National Aeronautics and
Space Administration

Kennedy Space Center

Technology Transfer News

KSC Innovators
Front row l-r Angie Diaz, Jonathan Gleeson, Krystal Acosta, Austin Atkins
BacK row l-r Evan Bell, Aaron Curry, Jason Fischer, Kenneth Engeling, Jerry Wang

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NASA/Cory Huston/Ben Smegelsky

Early-Career Innovators

At NASA's Kennedy Space Center, the following early-career innovators are making significant strides with their groundbreaking inventions. These talented individuals are pushing the boundaries of space technology and have been engaged with the KSC Tech transfer office via the submission of their "New Technology Reports" (NTRs). Their innovative solutions are not only enhancing current space missions but also paving the way for future use outside of NASA through the efforts of the Tech Transfer Office. By fostering a culture of creativity and technical excellence, NASA is ensuring that our innovators remain at the forefront of technological advancement.

KRYSTAL ACOSTA is a Physicist in the Electrostatics and Surface Physics Lab (ESPL) and Swamp Works. She is also the Dielectric Materials and Thermal Dust Mitigation Lead. She received her BS in aerospace engineering, with minors in materials science and astronomy, from the University of Florida, and continued on to obtain an MS and PhD in aerospace engineering from the University of Michigan. Krystal wanted to work for NASA because she wants to help make interstellar travel possible and be able to go out into space and discover new planets and solar systems like in Star Trek, and NASA is the best place to work toward making this a reality. She had a fellowship at Langley Research Center during grad school, and has worked in the ESPL since completing her degrees.

Krystal is currently the Concept of Operations lead for a payload on a Commercial Lunar Payload Service (CLPS) mission to the moon to demonstrate Electrodynamic Dust Shield (EDS) technology. EDS technology was developed to remove dust from surfaces using high electric fields; the demonstration in this CLPS mission will give NASA confidence that the technology will work as expected on future missions. Krystal also works on other EDS-related projects, including the Vertical Solar Array Technology (VSAT) project with Astrobotics, the development of EDSs with nanometer-thick coatings that can be used on thermal radiators without impacting their performance, and the application of EDSs to a gasket for the Human Landing System (HLS) to prevent hatch seals from leaking due to dust. She is also part of a project for a Lunar gravity flight with Blue Origin New Shepard, which plans to loft dust using an ultraviolet source in vacuum under Lunar gravity to mimic some phenomena that were observed on the Moon.

Her favorite NASA memory is when she went inside the SLS main engine section to perform electrostatics measurements to ensure everything was grounded properly. She recalls that seeing everything up close, the size of the rocket, and being in something that was going to go into space was surreal. In her free time outside of work, Krystal enjoys playing games, doing arts and crafts, reading, and going for walks.

AUSTIN ATKINS is an interdisciplinary R&D scientist in the Applied Physics Lab (APL) and the Granular Mechanics and Regolith Operations (GMRO) lab. He has a BS in physics with a minor in electrical engineering and an MS in physics from the University of New Hampshire. Austin has been interested in spaceflight technologies since he was young and has self-taught experience as a computer technician, electronics technician, and automotive technician, as well as custom fabrication experience. These experiences, as well as his formal education in physics, gave him a unique skill set that he was able to utilize to obtain his current position at KSC.

He and his team are currently working on four core projects, three in the GMRO and one in the APL. For the GMRO they are developing a millimeter wave Doppler radar to measure the velocity of plume ejecta that may fly on a lunar lander in the near future. They are also developing a laser-based dust concentration monitor and studying the gas permeability of lunar regolith simulant under vacuum to assist computational modeling efforts for upcoming plume surface interactions (PSI) tests. For the APL, they are developing a capacitance-based tank gauging technology to accurately measure how much fuel or oxidizer is remaining in a spacecraft's tank in zero g.

There isn't one particular project that he would call his favorite, as each project brings its own set of interesting challenges and opportunities. His favorite memories are the ones where developing rapid, clever solutions to unforeseen

problems helps advance his work and leads to new technology reports. In his free time, Austin has started a small business designing physics education kits to help students learn STEM topics and ease the workload for teachers.

EVAN BELL is an AST Mechanical Experimental Equipment for the Advanced Engineering Development Branch, and works mostly with the Granular Mechanics and Regolith Operations (GMRO) Swamp Works lab. His interest in science was sparked by his grandfather and his mother. As a child, Evan wanted to be a mad scientist and produce his own inventions and robots from scrap parts; his parents often found him creating something or nearly setting the house on fire. He decided to pursue mechanical engineering to learn as many different fields of design engineering as possible, and obtained a master's degree in mechanical engineering with a focus in robotic systems from Embry Riddle Aeronautical University. Evan began his NASA career as a Pathways intern with LX before transitioning to a full-time position in the EGS engineer group NE-XD. He has worked on many projects including the vehicle stabilizer system, OSCAR, GaLORE, additive construction using polymers and regolith, and cryo-vacuum systems, among others.

Evan is currently the PI for the Modular Interface for CLPS Excavators (MICE) project, and a lead mechanical designer for the Molten Regolith Electrolysis (MRE) GCD and Additive Construction Twin Screw Extruder (ACTSE) projects. He also worked on the Relevant Environment Additive Construction Technology (REACT) project, which produced a scale lunar habitat under cryogenic vacuum conditions using a mixture of PLA polymer and lunar regolith simulant.

His favorite project that he has worked on is the REACT project, since it combined all his interests at KSC and was a completely new and exciting technology. Other favorite memories from his time at KSC include running The Pink Team, a high school robotics team on center, and seeing the Artemis launch. Outside of work, he enjoys 3D printing, car restoration, Star Trek TNG, camping, backpacking, and cycling. He has done multiple backpacking trips in Washington, Tennessee, and Colorado, and traveled to New Zealand with other NASA engineers to bike 200 miles in six days!

AARON CURRY is a Scientist on the LASSO II contract, and works in both the microbiology lab and the Microgravity Simulation Support Facility (MSSF). He has a BS in molecular and microbiology, along with a minor in chemistry, from the University of Central Florida, and an MS in medical sciences from the University of South Florida. With a background in food safety, Aaron never thought he would work for NASA, as he had always assumed it was mostly engineers working on hardware for spaceflight. He was surprised when he learned that are opportunities for someone with his skillset and expertise at NASA, and was excited to join the team!

His work at KSC involves providing safe and sustainable food for the crew of the International Space Station (ISS) and future missions. Currently, he is trying to expand the capabilities of a seed film technology to allow the crew to plant crops on demand to fit their dietary needs. He is also hoping to work on methods for post-harvest produce sanitization, since the current methods are not ideal for the crew.

Aaron's favorite project was Veg-03J, which used the seed film technology to encapsulate Red Romaine 'Outredgeous' Lettuce seeds and allowed the ISS crew to accomplish the first live planting of crops in flight. He also enjoyed his work with PH-04 peppers, which was a good learning experience for how to handle difficulties that may arise during a flight scenario in the future. In his free time, Aaron coaches his son's Little League baseball team and tinkers with CAD modeling and 3D printing at home. He also enjoys doing puzzles and playing board games with his family.

ANGIE DIAZ is a Scientist for the LASSO II contract, and works mainly in the microbiology and water chemistry labs. She has a BS in molecular biology and microbiology and an MS in nanotechnology from the University of Central Florida. When Angie completed her MS, she knew she wanted to use her experience to work at NASA because space research fascinates her. She was excited when she learned of the opening for her current position, and has been with NASA for over five years now!

Currently, Angie's main project is the development of a silver foam meant to disinfect potable water. She also studies biomass growth to support a model of microbial growth in certain areas of the ISS water processing assembly, and has worked on lunar soil enrichment for plant growth with microbes. She has also provided support for the lunar electrostatic dust removal tool and the making of pretreatment for the ISS water recovery system and performance testing of a Spacesuit Water Membrane Evaporator tested with microbial growth.

Her favorite NASA memory is the first time she was in the microbiology lab and things started rattling around due to a launch, and realizing how powerful the launches are. She also loves that she can walk outside for a few minutes during a workday to watch a launch, and says it is an amazing experience that never gets old. When asked about her favorite project, Angie joked that it is whichever one decides to behave at the time, and that they're all fun in different ways. Outside of work, she likes to explore new places and interactive art, and often looks for interesting art installations and experiences.

KENNETH ENGELING is a Research Aerospace Science Technologist in the Applied Chemistry Lab at KSC. He received a PhD in Nuclear Engineering and Radiological Science from the University of Michigan, where his research was focused on plasma physics and plasma chemistry. Kenneth joined NASA because he wanted to be part of the discovery and development of new technologies, such as the low temperature plasma chemical processing he has worked on, that may one day have a substantial impact on space and terrestrial sustainability.

Kenneth has been involved in many projects at KSC that utilize plasma technology for different applications. He has worked on plasma activation of water for nutrient recovery, nitrogen fixation, and sterilization; hydrogen plasma reduction of lunar regolith for oxygen extraction; and plasma abatement of volatile organic compounds. He has also been part of the development of molten regolith electrolysis and trash-to-gas technologies. In addition to these projects, he is also involved in another exciting development that will be publicly announced soon!

When asked about his favorite project, Kenneth responded that all his projects become favorites because they're all unique and provide new insights for space sustainability and life support. However, he also mentioned that some current ongoing work is the most exciting. His favorite part of working at KSC is the opportunity to watch a rocket launch with his morning cup of coffee. When he's not working, Kenneth enjoys being outside in nature by hiking, going for walks, and visiting local events.

JASON FISCHER is a Research Scientist on the LASSO II contract. He supports the plant, microbiology, and molecular biology labs with various projects and testing, and also supports research in the chemistry lab on ISRU approaches to turn trash into value-added products and on plasma technologies for ECLSS optimization. He has a BS in molecular and microbiology from the University of Central Florida and an MS in biotechnology from the University of Maryland. When asked why he wanted to work at NASA, Jason responded "Who doesn't want to work at NASA?". He explained that he grew up watching shuttle launches on Merritt Island, and has always wanted a career with NASA due to the prestige of the agency and the awe of the work done.

He currently has two main projects that he is working on. The first is a bioregenerative water purification project, which involves a complex purification system with two bioreactors that help process, break down, and convert high-strength wastes into usable products such as plant fertilizer solutions. The second project involves biomanufacturing in space, and uses a fermentation membrane bioreactor that is fed alternative feedstocks to produce biomanufactured value added products. In addition to these projects, he also mixes and certifies the urine pretreatment solution and silver water that is used on the ISS.

One of Jason's favorite projects he has worked on is the bioregenerative water purification project. He also works on multiple plasma-related projects for ISRU applications which are really interesting. In addition to these projects, he also previously worked on a flight project called TICTOC, and had the opportunity to speak with the astronauts that would be carrying out the experiment on the ISS, which was an amazing experience. Outside of work, Jason enjoys rock climbing, but mentions that as Florida is "vertically challenged" he usually visits indoor climbing gyms. He also enjoys playing the guitar and video games.

JONATHAN GLEESON is an Engineer on the LASSO II contract, and provides engineering support to the Microgravity Simulation Support Facility (MSSF), Laboratory for Applied & Integrated Research (LAIR), and the Granular Mechanics & Regolith Operations (GMRO) lab, including the Electrostatics and Physics lab (ESPL) and Swamp Works. He has a bachelor's degree in aerospace engineering from the Florida Institute of Technology. Jonathan has always loved sci-fi, including Star Trek and Star Wars, which got him interested in real-life space exploration. He knew he wanted to work at KSC, so he decided to attend a university in Florida in the hopes of making connections and finding a job there after graduation. He started at KSC as a Quality Engineering intern, and was quickly brought on full-time to LASSO.

Jonathan is currently supporting the build of the Engineering Development Unit for Ohalo III, which is a payload for demonstrating food crop production technology in microgravity. He is also working on the Vertical Lunar Regolith Conveyor (VLRC) and Electrostatic Dust Lofting (EDL) projects, which will both launch aboard Blue Origin's New Shepard to test regolith physics under simulated lunar gravity. Finally, he supports the MSSF in a variety of engineering tasks including rapid prototyping, Prototype Verification System (PVS) documentation, CAD modeling, and assisting visiting researchers who need engineering designs and 3D printed hardware for their experiments.

His favorite memories are from the Orbital Syngas Commodity Augmentation Reactor (OSCAR) project, which was the second LASSO project he worked on. The young, multidisciplinary team for this Early Career Initiative project was fantastic to work with and learn from, and the project led to a lot of unique and interesting experiences for a new engineer, such as drop-tower testing at Glenn Research Center and seeing the product fly on two suborbital flights aboard Blue Origin's New Shepard. Outside of work, Jonathan likes to play videogames, boardgames, and Dungeons & Dragons with his friends and family.

JERRY WANG is the Lead Electrostatics Experimentation & Optical Dust Mitigation in the Electrostatics and Surface Physics Laboratory, or just "researcher" as he says. He has a BS and an MS in Aerospace Engineering, and has worked at NASA since 2016. He started as a Pathways intern, and has continued to work in the same lab since then. Jerry began working at NASA because he wants to help ensure that the US maintains their advantage in the space sector.

Jerry has worked on a wide variety of projects, such as p-static Electromagnetic Interference (EMI) experimentation, triboelectrification of Exploration Extravehicular Motor Unit (xEMU) material in vacuum, and the electrostatic precipitator for Mars and stratosphere dust collection. He has also been involved in the Lunar Electrostatic Discharge (ESD) and Dust Mitigation Tool (LEDM) project, where a tool was developed that astronauts can use to clean dust off of EVA suits and eliminate static discharge. Jerry also participated in the Electrodynamic Dust Shield (EDS) project for solar cells and camera covers, and the characterization and experimentation of dust lofting for Volatiles Investigating Polar Exploration Rover (VIPER), ISRU Pilot Excavator (IPEX), and Human Landing System (HLS). Lastly, Jerry also worked on the modeling and experimentation of spacecraft charging and polarization effects during docking maneuvers.

Out of all those projects, Jerry's favorite is the p-static EMI experimentation. The test setup for this project was unique, and not many people have done it before. Outside of work, Jerry likes to go to the gym, claiming that for him "it's basically therapy."

YOUR IDEAS MATTER

The ideas and innovations that you develop can have a profound effect on the global community. You can report new your inventions by submitting a New Technology Report to the Technology Transfer Office (https://invention.nasa.gov). These new technologies may be transferred to entrepreneurs, industry or academia, where they will produce commercial products and services that will have a substantive economic benefit as well as a technological advancement.

If you have an idea or innovation and want to submit a New Technology Report, we are here to help. For further information contact one of our New Technology Representatives or stop by the Technology Transfer Office in Room 3054 of the Space Station Processing Facility (SSPF).

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SLOT: Structured Light Optimizing Tool for Window Inspections

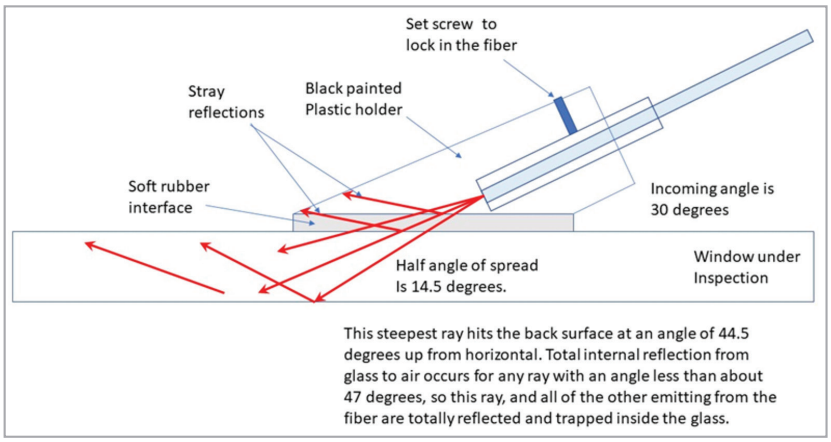
During the Space Shuttle program, a small but impactful tool was developed to enhance the inspection of Orbiter windows. This device, known as the Structured Light Optimizing Tool (SLOT), used total internal reflection to make small defects on the windows visible, like stars against a dark background. Initially, a drop of water was required to couple light between the SLOT and the window, and the device relied on relatively poor suction cups for attachment. An upgraded version improved on these aspects by incorporating a syringe for water application and better suction cups with a hand pump.

More recently, Orion window inspectors sought to use the SLOT for inspecting windows on the Orion vehicle at the launch pad. They needed the SLOT to be portable, battery-operated, compliant with Class I Div II safety requirements, and capable of coupling more light into the windows.

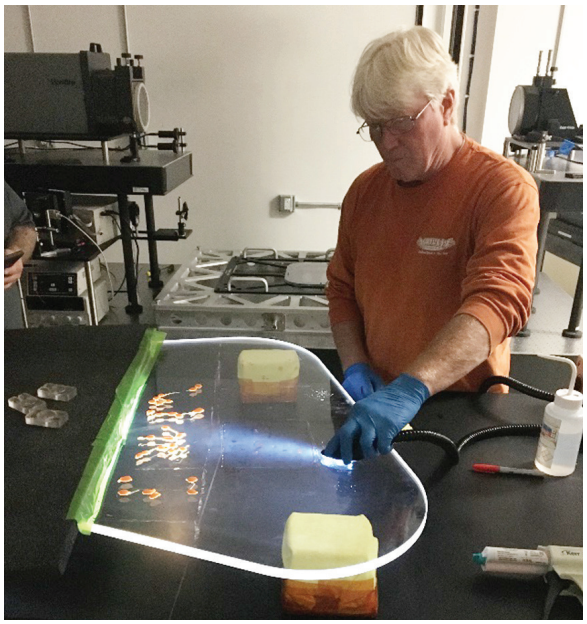
An attempt to create a battery-operated SLOT using bright white LEDs ultimately failed due to approval issues for Class I Div II locations. The solution was to use an AC-powered light source positioned away from the vehicle, with light delivered via a 20-foot fiber optic bundle. This setup proved successful and received high praise from the inspectors.

Key to the SLOT's functionality is its optical head, designed to couple light into a window at an angle that ensures total internal reflection. This component was meticulously crafted from optically clear acrylic, with careful attention to the angles and materials used to optimize light transmission. The optical head's design prevents light from escaping or causing distractions, ensuring efficient and effective window inspections. The SLOT system, with these enhancements, continues to be a valuable tool for maintaining the integrity of spacecraft windows.

The delivered SLOT using a 20-foot length of multimode fiber and remote light supply.



A sketch of the SLOT system head showing the path of the light emerging from the fiber bundle.



The new SLOT being used by an Orion window inspector to couple light into windows.

Sharing Software

The Software Release Process

NASA employees and contractors develop a variety of software each year, and it is shared as much as possible among NASA centers, with other government agencies, and with the public. However, some software contains sensitive information and has limitations on who it can be shared with. To ensure that software is only shared with the appropriate parties, developers must follow a specific process for the release of their software. Although each software release is unique, they all generally involve legal, export control, IT security, 508 compliance, and software engineering considerations.

There are three main categories for software release: Government Purpose, General Purpose, and Open Source. The categories vary in how restrictive the release is in terms of who can access the software. Government Purpose releases are the most restrictive, allowing the software to be used for government purposes only and typically only by US persons. This category includes intra-NASA, inter-agency, project, and beta releases. General Purpose releases are more general and allow the software to be used for non-government purposes. These releases may be US-only, US and foreign, or public. Open Source releases are the least restrictive, and allow the software to be used by anyone and to be redistributed. Although Open Source releases are encouraged whenever possible, there are stringent requirements relating to when they are allowed and many products may not qualify due to their sensitive nature.

To initiate a software release request, the software must first be reported through the NASA Technology Reporting System. This report includes a description of the software, the individuals involved in its creation, the development timeline, and any available documentation related to the software. Once the NTR is complete, developers can submit a Software Release Request Authorization (SRRA) through the Software Release System (SRS) online. The SRRA includes questions to determine the different reviews that will be required to release the software, as well as the Compliance Matrix to ensure the software is classified appropriately per NPR 7150.2B.

After the SRRA is submitted, it is first reviewed by the NASA project POCs before it is sent to the Software Release Authority (SRA, Delvin VanNorman at KSC) for an initial review. If the initial review is successful then the package is sent to different offices such as legal, export control, IT security, and 508 compliance for further review. If all offices approve the release, the SRA makes the final decision on the classification of the software and the type of release.

Finally, the software is uploaded to the database and released on the software catalog, which can be found at software.nasa.gov. Open source software can be found on the NASA Github site, code.nasa.gov. When someone requests access to the software, a team at Stennis Space Center reviews the request and ensures that the requesting person meets the requirements to utilize the software. If the requesting person does meet the requirements, a Software Usage Agreement is signed, and a link to download the software and any associated documents is sent.

The release of software is completely voluntary for developers; however, it is highly encouraged by NASA and the Tech Transfer office as it can benefit other centers, government agencies, and the public. If you are considering a release for your software, it may be helpful to contact the SRA early to discuss your goals and begin the reporting and release process. Additionally, it is recommended that you review NPR 7150.2B and the Compliance Matrix early on in the software's development, so you can ensure that it meets all the requirements for classification and release. Being aware of these requirements ahead of time and ensuring compliance makes the release process easier and helps it run smoothly.

Hawamann

A Weather-Related App for Farmers

Increasingly unpredictable monsoon seasons in India are playing havoc with small farms to the point that, according to India's National Crime Records Bureau, thousands of the country's farmers commit suicide every year, a crisis that troubled Pankaj Patil.

As someone who grew up in a rural area of the South Asian nation, Patil knew farmland was prone to droughts, and that problem was only getting worse with climate change. These areas were not well served by ground-based weather forecasting technologies like Doppler radar.

Having worked with NASA Kennedy Space Center's Technology Transfer Office in 2013 and doing research on KSC's Position Sensor as a graduate student in Florida, he knew the instruments aboard the agency's Aqua and Terra satellites could help. In 2020, Patil cofounded ilika Geospatial LLC of Edison, New Jersey, and developed a weather app that uses data from NASA's satellites to provide an accurate forecast on the Indian subcontinent. The company also uses this satellite data in observations for its wider geospatial intelligence business.

One of the first projects undertaken by the company was an app called Hawamaan, which means "weather" in the Hindi language. The application has a specific focus on South Asia, targeting the underserved farmers Patil knew of. The app can show the availability of water and rainfall trends in the region, simplified from raw satellite data into easy-to-read graphics.

"We needed to get these images in front of these people in the most convenient way possible," Patil said. "So why don't we just write an app that is not only giving the weather forecast but also giving this additional context where people can look at the numbers?"

Patil says the app is now used by thousands of farmers across the subcontinent. Hawamaan can be downloaded on smartphones and mobile devices that are popular in the region.

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Virtual Events

NASA's Technology Transfer Program ensures that innovations developed for exploration and discovery are broadly available to the public, maximizing the benefit to the Nation. Companies looking to start a new company, enhance an existing product, or create a new product line, can gain a competitive edge in the marketplace by putting NASA technology to work for their companies. One method NASA gets the word out on their technologies is through the NASA Technology Transfer's Webinar series. Each month NASA scientists and engineers deliver a webinar focused on the technology they developed while working at NASA. To be kept in the know on what technologies will be discussed each month there is a sign-up link that feeds directly into a webinar subscribers list. https://bit.ly/NASA-tech-webinars

Previous webinars can be found on YouTube. https://www.youtube.com/@NASATechTransfer

NASA **TECHNOLOGY TRANSFER** PROGRAM

Kennedy Tech Transfer News is the magazine of the Technology Transfer Office at NASA's Kennedy Space Center, Florida.

This magazine seeks to inform and educate civil servant and contractor personnel at Kennedy Space Center about actively participating in achieving NASA's technology transfer and partnership goals.

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