National Aeronautics and Space Administration

KSC NEWS

tech transfer

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Anne Meier is a Chemical Engineer and the Lead Researcher in the Applied Chemistry Lab on the OSCAR project. Learn more on page 6/7.

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Photo credit: Tony Gray

Meet your Chief & Deputy Chief Technologists

Barbara Brown & Kathleen Loftin

Barbara Brown

Barbara's interest in NASA was born while watching an episode of Star Trek and her NASA career began as a KSC engineering design student. She has also worked for the Ames Research Center (ARC), completed three rotations at NASA Headquarters, and held numerous roles, including Exploration Research and Technology Programs Assistant Director, Advanced Ground Systems and Maintenance Element Integration Lead, KSC Artificial Intelligence Laboratory Manager, KSC Program Manager for X-34 Eastern Range Test Flight Operations, KSC Chief Information Officer, and ARC Crew Exploration Vehicle Work Package Lead. She has dedicated much of her career to the research and development of software and hardware capabilities to enable automated and autonomous ground, surface, and space-based operations.

Barbara has a Bachelor of Science in Computer Science and a Master of Science in Industrial Engineering. She is a Harvard School of Government Senior Executive Fellow and Senior Executive Service Candidate Development Program graduate.

Barbara Brown and Kathy Loftin work closely together in the Office of the Chief Technologist at the Kennedy Space Center. Their responsibilities are numerous and varied. The pair work together to foster the spirit of innovation in the research and technology labs at KSC and at the Agency level. Because of the immense work load, Kathy and Barbara spend a considerable amount of their time in meetings, so they have to optimize the time that they have in their office as much as possible. It is important that they keep the center's research and technology portfolio aligned.

Kathy Loftin

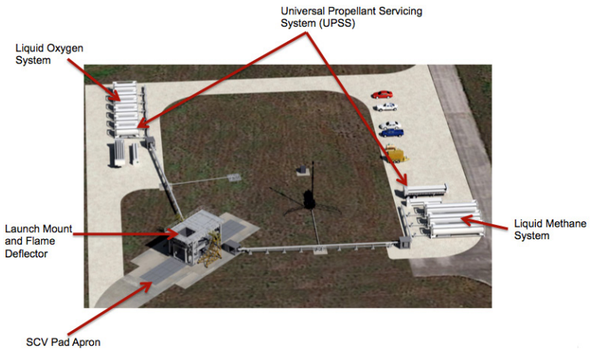
Kathy's interest in working at NASA started when she was still in school working on her master's degree in industrial chemistry. Her master's research was on cleaning up pollutants that had been left behind from the Apollo era. After visiting Kennedy to do research, she knew that she wanted to spend her career at NASA. Kathy began her career at Kennedy in the Materials and Sciences lab after she completed her PhD in chemistry with a specialization in materials and environmental chemistry. Recently, Kathy changed roles at Kennedy and moved from researcher to Deputy Chief Technologist. Kathy also holds a Bachelor of Science in Chemistry and a Master of Science in Industrial Chemistry.

Universal Propellant Service System

Encouraging Entrepreneurial Startups to Utilize Space Technology

The idea behind the Universal Propellant Servicing System (UPSS) was simple, a universal fueling system that would accommodate the multi-user spaceport. The UPSS was designed for versatility and customizability.The asset is focused on fueling commercial rockets. Additionally, the UPSS is going to be used at KSC's development test site for cryogenic technology demonstration projects. The UPSS currently consists of a liquid oxygen (LOX) system and a liquid methane (LCH4) system. These systems can be used together or separately

The Technology Transfer Office determined that the system had commercial viability and worked to transfer it to commercial space companies to use and further develop the innovation. This system has been transferred to a commercial partner for testing and use on their Launchpad.



Swamp Works: The Origin

A Conversation with Rob Mueller

Swamp Works was the brain child of a group of engineers, researchers, and scientists who had a common goal of pushing humanity toward interplanetary habitation. These individuals concluded that space resources and advanced technologies were the key factors that would advance space exploration by using the collective experience from space operations and technologies that Kennedy Space Center and NASA has gained in the past 60 years.

The original founders were Rob Mueller, Phil Metzger, Jack Fox, Jim Mantovani, Van Townsend, AJ Nick and Jason Schuler in the KSC Granular Mechanics & Regolith Operations (GMRO) lab as well as Carlos Calle and Paul Mackey in the Electrostatics and Surface Physics Lab (ESPL). Other labs joined the Swamp Works group in a subsequent reorganization.

The idea for the lab was inspired by the achievements and methods of Lockheed Martin's Skunk Works as well as the accomplishments of Wernher von Braun in the Apollo program. The name Swamp Works was chosen as a clever derivation of Skunk Works and as a nod to the lab's location on Cape Canaveral, where individuals are routinely escorted to their cars by errant alligators.

This group of renegade researchers, engineers, and scientists soon realized that they would need to take a drastically new approach to their research, in order to achieve their formidable goals. Their guiding principle revolved around the idea of accelerating development rapid iteration. "A big part of this philosophy is a higher level of risk tolerance and embracing rapid pace experimentation with quick recoveries from setbacks and nimble incorporation of lessons learned," said Mueller.

Swamp Works aims to be a leader in innovation so that new technologies can be developed for affordable and sustainable space exploration. A major goal of the Swamp Works is not only to develop new technologies, but to also develop an innovative workforce with advanced skills and to set an example for the entire space industry on how cost effective innovation with high rewards can be accomplished.

Applied Chemistry Lab

Closing the Lid on Space Waste

Waste isn't usually the first thing associated with space travel, but maybe it should be.

"On a one-year mission, a crew of four will produce about 2,500 kilograms of trash," said Dr. Anne Meier. Dr. Meier and the researchers in the Applied Chemistry Lab are working to "close the loop" on in-space waste utilization.

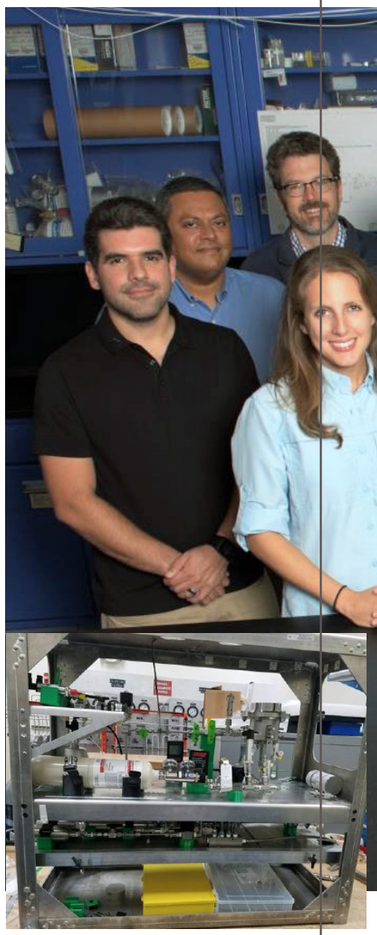
Dr. Meier joined the KSC team in 2011, following the completion of her master's degree. Meier, who also holds a PhD in chemical engineering, leads a team of researchers in a bold new effort to recycle and utilize logistical trash on deep-space missions.

The project is of critical importance for long-duration crewed missions. Everything astronauts eat comes in some sort of package, including hygiene products and other single-use packaging. The researchers' solution to the problem of waste is OSCAR (Orbital Syngas/Commodity Augmentation Reactor). Syngas is an abbreviation for synthetic gas, which is a mixture of things like carbon monoxide, carbon dioxide, and methane, which are very simple. "We call them permanent gases that are very small molecules that can be used as building blocks for other things, whether it be for life support or for fuel production," said Dr. Meier. This project has progressed relatively quickly, with researchers going from early stage concepts and drawings to full-blown engineering schematics to prototyping, testing, and now analyzing data.

This project is especially exciting, because it could allow formerly cumbersome waste materials to be converted into valuable fuel- while providing a safe reliable solution to the in space waste problem. Jettisoning trash from a vehicle at the Deep Space Gateway DSG or during transit to a deep space location (i.e. Mars) requires energy for pressurization and depressurization and could become an orbital debris issue.

Leaving waste on a planetary surface risks the violation of planetary protection rules. The reuse of discarded materials on any long-duration, deep-space mission will reduce the overall mission mass, increase usable spacecraft and habitat volume, and improve mission reliability and robustness. Over the next two years, the team will use iterative development via microgravity (µg) demonstrations with the teamwork of µg and combustion experts at GRC, and a suborbital flight demonstration on a commercial vehicle.

These experiments will advance a prototype µg waste conversion system.The reactor (OSCAR) would take all of the waste and heat it to a minimum of 300 ºC, causing the component elements of the trash to increase in temperature, and then start an exothermic reaction, causing even higher temperatures. The molecules the begin to degrade or to separate from solid form into a gas form. This reaction would have three elemental results: methane gas, oxygen, and water. The idea is to start looking at waste as a resource rather than an inherent burden. This technology could have numerous terrestrial applications as well for both resource utilization and landfill mitigation. As the team lead, Meier is looking to the future for new ways to test and apply this exciting new research. Currently, there is a public challenge called Recycling in Space. "We are requesting help from the entire world," she said. This kind of innovative crowdsourcing is pushing the boundaries of creative collaboration and research expertise. The call for input closed in December and the submissions are being reviewed. Researchers are hopeful that they will be able to include the winner's technologies in future iterations of the technology. The reactor is scheduled to ride on a suborbital flight with one of KSC's commercial partners in the near future to conduct further tests and demonstrations.



Close up view of the reactor prototype

Members of the KSC Applied Physics Lab gather next to the OSCAE reactor. Back row (right to left) Jaime Toro Medina, Arun Arora, Jonathan Gleeson, Jake Hochstadt, Jon Bayliss, Thomas McClure, Evan Bell, Gino Carro, Malay Shah. Front row (right to left) Anne Meier, Cristy Oropez, Emily Forrester.

Interagency Partnership Award

AFTU team receiving the FLC award (left to right)Shawn Quinn, Lew Parrish, Roger Zoerner, Lisa Valencia, Erik Magnuson, and Robert Cabana.

The Autonomous Flight Termination Unit (AFTU) developed by KSC, Defense Advanced Research Projects Agency (DARPA), U.S. Air Force, and Federal Aviation Administration (FAA) won the FLC's Interagency Partnership Award. The AFTU technology has been transferred to 35 recipients, including commercial space companies and Department of Defense agencies, and will be fully operational by summer. KSC is making available the reference design drawings and generic wrapper software that will allow custom implementation by each partner. The Federal Laboratory Consortium for Technology Transfer (FLC) is the nationwide network of over 300 federal labs, agencies, and research centers that fosters commercialization best practice strategies and opportunities for accelerating federal technologies from out of the labs and into the marketplace.

Technology Transfer Licensing Award

The Kennedy Space Center's Technology Transfer Program was presented with an internal trophy for leading the agency with 18 patent licenses in 2018. Dan Lockney, NASA Headquarters Technology Transfer Program executive, presented the team with the trophy via Skype on March 18. Lockney first purchased this inhouse trophy three years ago as away to incentivize healthy competition among NASA's 10 centers for patent licensing. This trophy travels to the winning center for one year at a time, and this year, Kennedy will have it on display, "cementing Kennedy's place in tech transfer" said Lockney.

Robert Cabana holding the Technology Transfer Licensing Trophy

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