FEBRUARY 2024





INSIDE THIS ISSUE

- Technology Transfer Inventor of the Month
- When Should You File an NTR?
- Farewell to Joe Famiglietti



NP-2024-1-216-GSFC

YEAR OF THE DRAGON 2024

Dr. Berhanu Bulcha, research engineer at NASA Goddard in development of a new technology. Photo Credit: N4 Solutions





Byte Sized Talks Wednesday February 14, 2024 12:00 PM - 1:00 PM

Join us in the building 21 cafeteria for a refreshing twist on the traditional lunch-and-learn format!

This month's Tech Transfer Tip with Senior Technical Writer Doug Scott

Ensuring the success of every NASA mission goes down to the last detail. That is what drives innovation throughout Goddard. Whether that's transporting astronauts to and from the International Space Station or launching a satellite into orbit around Mars. SPO brings Goddard-developed technologies down to Earth by helping innovators get their innovation out of the lab and into the hands of companies that can commercialize them. Will the next innovation be yours?





Image Credit: N4 Solutions

Return on Investment

This is the first of a monthly series highlighting Goddard technologies, which inventors filed a New Technology Report (NTR) that the Strategic Partnership Office (SPO) believes have commercial potential. These are also innovations, whose patent application was recently sent to the United States Patent and Trademark Office for consideration.

nceladus, an icy moon of Saturn, contains many building blocks needed to support life, including water, carbon dioxide, methane, ammonia, and hydrogen gas. Data collected from NASA's Cassini spacecraft of the water-vapor plumes in the south-polar region of the moon has only recently detected evidence of hydrogen cyanide, a gas that plays a key role in the development of life.

"It's the starting point for most theories on the origin of life," Jonah Peter, a biophysicist at Harvard University and one of the authors of the study, Detection of HCN (hydrogen cyanide) and diverse redox chemistry in the plume of Enceladus, recently told the New York Times. "It's sort of the Swiss Army knife of prebiotic chemistry."



Dr. Berhanu Bulcha in the lab holding the newly developed Far-Infrared Imaging Receiver (Fl_vIR). Photo Credit: N4 Solutions

Cassini flew by Enceladus, and during observations of the icy moon, instruments on board recorded the presence of icy jets and towering plumes from the surface, ejecting large quantities of particles. Within those plumes scientists have also recently detected evidence of several other organic compounds, including acetylene, propene and ethane, which also signal the moon's potential to support life. However, much more precise information is needed of the molecules in these icy jets and towering plumes to fully understand if Enceladus does indeed support some form of life in the saltwater ocean that lies beneath its icy surface.

To capture that data, Dr. Berhanu Bulcha, a research engineer in the Microwave Instruments and Technology Branch (Code 550) at NASA Goddard, has a developed the Far-Infrared Imaging Receiver (FI_KIR), a powerful Heterodyne-based submillimeter-wave imaging spectrometer array. This remote sensing tool can be attached to a space telescope's antenna to accurately detect the physics and chemistry contained within icy jets and towering plumes from a planet or a moon.

continued on page 3

_ 2 _

continued from page 2

A spectrometer is a device that provides scientists with an "image" or radio frequency signature of the organic materials of an object far out in space. What makes FI_KIR unique is, that unlike presently used spectrometers that only use one pixel for imaging, this one has eight pixels to increase its sensitivity to detect organic compounds or gases in the moon's clouds or plumes.

"Each tiny molecule from a plume is like a fingerprint that gives us a unique signature," explained Bulcha. "For example, water has its own signature, ammonia has its own signature, and methane has its own signature, etc. The way this works is the atoms in these materials actually



The Far-Infrared Imaging Receiver (FI_KIR), developed by Dr. Berhanu Bulcha. Photo Credit: N4 Solutions

vibrate and those vibrations emit energy, and we see that energy as a signature. Also, a single pixel on a spectrometer only gets to see one portion of the plume, but with the eight pixels on our spectrometer, we get to see the entire plume."

The other thing that makes this imaging spectrometer unique is its small size and weight, comparable to a candy bar. Because it does not use motors or mechanisms to operate – it is just attached to an antenna on a spacecraft – it uses very little power. That means Fl_kIR can be deployed on something as small as a SmallSat or CubeSat.

Ultimately, this Heterodyne-based submillimeter-wave imaging spectrometer is designed to be used not just for discovering the properties of moons or planets in our solar system. FI_KIR also can be used to answer fundamental questions about molecular clouds and properties anyplace in the galaxy to help scientists understand their direct relation to star and planet formation. Bulcha believes this spectrometer can potentially be used on projects such as NASA's Pandora mission, which is designed to find exoplanets that contain life in the far reaches of space.

Also unique to this spectrometer is its compact, wideband, multi-pixel receiver that can collect signature information in the 530-600 GHz (Gigahertz) radio frequency range. That frequency provides the highest and best-known efficiency range for seeing signatures with any submillimeter telescope. Bulcha believes that because of its operational frequency and the fact that the spectrometer design contains a novel receiver array, private industry will be very interested in this technology for many different commercial applications.

"There are several components – up to 40 – that go inside of this, and the majority of its subsystems are unique," said Bulcha of the technology that was funded through an Independent Research and Development (IRAD) grant. "As a total system there is potential for commercial use, but the individual subsystems in the design also could potentially be used for many kinds of commercial uses. In fact, SPO already concluded a non-exclusive license agreement for parts of the internal design with a private firm."

The spectrometer is now in Technology Readiness Level 4, which means it has been tested and proven to work in the lab. Next, it is scheduled for environmental and in-flight testing, which will make it ready for a full technology demonstration in Level 5 or 6. Bulcha is now writing a proposal for NASA's Maturation of Instruments for Solar System Exploration (MatISSE) Program, which will allow him to integrate the technology into an inflatable antenna that will transmit all the data captured from the spectrometer. The goal of MatISSE according to the program is to "develop and demonstrate planetary and astrobiology science instruments to the point where they may be proposed in response to future announcements of flight opportunity without additional extensive technology development."

"We want to mature this technology for space exploration but presently there are no NASA missions ready [to include this in] right now," said Bulcha of the innovation that he has been working on since 2019. "That is the ultimate mission for this spectrometer beyond Enceladus, to find exoplanets in our entire galaxy and I am convinced this technology will achieve that. That is the return-on-investment IRAD made with this technology."

_ 3 _



When Should You File an NTR?

Your mission milestones have deadlines, but what is your deadline for completing your New Technology Report (NTR)? As with many things in life, the answer depends on many factors. If you are working to develop a new technology and wondering when it's time to go to e-NTR and fill out a report with the Strategic Partnership Office (SPO), you should stop and ask yourself three questions.

Do You Have an Idea?

Josh Levine, a technology manager at SPO believes any idea is worth submitting an NTR, even preliminary concepts or improvements on previous inventions. "Your idea does not have to be groundbreaking or revolutionary, although we welcome that too," said Levine. "Sometimes we will ask the innovator to send an NTR at various stages of its implementation. Keep in mind, sometimes an idea that begins with no commercial application might evolve into an invention with potential use in private industry." If you are ever in doubt, Levine says you should feel free to contact your technology manager. (You can find the manager assigned to your code in the list below). They can walk you through your specific case and advise you based on your unique circumstances.

Do you Intend to do Research or Pursue Your Idea?

Does SPO really mean any idea should be submitted for an NTR? "Think of it this way, if you take your idea beyond its conceptual stage and develop it further, then it warrants an NTR," said Manohar Deshpande, a technology manager at SPO. "It's OK if your idea does not yet have funding or if you don't have all the details worked out." Deshpande believes that if you plan to pursue your idea, you should file an NTR. "Don't worry too much about whether or not your invention has potential or can be patented," added Hossin Abdeldayem, who is also a technology manager at SPO. Those determinations are typically made by technology mangers like Levine, Deshpande, or Abdeldayem. When you fill out your NTR, you are encouraged to include commercialization ideas or relevant industries that may be interested in your idea.

- 4 -

continued from page 4

Are you Planning to Submit a Paper or Present at a Conference?

The moment you publicly disclose the details of your innovation, a countdown clock begins. To protect your idea, Goddard's Office of General Council (OGC) must file a patent application within a year of your disclosure. "That is why it is always better to submit your NTR prior to presenting your invention in a public setting," said Matt Johnston, the chief patent council at OGC. "That way, SPO and our office can evaluate your idea for patentability and commercial potential before you set the clock ticking." Johnston advises that, if you are planning to submit a paper or present at a conference, to please contact one of the technology managers at SPO and go over the details of your situation. SPO can also help you fill out and submit your NTR.

Contact Your Technology Manager Today

If you have questions about submitting an NTR, reach out to your technology manager.



Hossin Abdeldayem hossin.a.abdeldayem@nasa.gov

Codes: 400, 410, 440, 460, 490, 551, 554, 596-599, 660



Manohar Deshpande manohar.d.deshpande@nasa.gov Codes: 470, 550-553, 555, 610



Josh Levine joshua.h.levine@nasa.gov

Codes: 450, 480, 551, 540, 560, 590-595, 690



Viva Miller viva.l.miller@nasa.gov Codes: 800



Dennis Small <u>dennis.a.small@nasa.gov</u> Codes: 100, 200, 300, 420, 580, 600, 603-606, 700

To learn more about the **Strategic Partnerships Office**, please visit <u>https://partnerships.gsfc.nasa.gov</u>.





_ 5 _

Never Can Say Goodbye

Joe Famiglietti, Longtime Goddard and SPO Employee Retires

t is sometimes hard to say goodbye to old friends. On December 31, Joe Famiglietti, who has been a fixture at NASA Goddard since June 1990, when he joined the center as an instrument engineer, retired. Famiglietti spent his entire 33-year NASA career at Goddard, serving as Goddard's Center Lead for the NASA SBIR/ STTR (Small Business Innovation Research/Small Business Technology Transfer) program since June 2016. He would have it no other way.

"I think what has made my career at Goddard so worthwhile and such a positive experience was because of all the great relationships I made along the way," said Famiglietti, who throughout his time at Goddard had collaborated with engineers and scientists in almost every division. "If you have fun with what you do and you have fun with the people you are with, that is what made it such an enjoyable and rewarding career. It really was a hard decision to retire."



GSFC Lead for the SBIR/STTR Program, Joe Famiglietti. Photo Credit: Samantha Kilgore

"I will definitely miss him," said Darryl Michell, chief of the Strategic Partnership Office (SPO), who Famiglietti worked under as NASA SBIR/STTR Goddard Center Lead. "I worked on and off with Joe over the past 26-27 years, and he very much espoused the idea of doing what's needed to get the job done but having fun while you are doing it. It was a great relief as a supervisor to never have to worry about the quality of work that came out of Joe. He had a sense of humor but, more importantly, he had the confidence in his job and his position that he could make it fun at the same time."

NASA's SBIR/STTR programs fund the research, development, and demonstration of innovative technologies that fulfill NASA needs as described in its annual solicitations. These technologies are often deemed to have significant potential for successful commercialization. The goals of NASA's SBIR/STTR programs are to stimulate technological innovation and to meet federal research and development needs. They also increase private sector commercialization of innovations developed through federal research and development funding.

"Joe was the senior center technology liaison for SBIR/STTR, so he basically organized and implemented the program for Goddard," said Mitchell. "He made sure all the proposals coming in for Goddard were reviewed by the right people and had multiple reviewers. He made sure all the SBIR/STTR proposals represented all the program's topics and subtopics to ensure they were meeting the needs of all of NASA's missions in the future. Joe was great at looking after Goddard's interests in that respect."

Famiglietti came to NASA Goddard after serving in the U.S. Navy in the mid-1980's as an electronics technician and reactor operator aboard the Los Angeles Class nuclear submarine USS Honolulu. Stationed in Hawaii, his tour of duty took him to Japan, Guam, the Philippines, and Micronesia. After leaving the Navy he enrolled in George Mason University and hoped to pursue the same career path of his father-in law, as an accountant.

"I always liked math and science," he recalled. "I started my college career in accounting but after the first six months I said, 'this is not for me,' and that is when I changed my major to physics. Once I figured accounting was not for me, you can say my Navy career inspired me to pursue physics."

- 6 -

continued from page 6

While at George Mason, he applied to the co-op programs with the United States Naval Research Laboratory, NASA Goddard, and the NASA Johnson Space Flight Center. A co-op is a special type of internship, wherein a student typically alternates semesters between full-time work and full-time study before graduation. While receiving offers from all three, Famiglietti chose Goddard because it was not only close to his home in northern Virginia but because, he said, "they liked my ability to learn, and the skills, and discipline I acquired in the Navy."

After starting his NASA career as an instrument engineer in 1990 in the Earth Science Division, Famiglietti became introduced to the SBIR/STTR program a few years later, first as a proposal reviewer and then a co-lead subtopic manager. One of his favorite memories of working with the Earth Science Division was managing a "hitchhiker payload" on the Technology Applications and Science (TAS-01) Experiment Module on the Space Shuttle Discovery (STS-85) in 1997.

Following the success of this mission, Famiglietti went to work as a technology manager with Mitchell for what became SPO. "My transition into the technology transfer office afforded me the opportunity to work with the broad array of excellent scientists and engineers across Goddard," he said.

Later, while serving as the Earth Science Technology Office's (ESTO) Advanced Component Technology Program Manager for nearly a decade, Famiglietti was approached to serve as Goddard's SBIR/STTR Center Lead in 2016. "I didn't hesitate at the opportunity for another chance to work with the broader Goddard technical community," he said. "Who knew I'd become close to all the engineers and scientists that I interacted with along the way and very much enjoyed working with. Goddard has been a great place to work all these decades, enabling me to have a host of opportunities during my career."

Now that he has retired, Famiglietti plans to travel throughout the United States to places like Mount Rushmore and Yellowstone National Park with his wife Mary. He also hopes to attend baseball games in all 30 major league stadiums. Along the way, he plans to dine at as many of the 2,988 Chick-fil-A restaurants across the U.S. as possible. "It's a tall order," he said, "But somebody has to do it."

"I did not change jobs at Goddard because I did not like them," he said. "It was more like I was growing as an engineer and taking on positions of higher levels of responsibility, from instrument engineer, payload manager, tech manager in tech transfer, program manager in ESTO, to becoming Center Lead for SBIR/ STTR. It was more of an awareness ladder if you will. It was a good journey, and I will miss everybody. However, I am a bit jealous that I will no longer get to work on all the great technologies moving forward."



Joe Famiglietti. Photo Credit: SPO

Advice for Young Engineers After over 30 years, Joe Famiglietti is retiring from Goddard. Here is some advice he has to offer for young engineers, scientists, and interns.

"To a young engineers and scientists, I would like say, don't pigeonhole yourself, don't become just a lab rat," Famiglietti recommends. "Obviously, you have expertise and are a subject matter expert at something. So, broaden your horizon, reach out to different people or groups at Goddard. Do things like support SBIR/STTR (Small Business Innovation Research/Small Business Technology Transfer) and become a reviewer. Doing so you get to learn about new technologies that are out there that you may not know anything about. And don't just stay in science and engineering, go into project management to broaden your horizon, do things like that."