

Glenn Advances Propulsion Toward Low-Carbon Aircraft

Since the beginning, commercial planes have been powered by carbonbased fuels such as gasoline or kerosene. While these fuels provide the energy to lift large commercial jets into the world's airspace, electric power is now seen as a new frontier for providing thrust and power for flight.

Just as hybrid or turboelectric power has improved fuel efficiency in cars, boats and trains, NASA aeronautical engineers are exploring how planes can be redesigned and configured with electrical power. One of NASA's goals is to help the aircraft industry shift from relying solely on gas turbines to using hybrid electric and turboelectric propulsion in order to reduce energy consumption, emissions and noise.

"Aircraft are highly complex machines," said Jim Heidmann, Aeronautics Directorate and NASA's Advanced Air Transport Technology project manager. "Moving toward alternative systems requires creating new aircraft designs as well as propulsion systems that integrate battery technologies and electromagnetic machines like motors and generators with more efficient engines."

Glenn researchers are looking at power systems that generate electricity in place of, or in addition to, thrust at the turbine engine. Then the electricity is converted into thrust using fans at other places on the aircraft.

"These systems use electric motors and generators that work together with turbine engines to distribute

Continued on page 2

Celebrating a 75-Year Legacy



A mechanic watches a General Electric I-40 turbojet engine firing. The I-40 was incorporated into the Lockheed Shooting Star airframe, which became the first successful U.S. jet aircraft reaching 500 miles per bour. With this issue, AeroSpace Frontiers begins a series that bigblights the center's technology over the past 75 years. See page 5.

Technology Transfer Office Hits the Road

Did you invent something new, or does your research make technology better, stronger or faster? Glenn's Technology Transfer Office (TTO) wants to help you get that research documented, protected and ultimately licensed to industry so it can benefit the nation.

This year, the TTO New Technology Representative and Administrator, along with TTO technology managers will begin a series of internal monthly informational sessions—dubbed "road

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Verifying Our Egress-Housekeeping Efforts

I applaud the Glenn community for your overwhelming response to the Egress and Housekeeping Cleanup Initiative. Organizations throughout the center quickly got to work sorting through workspace clutter and tossing outdated/unnecessary items. Our Facility, Logistics and Environmental staffs can attest to your efforts. They are systematically addressing the high volume of work orders requesting removal of excess equipment and materials. Similarly, as we verify all technical developments to assure quality, safety inspections will be our final step in this initiative to verify that we are indeed achieving a much safer and cleaner workplace. I encourage your continued cooperation and look forward to the results of this outstanding initiative!

Achieving a Safe and Healthy Workplace is a Team Effort and You're Stepping Up to the Challenge. —Jim

Advancing Low-Carbon Aircraft

Continued from page 1

power throughout the aircraft in order to reduce drag for a given amount of fuel burned," said Amy Jankovsky, Aeronautics Mission Office. "Part of our research is developing the lightweight machinery and electrical systems that will be required to make these systems possible."

In addition to designing better motors, generators and integrated electrical system architectures, Glenn engineers are also researching the basic materials that go into those components. Research is being performed on the conductors inside, and the insulation around the wires. Along with studying the design of motors and the architecture of power electronics, engineers are improving magnetic materials and semi-conductors to make these motors and electronics lighter and more efficient.

"Our work is laying a foundation for planes that will require less fossil fuel in the future," said Cheryl Bowman, High Temperature and Smart Alloys Branch. "Considering that the U.S. aviation industry carries more than 700 million passengers every year, making each trip more fuel efficient (by up to 30 percent) can have a considerable impact on the nation's total use of fossil fuels."



By Nancy Smith Kilkenny

Tech Transfer on Road

Continued from page 1

shows"—to help civil servants report their new technologies. The TTO technology managers are skilled in promoting, negotiating and transferring technology into the private sector and aligning our patent portfolio with industry needs.

"We'll be providing an overview of NASA's Technology Transfer Program and will inform employees on why it is important to file a New Technology Report (NTR). The TTO will also hold hands-on sessions to assist employees in filling out and submitting an NTR," said Glenn-Headquarters New Technology Representative, Irene Cierchacki, TTO. "NTRs are the basis for protecting the center's and inventors' technologies, and ultimately ensuring that taxpayers get the most benefit from our innovations."

NTRs provide:

- Protection of intellectual property
- Eligibility for internal and external awards and recognition programs
- Opportunities to patent inventions, which, when licensed to companies, reap royalties that are shared with inventors

Road shows will be scheduled throughout Glenn's research and technology organizations. Look for announcements on *Today@Glenn*. For further information, contact Irene Cierchacki at 216-433-6036, Irene Cierchacki-1@nasa.gov.

Presenting at a Conference in 2016?

The Technology Transfer Office (TTO) can help you take your technology to the next level! We can provide you with informational brochures and slides to include in your talk and we can engage with any leads you receive! Please contact Karen Bartos at 3-6478 or at ttp@grc.nasa.gov today!

CFC 2015 Campaign Proves "You Can Change a Life"

NASA Glenn's Combined Federal Campaign (CFC) Committee concluded its successful 2015 drive, which provided opportunities for employees to support a vast network of deserving nonprofit organizations. Thanks to the generosity of our employees, the center raised \$425,000 that will go to many worthy charities who urgently need our help.

The campaign included several events at Lewis Field and Plum Brook Station that raised more than \$16,000 toward the total. The basket raffles at both Glenn campuses reaped more than \$10,000! Additionally, other committee-sponsored events—the Chili Cook-Off, Tailgate Party, International Food Fair, Art Show and Pie the Manager offered fun ways for giving.

CFC Chair Andrea Bonesteel and Co-Chair Mary Jo Long-Davis said several directorates held their own special events, such as lunches and bake sales, boosting the campaign total.

"I'm honored to be the 2015 CFC chair," Bonesteel said. "I want to thank all the volunteers and supervisors, as well as employees throughout the center who participated in CFC committee activities, organized their own special events and donated in any way. I'm also grateful for the dedication of my co-chair, Mary Jo, who outdid herself by baking for many of these events. NASA Glenn employees proudly stepped up to the challenge, and together we changed many lives."

A long-time CFC supporter, Long-Davis said she was humbled while working behind-the-scenes this year, working with individuals motivated by the purpose of helping others. "It was a truly heart-warming experience and I'm very excited about serving as the chair for next year's campaign," she said.

Editor's note: An appreciation event, held earlier this month, announced the directorates with the highest participation, donations per employee and other awards. That information will appear in a future *AeroSpace Frontiers* article.

By Doreen B. Zudell



Pie the Manager (Director Jim Free)



Chili Cook-Off



Art Show



Basket Raffle and Costume Contest



Plum Brook Station CFC Festival



International Food Fair

News and Events



GBC-2016-C-212

Photos by Rami Daud GRC-2016-C-216

MLK Observance: "A Day On, Not A Day Off"

NASA Glenn's Office of Diversity and Equal Opportunity presented a program that reinforced Dr. Martin Luther King Jr.'s (MLK) philosophies of love, hope, forgiveness and prophecy during the MLK Observance, Jan. 20. Clarence Bozeman,



driver for Dr. King and his wife, from 1958 to 1960, gave the keynote address. Bozeman shared personal accounts of the Baptist minister and social activist's trials and tribulations as he led the U.S. Civil Rights Movement through most of the 1950s–1960s. Kennedy Jones, local police officer and award-winning gospel singer and songwriter, vocalized the themes of hope and perseverance. Pictured far left: Bozeman recalls the lessons he learned from Dr. King. Pictured left: Jones performs a medley of inspirational songs.

Dr. Nazario Merits SFA Honoree Award

Dr. Margaret "Meg" Nazario, European Service Module Integration Office, received a Space Flight Awareness (SFA) Honoree Award during an event at NASA's Johnson Space Center in Houston last month.

Nazario (pictured right) was recognized for leading the integration between NASA, Lockheed Martin, the European Space Agency and the Airbus Defence and Space to ensure successful delivery of the Orion European Structural Test Article (E–STA) to Plum Brook Station. As a project manager for the E–STA test campaign, she is cited for coordinating the effort, under tight resource constraints, for structural tests that will begin in March.

The SFA Honoree Award is one of the highest and most prestigious awards available to NASA or industry personnel supporting the human space flight program.



Photo by Barb Klubnik

Glenn Workshop Helps Educate the Educators

Approximately 35 educators from Glenn's six-state region participated in an Engineering Design Challenges (EDCs) workshop conducted by members of the Office of Education, Dec. 10. "Let it Glide," the first of three EDC workshops scheduled for Fiscal Year 2016, celebrated NACA's 100th anniversary and highlighted Glenn contributions from 75 years of aeronautics research. The group of math, science and after-school program educators received professional development training on the science of flight and the engineering design process to help students design and build their own shoebox glider. Pictured, Glenn instructor Roger Storm, right, watches one of the many glider test flights being conducted.



GRC-2015-C-8062

Photo by Marvin Smith

FEBRUARY 2016

Celebrating a 75-Year Legacy

This is the first in a monthly series of historical highlights commemorating Glenn's 75th anniversary and extraordinary technical accomplishments that reach across 7 decades.



Looking Back: 1940s

The turbojet engine transformed aviation in the mid-20th century by significantly increasing speed, altitude and range. These advances led to supersonic military aircraft, intercontinental flights and the democratization of the airline industry. Systematic improvements to the jet engine in the 1940s by NASA Glenn—then known as the NACA Aircraft Engine Research Laboratory—resulted in exponentially greater performance in the 1950s and 1960s.

The first U.S. turbojets emerged during World War II, just as Glenn initiated its research activities. Secret wartime testing in the Altitude Wind Tunnel improved the modest performance of these initial engines. After the war, the center concentrated almost all of its resources on the jet engine. During this period, researchers analyzed nearly every emerging turbojet model in its world-class altitude facilities.

Researchers also made significant advances in compressor design, turbine



GRC-1947-C-19794

General Electric's TG-180 axial-flow turbojet was installed in the Altitude Wind Tunnel for a series of investigations in 1945. Although the TG-180, also known as the J-35, was not the breakthrough engine that the military had hoped for, it powered the Douglas D-558-I Skystreak to a world speed record in 1947 and was also used on the Republic F-84 Thunderjet and the Northrop F-89 Scorpion.

cooling, high altitude combustion, engine controls and the use of afterburners and variable-area nozzles to increase thrust. Glenn continues aeropropulsion work today, emphasizing efficiency, noise-abatement and emissions reduction.

Courtesy of NASA Glenn History Office

News and Events Students Gear-Up for Medieval-Themed Robotics Challenge

Nearly 100 students representing Ohio and Pennsylvania teams, gathered locally for the FIRST (For Inspiration and Recognition of Science and Technology) Robotics Competition global kickoff, Jan. 9, at the Tri-C Unified Technologies Center. Glenn's FIRST Project Manager, Stephanie Brown-Houston, provided welcoming remarks and updates on education opportunities at Glenn prior to the unveiling of this year's game challenge, the medievalthemed FIRST STRONGHOLD. Pictured: Team 120 and Glenn mentor Larry Oberle, far left, pose with guest speaker Sgt. Timothy Maffo-Judd, Cleveland Police Dept. Bomb Squad. They later helped distribute game "Kit of Parts" to teams so they can begin building their robot.



Photo by S. Jenise Veris

The 15th annual Buckeye Regional FIRST Robotics Competition is March 16-19, 2016.

Retirements

Anastacio Baez, Power Management and Distribution Branch, Power Division, retired Jan. 1, 2016, with 37 years of service.

Kevin Carmichael, Power Division, Research and Engineering Directorate, retired Jan. 1, 2016, with 37 years of service.

Elaine S. Daugherty, Data Systems Branch, Testing Division, retired Dec. 31, 2015, with 33 years of service.

Troy R. Hauser, Data Systems Branch, Testing Division, retired Dec. 31, 2015, with 28 years of service.

Dr. Donald A. Jaworske, Fluid Physics and Transport Processes Branch, Propulsion Division, retired Jan. 1, 2016, with 32 years of service.

Bonita J. (Tufts-Davis) Jeffery, Information and Applications Office, Office of the Chief Information Officer, Jan. 1, 2016, with 35 years of service.

Grisselle LaFontaine, Mission Support Office, Office of the Chief Information Officer, retired Dec. 31, 2015, with 28 ½ years of service.

Eric Miller, Data Systems Branch, Testing Division, retired Dec. 31, 2015, with 33 years of service.







Onest

Baez

Carmichael

Jeffery

ry



Paulin

James J. Onest, Operations Management Branch, Facilities Division, retired Oct. 2, 2015, with 41 years of service.

Jeffry Paulin, Wind Tunnel and Propulsion Test Branch, Testing Division, retired Jan. 1, 2016, with 41 years of service.

Maryann Pawson, Procurement Division, Center Operations Directorate, retired Jan. 1, 2016, with 36 years of service.

Marisa Pischel, Operations Management Branch, Facilities Division, retired Jan. 1, 2016, with 36 ½ years of federal service, including 35 years with NASA.

Andrew Reehorst, Icing Branch, Propulsion Division, retired Jan. 1, 2016, with 34 years of service.

Juan Rivera, Data Systems Branch, Testing Division, retired Jan. 1, 2016, with 36 ¹/₂ years of service.

Michael A. Robertson, Data Systems Branch, Testing Division, retired Jan. 1, 2016, with 39 years of federal service, including 35 ½ with NASA.

Leo Robinson, Operations Management Branch, Facilities Division, retired Dec. 31, 2015, with 33 years of service.

Larry Trase, Power Management and Distribution Branch, Power Division, retired Dec. 31, 2015, with 32 $\frac{1}{2}$ years of service.

Calendar

BLACK HISTORY MONTH PROGRAM:

Glenn's African Heritage Advisory Group will host a leadership panel featuring Glenn's past three African American Center Directors: Donald Campbell, Dr. Julian Earls and Dr. Woodrow Whitlow Jr., Wednesday, Feb. 17, from 10 to 11:30 a.m, in the MIC Auditorium. The discussion will focus on "Celebrating the Triumphs and Exploring the Future of African Americans at NASA Glenn Research Center." A reception follows. Lunch can be purchased.

RETIRED WOMEN'S LUNCHEON:

The next NASA Retired Women's Luncheon is Thursday, Feb. 18, at 1 p.m. at the 100th Bomb Group on Brookpark Road, Cleveland. Please contact Gerry Ziemba, 330–273–4850 or gto64gerry@ yahoo.com to reserve your place.

WOMEN IGNITE WORKSHOP:

Come hear engaging speakers on a variety of topics affecting women, Wednesday, March 9, 8:30 a.m. to 12:30 p.m., in the MIC Auditorium. The workshop is open to everyone. Men are encouraged to attend! Registration is available through SATERN. See *Today@Glenn* for details. POC: Marlena Hudson, 3–8928.

IFPTE LOCAL 28, LESA MEETING: LESA will hold its next membership meeting, Wednesday, March 9, noon, in the Glenn Employee Center's Small Dining Room.

NASA SPINOFF ONLINE: The 2016 NASA Spinoff publication and video is now available and features how NASA is "Bringing Technology Down to Earth." Visit spinoff.nasa.gov.

Friendship 7 Anniversary

On Feb. 20, 1962, John H. Glenn became the first American to orbit the Earth. NASA Glenn's namesake spent 4 hours and 56 minutes in flight in the Mercury spacecraft *Friendship* 7 and orbited Earth three times.



Welcome to the NASA Family



Left to right, first row: Miller and Gerges; second row: Ondercik, Odelberg and Ponce; and third row: Kehrt, Strick, Harris and Ljubanovic

Glenn welcomed three new hires at the close of the year, Dec. 28, 2015. They include Amjad Almansour, Ceramic and Polymer Composites Branch; Ronald Kehrt, Aviation Environments Technical Branch; and Jason Smith, Testing Division. An additional eight new hires reported for orientation, Monday, Jan. 11, 2016. They include Daniel Gerges, Space Combustion and Materials Branch; Harry Harris, Mechanical Systems Design and Integration Branch; Damir Ljubanovic, Power Management and Distribution Branch; Sara Miller, Power Architecture



Left to right: Smith and Almansour.

and Analysis Branch; Trevor Odelberg, Power Management and Distribution Branch; Jason Ondercik, Engineering Management Branch; Raul Ponce, Structural Mechanics Branch; and Robert Strick, Engineering Management Branch.

More Than a Memory

Thomas B. McDevitt, 80, a 1990 NASA retiree and Korean Air Force veteran with 31 years of federal service, died July 3, 2015. McDevitt joined the NASA workforce in the 1960s. He served as an aeronautics mechanic in the Test Installation Division, supporting engine research and space power services. He supported drop tests in Cleveland's Terminal Tower elevators using Styrofoam as a potential decelerator for the center's Zero-Gravity Facility. He also worked on the Advanced Gas Turbine Project, demonstrating the feasibility of a fuel-efficient high-

temperature turbine engine for automobiles.

Louis R. Revnyak, 91, a 1980 NASA retiree and Navy veteran with 37 years of combined federal service, died November 11, 2015. Revnyak began his NACA-NASA career as an airplane mechanic. He was an active member of the Lewis Speakers Bureau and performer for the Lewis Performing Arts Theatre that put on the center's annual Christmas play. Revnyak retired as an administrative specialist in the Materials and Structures Division.



Revnyak

Awards

Derrick Cheston and Calvin Robinson will be honored this month during the 30th Annual Black Engineer of the Year (BEYA) STEM Conference sponsored by Career Communications Group Inc.

Cheston, chief of Glenn's Systems Engineering and Architecture Division, will receive the "BEYA Special Recognition Award." He is recognized for technical leadership



Cheston

and contributions as one of NASA's senior leaders. In addition to being the first African-American appointed to serve at the NASA Engineering and Safety Center, he has led several Glenn engineering organizations during his 31-year career resulting in space flight and aeronautics development achievements.

Robinson, a computer scientist on the Graphics and Visualization Team, Office of the Chief Information Officer, will be recognized as a "BEYA Modern-Day Tech-



Robinson

nology Leader for Community Service." He is recognized for partnering with the Cuyahoga County Public Library to create educational robotics activities at several branches and coordinating with Tech Corps on programming lessons for a local high school. Robinson also served as an advisor for NASA Glenn's Explorers Post 631, an after-school program designed to teach computer technology to high school students.



Emergency and Inclement Weather Lines Lewis Field: 216–433–9328 (WEAT) Plum Brook Station: 419–621–3333

National Aeronautics and Space Administration

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www.nasa.gov

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March 2016 Calendar section deadline: Feb. 19, noon News and feature stories require additional time

Editor: **Doreen B. Zudell**, ATS Assistant Editor: **S. Jenise Veris**, ATS Managing Editor: **Kelly R. DiFrancesco**





Read AeroSpace Frontiers online at http://www.nasa.gov/centers/glenn/news/AF/index.html

MIC Art Draws Inspiration From Above

For decades, Earth-observing environmental satellites have provided invaluable information, and the vantage point of space has provided new perspectives on the Earth. These images showcase Earth's aesthetic beauty in the patterns, shapes, colors and textures of the land, oceans, ice and atmosphere. Some of these stunning images are captured in murals positioned in the recessed alcoves along the Mission Integration Center (MIC) hallways and lobbies.

"When choosing interior design elements for the Mission Integration Center, we wanted artwork that would reflect the uniqueness of this new office building," said MIC Project Architect, Jared Reed, Facilities Division. "The wall coverings needed to provide color and timelessness, while reinforcing a clean, uncluttered feel throughout the building."

Kelly Shankland (ATS), lead graphic artist in Publishing and Media Services, recommended adapting art from the NASA-produced book, "Earth As Art." The publication features images of Earth from NASA's Terra, Landsat 5, Landsat 7, EO-1 and Aqua satellites.

She identified 17 images that were transferred into vinyl wall coverings and then installed within the recessed alcoves. The murals feature satellite



Pictured above: A 4- by10-foot mural of the Vatnajokull Glacier Ice Cap in Iceland on the MIC's top floor. Right: A 10- by 25-foot wall covering of the Bogda Mountains in China spans two floors.

views from geographic areas such as the Great Salt Desert in Iran and the Anyuyskiy Volcano in Russia. One of the most stunning is a 10- by 25-foot wall covering of the Bogda Mountains in China that spans two floors.

"While the artwork appears to be abstract, the pieces are actual images and not artist renderings," Shankland said. "To ensure people understood this, I placed a geographic indicator on each mural to show its location on the globe."



GRC-2014-C-5500

Photos by Marvin Smith

Jared said employees immediately embraced the distinctive wall coverings, which are very different from art typically placed in buildings throughout the center. "This artwork is a perfect match for this building and has become one of the most admired features of the MIC by employees and visitors alike."