA centers, and we have a diverse set of capabilities that serve many NASA goals. If you look at the mission directorates at NASA Headquarters — Human Exploration and Operations, Science, Space Technology, and Aerospace Research — Goddard is well-positioned in three of the four; we don't do much in aeronautics.

When it comes to human exploration — that is, in Artemis and putting the first woman and the next man on the surface of the moon in 2024 and beyond — we have a significant footprint providing the communications capability. We have some heliophysics instruments going on Gateway to study space weather, which might affect astronauts. We've developed tools for servicing, and we've put scientific instruments on the International Space Station.

When I think about the science portfolio, which is truly Goddard's bread and butter, we have the largest footprint of scientists anywhere in the world. Technology is the key piece in making science happen. Goddard is very well-positioned, with its cadre of technologists, IRAD (Internal Research and Development) funding, and new capabilities supported by NASA's Space Technology Mission Directorate. We have a great portfolio that leverages the past while looking toward the future.

What trends do you see that could affect research and development at NASA?

Some of the things that we have been pursuing in the past, like optical communications, show the way. We just finished putting together the Laser Communications Relay Demonstration, and optical communications and high-data-rate communications support constellation architectures: multiple spacecraft doing single observations.

Constellations are going to be key in the future, as are autonomous systems that use machine learning to support science and mission planning and make them more cost-effective and efficient.

We're also looking at new cryogenic technologies for future space telescopes. We're seeing more and more capabilities come out of Wallops, particularly in the areas of suborbital missions that cost-effectively demonstrate technology on aircraft, sounding rockets, and balloons.

Continued on page 7

How will you support those seeking to ensure equal access and opportunities at Goddard?

For eight years before I left Goddard, I championed the African Americans Advisory Committee. It was a very rewarding experience, and one that made me a true believer in supporting other advisory councils.

Diversity in thought and ideas is what makes future science happen. We need everyone to come up with new concepts, new technologies, and new capabilities that don't come from one mindset.

More than just race and national origin, diversity includes veterans, new and early-career employees, and first-line supervisors. It means making sure everyone is included in what we do and how we do it. It's encouraging people to realize that supporting these advisory committees, and their activities, is part of our jobs. I want people to feel included. I want people to feel safe.

What new directions or initiatives do you see for Goddard?

When I came on board, I had three priorities: meeting our commitments, focusing on the future, and developing our people.

In the past, Goddard has been extremely successful at meeting our technical and scientific goals, but we haven't always focused on cost and schedule. In the smaller and mid-size missions, we've done very well; however, on the flagships, where there's a lot of new technology and new capability, schedule and cost are things we could focus on more. As we look to the future, I'd like us to be successful in all three: schedule, cost, and technical performance.

The point of focusing on the future is to be competitive in our new science capabilities and in supporting Artemis. I'm excited about our role in human spaceflight. I'm excited about being able to manage constellations more efficiently and effectively and showing interoperability in new technologies. I'm excited about competing well in new science opportunities.

And finally, it's about the people. They are at the heart of what we do. I believe we can support current employees and bring in new folks, training them for future leadership positions.

So, Goddard is a place where people can grow their careers as well as their missions?

I've been doing It for three-plus decades, and yes. ❖

Small Packages, *continued from page 5*

continued from page 5

Future Potential — Self-Calibrating Fluxgate Magnetometer

In FY19, Gaun Le, working with Zesta, won an H-TIDeS award to develop Bonalsky's magnetometer into a self-calibrating model that would correct for drift, which occurs in fluxgate instruments over time.

"We want to develop better thermal calibration and stability," Bonalsky said. "Say you want to study the external field, but the temperature changes. A fluxgate magnetometer will measure a different field because the temperature changes, but we want it to do the same work."

Le's package uses an optical-pumped, scalar magnetometer to bombard rubidium atoms, providing a fundamentally accurate reading of the absolute, background magnetic field. This can reveal any drift in the fluxgate magnetometer's accuracy.

CeREs

The Compact Radiation belt Explorer (CeREs) mission, developed by Goddard Kanekal and the Southwest Research Institute in San Antonio, developed a compact telescope to study charged particles in the Van Allen radiation belts – concentric rings of charged particles around Earth (CuttingEdge, Spring 2014, Page 8).

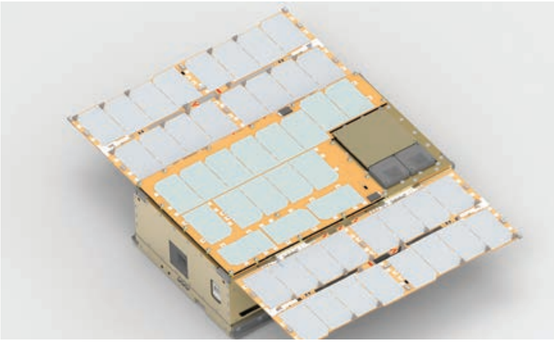


Photo Credit: NASA

This GTOSat engineering model depicts what the satellite will look like when finished.

The telescope, consisting of a stack of silicon solid-state detectors, could detect energetic electrons and protons, including short bursts of electrons that precipitate into Earth's atmosphere and from the radiation belts. The instrument performed flawlessly in testing, though the CubeSat was lost after launch due to mechanical failures. ❖

Volume 17 • Issue 1 • Fall 2020

The Art of the Leverage

Miniaturized Lidar System Advanced for Next-Generation SmallSat Remote Sensing

As wildfires raged across northern California and Oregon just weeks ago, jeopardizing air quality and human health, Goddard scientists became more convinced that their smaller, more versatile lidar system for monitoring clouds and aerosols was a much-needed capability for next-generation space missions.

The lidar system, dubbed TOMCAT, is short for the Time-varying Optical Measurements of Clouds and Aerosol Transport. It traces its heritage to larger instruments, including the Cloud-Aerosol Transport System, or CATS, which flew on the International Space Station between 2015-2018. Like CATS, TOMCAT would transmit laser light toward Earth and then use the returning signal to determine the vertical location of clouds and the miniscule particles that get lofted into the atmosphere during fires, dust storms, volcanic eruptions, and other environmental events.

TOMCAT would carry out its job using more robust technology in a smaller, less-expensive package, easily accommodated on a SmallSat platform. Such a capability would allow scientists to fly multiple TOMCAT platforms at a time, dramatically reducing the cost of these types of missions.

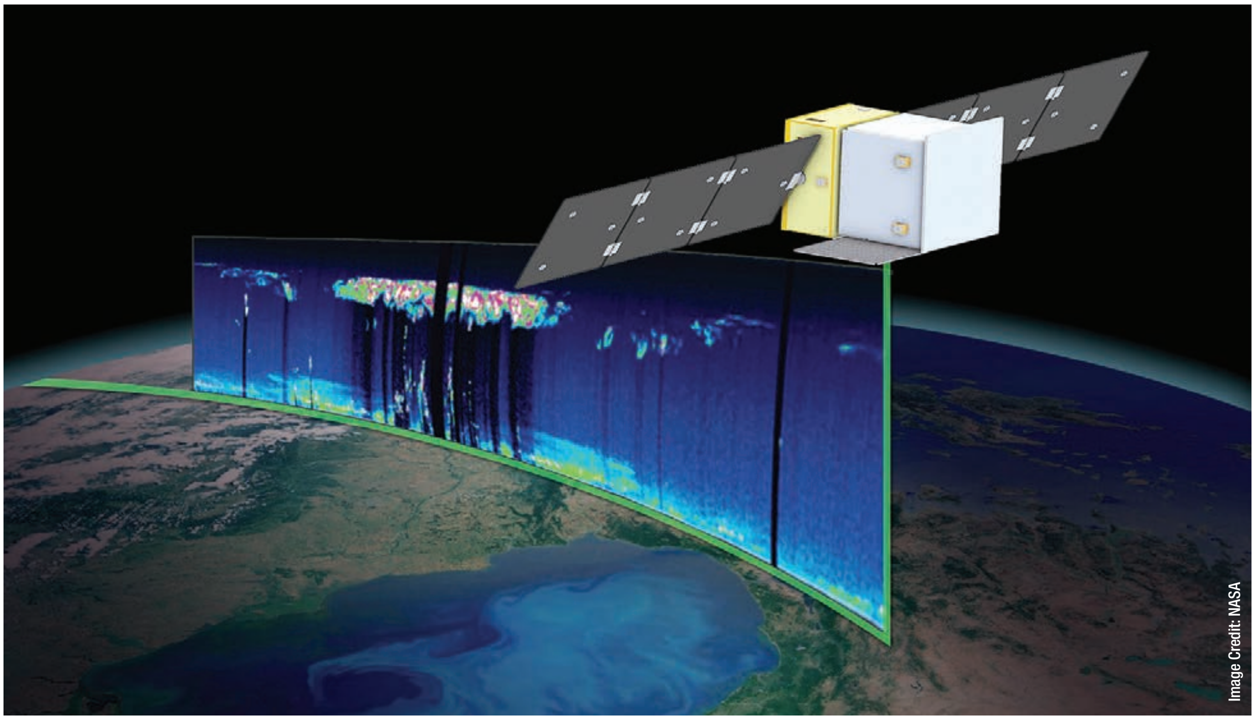
The concept, advanced with funding from Goddard's Internal Research and Development (IRAD) program and NASA's Earth Science Technology Office (ESTO), is being proposed as the base technology in an Earth Venture Mission-3 (EVM-3) proposal. It is also a viable candidate as one of the Aerosol, Clouds, Convection, Precipitation (ACCP) instruments now being formulated as part of the Earth Science Decadal mission study, said Matt McGill, the Goddard scientist responsible for the CATS instrument.

CATS, The Muse

"CATS data improved our knowledge of the Earth's air quality and climate, and TOMCAT will build on that success," said Goddard Research Scientist and TOMCAT Principal Investigator John Yorks. During its sojourn on the low-Earth-orbiting outpost, CATS transmitted more than 200 billion laser pulses toward Earth, proving that the active lidar measurement technique could be done from space (CuttingEdge, Fall 2014, Page 15).

Under the TOMCAT concept, scientists could accurately determine the location of clouds and their

Continued on page 9



The TOMCAT mission, shown here in this artist's drawing, provides a low-cost, high-TRL solution for essential cloud and air-quality profiling needs.

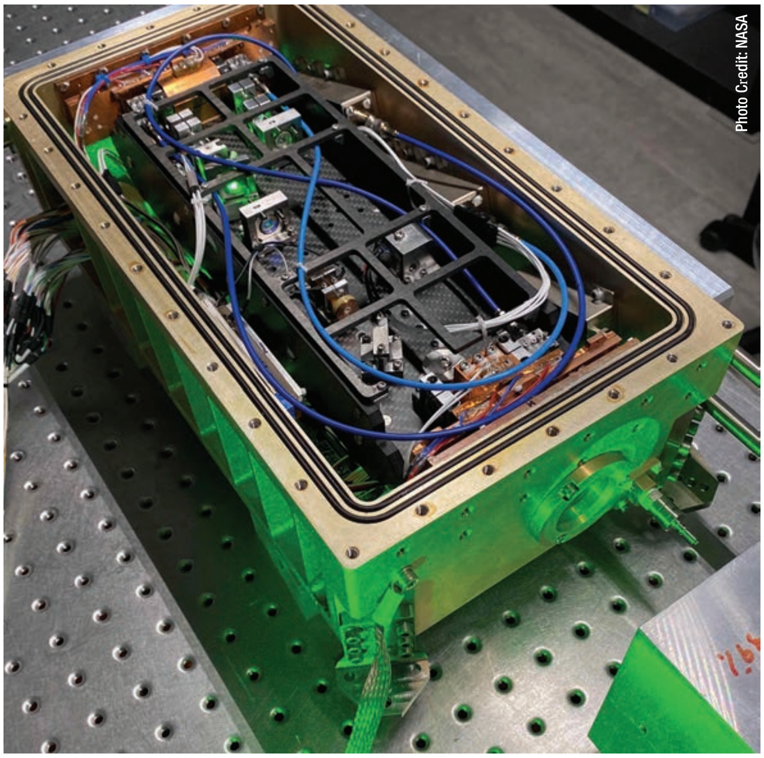


Photo Credit: NASA

Litespar, Inc., developed the TOMCAT laser, which is qualified and packaged for SmallSat use.

opacity, as well as the amount and type of particles the light encountered.

Scientists need this data to feed computer models, which help them better predict climate change, weather, and air quality. The height information — in other words, the altitude at which clouds and aerosols are located — also aids in real-time hazard detection, particularly important for the airliners traveling at stratospheric altitudes.

"We're using the data for aerosol and air-quality forecast models, but it has to be done in a more cost-effective way," Yorks said. "Going forward, we need to enable these measurements on a SmallSat platform."

And therein lies the challenge, McGill said.

The CATS instrument was not small. About the size of a refrigerator, it weighed 1,100 lbs. (500 kg.). While the TOMCAT team reused CATS's telescope, detectors, and optical design, it had to significantly reduce TOMCAT's overall size and weight, especially its laser and data system. Working in partnership with small business and using support from the IRAD and ESTO programs, the team successfully developed a smaller and lighter laser, which is ready for spaceflight. TOMCAT now weighs less than 200 pounds (90.7 kg) and measures about 35 inches (90 cm) in length, width, and depth — about the size of a small appliance.

TOMCAT Benefits

Should TOMCAT be selected for a future mission, McGill said the instrument offers several benefits, in addition to data collection.

"A technology-demonstration version of the TOMCAT instrument can be done for as little as $5 to $10 million, a Class D version for under about $20 million, and a Class C for under $40 million," McGill said. "These costs would drop as more units were built, and the costs sharply contrast with current 'BigSat' concepts that provide similar data products."

Aside from reduced costs, TOMCAT also demonstrated the value and need for mentorships, he said. "While I was the principal investigator on CATS, I was mentoring John (Yorks), who was an early-career professional at the time. John is now the principal investigator on the EVM-3 proposal. From my perspective, this is what more of our senior NASA scientists should be doing, helping develop mid-career scientists who can lead the future missions."

Yorks said he learned a lot from the experience, and envisions extending the TOMCAT concept beyond a single satellite.

"TOMCAT provides flexibility in cost and design, allowing the technology to be applicable to a variety of mission concepts," Yorks said. "The size and cost allow us to fly multiple satellites in space at the same time. This would give us wider coverage, multiple times a day. As a result, we'd be able to learn more about the evolution of clouds and aerosols than we could with a single sensor." ❖

Photo Credit: NASA

Sigma Space Corporation created TOMCAT's single-board data system.

CONTACTS

Matthew.J.McGill@nasa.gov or 301.614.6281
John.E.Yorks@nasa.gov or 301.614.6284

Building an Adaptable, Self-Driving Navigation Guidance and Control System

Increased onboard autonomy won't completely cut ground controllers out of the mission equation, but it certainly will save time and precious resources particularly for small satellites and pint-sized CubeSats operating near Earth, around the Moon, and near small bodies.

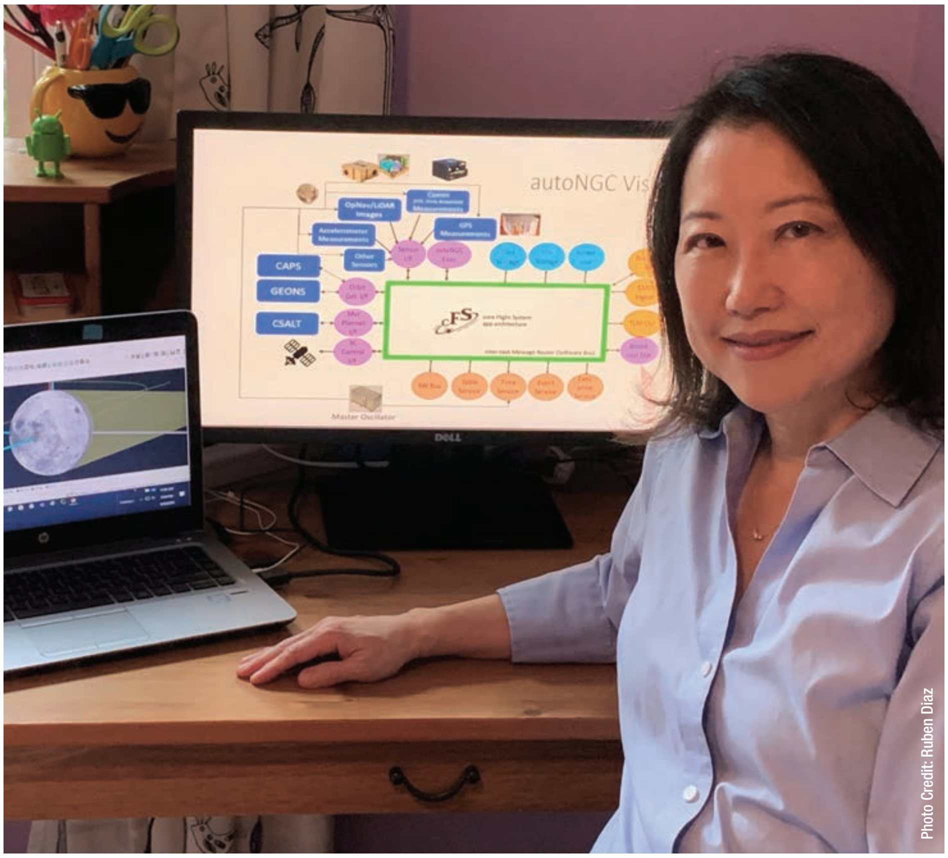


Photo Credit: Ruben Diaz

Working from her home office, Principal Investigator Sun Hur-Diaz evaluates the autoNGC architecture for use in and around the Moon.

Goddard engineer Sun Hur-Diaz is leading an R&D effort, known as autoNGC, short for autonomous navigation, guidance, and control. It integrates hardware and NGC software into a system that would support a wide range of spacecraft. Key to this system is its plug-and-play architecture compatible with the Goddard-developed core Flight System framework, or cFS. The autoNGC architecture would allow spacecraft designers to swap out sensors and software components, provided everything is cFS-compatible.

Navigation, guidance, and control are the basic functions of maneuvering a spacecraft in orbit or any vehicle, Hur-Diaz said. Navigation is knowing where the spacecraft is and planning maneuvers for it. Guidance is figuring out how to get from one place to another, and control covers the series of commands that execute those maneuvers.

The core of the system is an executive, software that directs the resources and makes everything work together, Hur-Diaz said. "It can use any application or hardware that can be adapted to work on a cFS framework; so, it is also scalable."

An adaptable autoNGC system would enable remote sensing, LunaNet communication network nodes, and distributed data-collection swarms that are the future of near-Earth space science and Artemis-era explorations of the Moon, Mars, and beyond, she said.

Leverages IRAD-Developed Technologies

Hur-Diaz and her team are building on software created for the Goddard Enhanced Onboard Navigation System (GEONS), a technology originally developed for NASA's Magnetospheric Multiscale (MMS) mission. GEONS determines the locations of MMS's four spacecraft and predicts where they will be in the future (*CuttingEdge*, Spring 2015, Page 2).

It also advances a previous Internal Research and Development (IRAD)-funded effort that demonstrated the executive function of the autoNGC platform through a laptop-based simulation. This year's IRAD goal is a closed-loop demonstration, including hardware, to advance the autoNGC concept beyond the software proof of concept.

Continued on page 11

"Earth-based ground network assets are a finite resource. With the expected increase in near-Earth, cislunar, and lunar activities, capabilities like autoNGC, which reduce that burden, will be essential to executing successful missions," said Jason Mitchell, Advanced Communications and Navigation Technology Division head for NASA's Space Communications and Navigation (SCaN) group as well as the agency systems capability leader for Communications and Navigation.

During the pandemic, autoNGC team members met virtually to continue developing their system: (From top, left to right) Sun Hur-Diaz, Victoria Wu, Sarah Dangelo, Michael Romeo, Noble Hatten, Lauren Schlenker, Steven Hughes, Sean Semper, Andrew Liounis, Samuel Price.

"The in-situ capability offered by autoNGC enables missions with rapid dynamic updates, such as rendezvous, proximity operations, and multi-craft constellations, especially for long-duration, or extended missions," said Cheryl Gramling, head of Goddard's Navigation and Mission Design Branch. "Performing these functions onboard is a game-changing enabler for the science missions Goddard and NASA are planning."

The team plans to simulate a lunar orbiter, using a board developed for the Modular Architecture for a Resilient Extensible Smallsat (MARES), a follow-on to the Goddard-developed Dellingr CubeSat (CuttingEdge, Winter 2020, Page 10). They are also developing a navigation camera for use in multiple mission scenarios, including possible lunar orbiters for the LunaNet communications network and a lunar lander.

For planning, the autoNGC will baseline the Collocation Stand-Alone Library and Toolkit (CSALT) — a general optimizer that efficiently plans orbital maneuvers for all mission phases and mission types.

"Where possible, we are trying to leverage technologies that have been developed already," Hur-Diaz said. "cFS has become the standard, and can be readily included into a variety of areas."

Turns on a Dime

Hur-Diaz is ensuring a flexible autoNGC architecture to take advantage of available components and allow for future advances in hardware and software, she said.

"We could potentially integrate a different camera, a different GPS," she said. "We're even considering a NavCube integration," she added, referring to a navigational capability that merges Navigator GPS with SpaceCube, a reconfigurable, very fast flight computer. "That's the thing about making it plug-and-play and cFS-based — we can select options that best meet mission needs."

The system will also incorporate fault-management algorithms to detect errors, isolate faults, and recover from upsets without a human controller. "It's a huge effort to bring all these things together," Hur-Diaz said. "Trying to think of everything that could go wrong is impossible, so we're prioritizing what is likely."

Targeted for 2024

The autoNGC technology is currently at a technology-readiness level of three (TRL-3), meaning it's still early in its development. To get closer to TRL-6, which means the technology could be incorporated into flight missions, Hur-Diaz and her team plan to implement the software on a flight-like processor this year.

The autoNGC team plans to be flight ready by 2024, in time for the first Artemis launches, Hur-Diaz said. To get there, she and her team have identified a possible low-budget flight test. She wants to book time on the International Space Station, specifically on the Robotic Refueling Mission-3 platform and camera, which already operates on cFS. The demonstration would allow the team to test aspects of its system in space at low cost, she said. ❖

CONTACT

Sun.H.Hur-Diaz@nasa.gov or 301.286.4259

Volume 17 • Issue 1 • Fall 2020

Goddard's Maven of Tech Passes the Torch

Photo Credit: NASA

In 16 years writing about Goddard's research and development efforts, Lori J. Keesey put faces and names with the technologies Goddard used to enable hundreds of cutting edge science missions and instruments.

Goddard Chief Technologist Peter Hughes, who assumed his role around the same time Keesey started, called her "an indispensable partner in both the planning and execution of our communications priorities."

Hughes credited her with identifying and communicating strategic technology trends and successes, and spreading the word about the return on Goddard's tech investments.

"She really increased awareness of Goddard's technology program," Hughes said. "She made it clear how CuttingEdge is an essential element for explaining these achievements as well as focusing on where we want to be down the road."

Taking the helm of the Tech Trends publication, Keesey ushered in a more-graphical, image-centered format. In 2011, she rebranded, establishing the CuttingEdge name and design.

Keesey combined excellent writing skills with insight in science and technology, said heliophysics Line of Business Lead Nikolaos Paschalidis. "She possessed critical thinking and interdisciplinary knowledge in a variety of space related topics. She was able to evaluate, understand and capture the essence of innovations and convey a clear-cut story. It was a pleasure working with her."

Many Goddard scientists and technologists came to know Keesey as a keen, witty and sharp communicator with an ear for a good story.

"She was always wonderful to talk with or be interviewed by," said Bill Cutlip, retired Earth Sciences Line of Business manager. "Her enthusiasm for all things technical was always at 11."

Earth scientist Matt McGill said he appreciated her wit and tenacity.

"She was always very personable," he said. "At least for me, she knew how to take it all in, get to the important bits and cast it in just the right way to connect with the general populace."

Keesey had a knack for finding just the right turn of phrase, McGill said. "She brought energy and enthusiasm and positivity. I'm really going to miss her." ❖

Cutting edge Goddard's Emerging Technologies

CuttingEdge is published quarterly by the Office of the Chief Technologist at NASA's Goddard Space Flight Center in Greenbelt, Maryland. The publication describes the emerging, potentially transformative technologies that Goddard is pursuing to help NASA achieve its missions. For more information about Goddard technology, visit the website listed below or contact Chief Technologist Peter Hughes, Peter.M.Hughes@nasa.gov. If you wish to be placed on the publication's distribution list, contact Editor Karl Hille, Karl.B.Hille@nasa.gov. Contributors to this issue: Madison Arnold and Lori Keesey.

Publication Number: NP-2020-9-593-GSFC