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Eye of the Hurricane

Global Hawk observed Matthew during NOAA mission

By Alan Buis
Jet Propulsion Laboratory Public Affairs

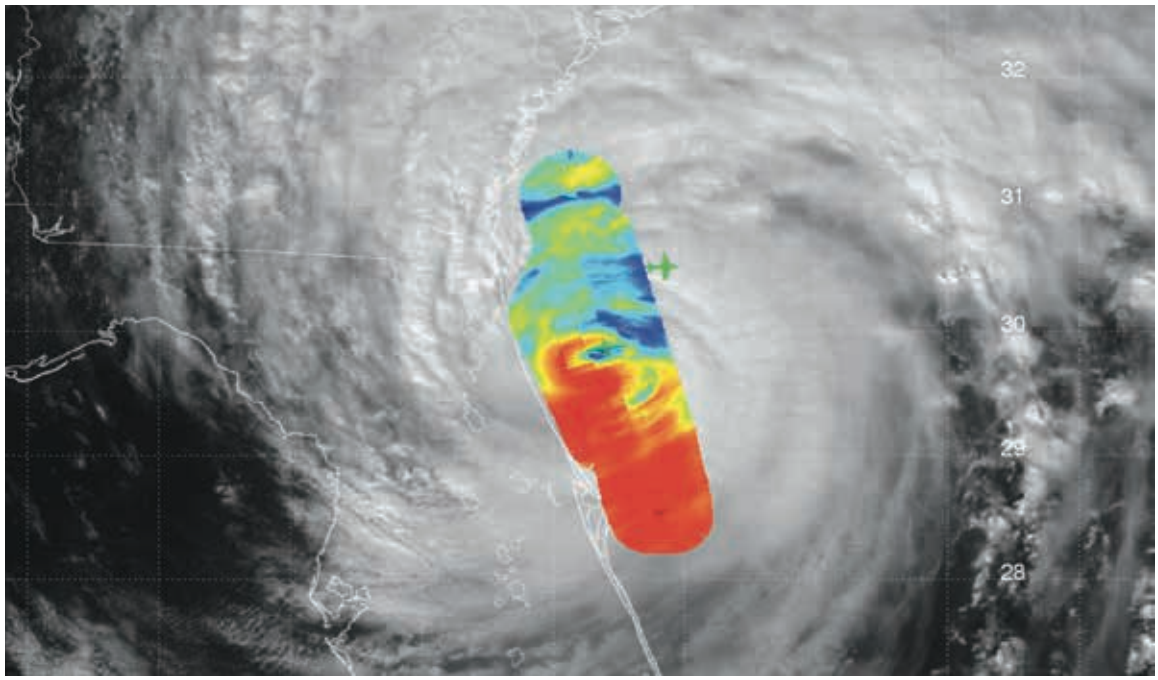
As Hurricane Matthew developed Oct. 7 a Global Hawk autonomous aircraft based at Armstrong carrying the Jet Propulsion Laboratory-developed instrument called the High-Altitude Monolithic Microwave Integrated Circuit Sounding Radiometer (HAMSR) recorded atmospheric temperatures.

A hurricane is like an engine: the more it revs up, the warmer it gets. HAMSR is a microwave sounder that can measure a hurricane's atmospheric temperature and humidity, even in the presence of clouds, and can also be used to measure rain and ice from Earth's surface to the top of the storm's convective clouds.

Global Hawk flew HAMSR repeatedly over Hurricane Matthew as part of the National Oceanic and Atmospheric Administration's Sensing Hazards with Operational Unmanned Technology (SHOUT) field campaign.

HAMSR observations were obtained above Matthew at an altitude of about 55,000 feet (16,764 meters) in the early morning hours of Oct. 7, as the storm was approaching Florida's east coast.

Matthew, page 12



NASA/JPL-Caltech HAMSR team/NOAA SHOUT Team/NASA Global Hawk Team

ED15-0249-24 **NASA/Carla Thomas**

***Above**, JPL's High-Altitude Monolithic Microwave Integrated Circuit Sounding Radiometer instrument recorded information from inside Hurricane Matthew's spiral clouds Oct. 7 while mounted on a NASA Global Hawk unmanned aircraft. Red colors show cloud bands without precipitation; blues show rain bands.*

***At left**, A NASA Global Hawk soars over Edwards Air Force Base during a checkout flight.*

Mars airplane flies

Student interns get a taste of flight test success

By Jay Levine
X-Press editor

Some interns get coffee. Others might make copies. Not at Armstrong, where a group of students successfully flew a prototype of an aircraft that could one day fly in the Martian atmosphere and send findings back to Earth.

Called the Preliminary Research Aerodynamic Design to Land on Mars, or Prandtl-M, the small, remotely piloted glider aircraft flew Aug. 11 at Armstrong. It continues an effort that began last year with a mostly different group of students.

"The first successful flights felt like a huge relief," said John Bodylski, a mechanical engineering student at Irvine Valley College in California. "While we still plan to perfect the design, it is a pretty exciting feeling to realize that the aircraft is working. At first I didn't believe it and had to rewatch the footage from the flight."

Bodylski is participating in a NASA student program aimed at developing skills learned at school and applying those abilities to a research challenge. The NASA Flight Scholars activity, which focuses on giving community college students an early opportunity to perform research, and the Education Unmanned Aerial Systems activity, which provides college students an opportunity to work on NASA UAS projects, are key components of the Prandtl-M team.

Bodylski worked on how to track the Prandtl-M last summer from Irvine, but this year he was accepted to come to Armstrong with the added responsibility of onboard avionics.

"Being at Armstrong this year has allowed for me to take advantage of the engineering knowledge and fabrication abilities of the center," he added. "Work at Armstrong is faster paced than working from a school and allows for designs to be created and tested in a more rapid fashion."

AFRC2016-0246-142 **NASA/Lauren Hughes**

The Preliminary Research Aerodynamic Design to Land on Mars, or Prandtl-M, flies during a test flight. Students during the past two summers worked on the concept leading to successful flights.

AFRC2016-0246-90 **NASA/Kyria Luxon**

Jonathan Adams, from left, John Bodylski, Justin Hall, Caitlin Kennedy and Dave Berger watch a computer screen providing the Prandtl-M's exact location and altitude.

Those are some of the concepts of the program, said Dave Berger, a key driver and manager of the two education activities.

"What we like about small prototypes and this student program is this is real research, real cutting-edge technology development," he explained. "They can work on all the major areas of aerospace engineering, such as controls, aerodynamics, structures and instrumentation encapsulated in one project. The program is small enough that we can design and fabricate very fast and we can try something that no one has ever done before. It might not be successful the first time, or the second time."

Inspiring and exciting students, while developing a talent pool for NASA and the aerospace industry, are key to science, technology, engineering and mathematics (STEM) education that is a goal of the agency.

"Students can see the path to a technical or engineering career path," Berger added.

That was the case with the Prandtl-M. It was through repeated challenges and learning that the successful aircraft flew.

Caitlin Kennedy, an undergraduate intern studying physics and astronomy from the University of Wyoming, said the Prandtl-M work has been a one-of-a-kind experience.

"When I came here I had no idea what operations engineers did," Kennedy said. "I absolutely love it because I had an overview and I was involved in every step of the project. It takes a while to get ready for a flight and we learn something from every flight."

As an example, she explained how rooftop flights of six or seven Prandtl-M vehicle shapes were tested to determine which shape would be dropped from a Carbon Cub aircraft. Once a shape was decided, servos were added to control the ailerons.

For Emersen Baker, who is studying aerospace engineering at California State Polytechnic University in California, the processes of manufacturing a carbon-fiber prototype vehicle and learning about the failures and success of a

Students, page 12

Inspiring Innovation

Armstrong trio helped plan agencywide event

By Jay Levine
X-Press editor

Three NASA Armstrong employees who competed for selection to an early career leadership program earned an unexpected opportunity.

Daniela Donkor (formerly Cruzado), Otto Schnarr and Shaun Smith were selected as the center's participants in the Foundations of Influence, Relationships, Success and Teamwork (FIRST) leadership training. Usually the training culminates in the selectees working together on a center project. However, when the Armstrong selectees began their training, they were told they would be a part of an agencywide event.

The Agency Innovation Mission event Nov. 1 started with a bang, or in this case a sonic boom, to kick off the event at the ISF. The day of activities included a vote on 17 technology proposals from across the agency, a technology panel discussion, speakers, a workshop to find people's "inner innovator" and social events.

A key focus of the event, which the 40 FIRST participants organized, included a vote on new technology proposals for the NASA Innovation Kick-Start initiative. Presentations by the 17 finalists will result in $100,000 in seed money, no more than $10,000 for a specific concept, to be decided. Results are intended to be announced within a few weeks. The event was broadcast on NASA TV and also available for viewing in the ISF.

The aim of the event was to nurture and celebrate past, current and future innovation across the agency. All of the proposals featured a cooperative component where at least two NASA centers work on the idea, Smith detailed.

NASA Deputy Administrator Dava Newman provided the keynote presentation from NASA's Kennedy Space Center in Florida and broadcast on NASA TV. Newman was a primary driver of the event's basic framework.

AFRC2016-0298-4 **NASA/Ken Ulbrich**

Shaun Smith, from left, Daniela Donkor and Otto Schnaar helped to organize an agencywide event as part of a NASA leadership program.

Another part of the event was an innovation panel to discuss technology developments at Armstrong. A social event wrapped up the day.

A final element of the Nov. 1 event was a component called the human innovation workshops. The workshop was designed to discover the innovator inside and focused on anything that could make the agency better or more efficient regardless of what area of the agency the idea focused, Donkor said.

Early challenges in organizing 40 people to put on a nationwide event was one of the hurdles when the effort began in February. Organization, a leadership structure, developing master schedules for coast-to-coast conversations and navigating differences in approach to problem solving represented first steps. The larger group divided into smaller groups, each tackling a different component of the event, said Schnarr, who said he is excited to be a part of the event.

When the 40 FIRST representatives began to organize the event, cross-center collaboration was a focus. One way the team decided to encourage cooperation during the event was through a remote control car social, where two centers virtually navigated a vehicle through an obstacle course. One center controls the car, but can't see it, and another center gives directions.

"I feel fortunate to be a part of something like this," Donkor said. "It is completely different from what other FIRST groups experienced because we are the initial group to have an agencywide project. We have developed relationships and had networking opportunities that we wouldn't have otherwise."

News at NASA

Could new planet be habitable?

A rocky extrasolar planet with a mass similar to Earth's was recently detected around Proxima Centauri, the nearest star to this solar system's sun. This planet, called Proxima b, is in an orbit that would allow it to have liquid water on its surface, thus raising the question of its habitability.

In a study to be published in The Astrophysical Journal Letters, an international team led by researchers at the Marseille Astrophysics Laboratory (CNRS/Aix-Marseille Université) has determined the planet's dimensions and properties of its surface, which favor its habitability.

The team said Proxima b could have an ocean covering its entire surface, the water perhaps similar to that of subsurface oceans detected inside icy moons around Jupiter and Saturn. The researchers also show that Proxima b's composition might resemble Mercury's, with a metal core making up two-thirds of the mass of the planet. Future studies could determine the habitability of Proxima b.

Proxima Centauri has a planetary system consisting of at least one planet. The new measurements show that this planet, named Proxima Centauri b or simply Proxima b, has a mass close to that of Earth (1.3 times Earth's mass). Such a short distance does not imply a high temperature on the surface of Proxima b, which is in the habitable zone of its star.

Center staff is honored

The NASA Honor Awards for Armstrong employees was Aug. 25 and included 25 individual honors and four group awards.

Outstanding Leadership Medal

Ethan Baumann

For outstanding leadership of the Supersonic Research Aircraft Testbed (SCRAT) team

Cynthia J. Bixby

For providing exceptional leadership to the Systems Engineering Branch and setting a great example for our engineering staff

Walter A. Kondracki

For outstanding technical and managerial leadership in the Flight Operations Directorate in support of the Agency's programs

Cheng M. Moua

For exemplary leadership of a first-ever health monitoring and volcanic ash research project on a production C-17 aircraft meeting a congressional milestone

Joel Sitz

For sustained and innovative leadership of the Programs and Projects Directorate

AFRC2016-0261-58 NASA/Ken Ulbrich

Tom Rigney, second from right, accepts a NASA Group Achievement Award for the Adaptive Compliant Trailing Edge project team from Center Director David McBride, far right. Also pictured are Joe Piotrowski, far left, and Deputy Director Patrick Stoliker.

AFRC2016-0261-59 NASA/Ken Ulbrich

Steve Schmidt, center, accepts a NASA Group Achievement Award for the Center Strategic Planning Committee from Stoliker, right and McBride, left.

Michael P. Thomson

For outstanding leadership of Armstrong's Earth Science mission resulting in critical scientific discoveries in support of an improved global system understanding

Exceptional Service Medal

Daniel W. Banks

For exceptional technical expertise in fluid dynamics and flow visualization, enabling critical understanding of the flow physics of atmospheric flight, for NASA's missions

Connie S. Bosworth

For unparalleled commitment to human capital management at NASA

Larry D. Hudson

For diverse, sustained and distinguished engineering achievement as a senior thermal-structural researcher

William A. Lokos

For diverse, sustained and distinguished engineering achievement as a senior structural loads researcher

Jeffery A. Nelms

For exceptional technical leadership and sustained performance through contributions to NASA's mission in the areas of information technology and data management

Patrick C. Stoliker

For outstanding leadership, service, innovative approaches and contributions to the safe and effective management of Armstrong

Anthony Thomas

For exceptional service in supporting NASA Armstrong information technology capability and infrastructure resulting in improvements to information security and handling

Exceptional Public Achievement Medal

Cacie Carrillo-Ferreyra
For substantial improvements in operations, efficiency and service of contracted program and institutional capabilities necessary to conduct NASA's mission

Exceptional Achievement Medal

Christopher B. Kostyk
For exceptional engineering contributions by significantly advancing the state of the practice of frangible joint testing and performance assessment

David H. Matthews
For exceptional achievement in the management of Armstrong's communications security program

Thomas K. Rigney
For exemplary leadership of the ACTE flap project and the achievement of successfully completing a first-ever flight research effort for this new technology

Gregory W. Strombo
For using advanced systems and new technologies to bring new capabilities to Armstrong without impacting the integrity of the telemetry frequencies

Early Career Achievement Medal

Brian J. Bennett
For work in human resources resulting in strong partnerships with customers in the development of a recruiting plan that emphasizes excepted service appointing authorities

Michael J. Buttigieg
For significant performance, creativity and substantial initiative in providing aero-mechanical design solutions in support of the Agency

Gemma V. Flores
For outstanding leadership in creating reliable facilities, energy efficient buildings, collaborative work spaces and a highly productive work environment

Susan D. Moreno
For making a significant impact through her innovative and analytical approach to the Flight Demo Capability program at Armstrong

Deleena M. Noble
For contributions to NASA's knowledge base in aerospace vehicle simulation

AFRC2016-0261-60 **NASA/Ken Ulbrich**

Michelle Haupt, second from right, accepts a NASA Group Achievement Award for the NAMIS audit team from McBride, far right. Also pictured are Troy Asher, far left, and Stoliker, second from left.

AFRC2016-0261-61 **NASA/Ken Ulbrich**

Ed Haering, second from right, accepts a NASA Group Achievement Award for the Adaptive Compliant Trailing Edge project team from Center Director David McBride, far right. Also pictured are Dennis Hines and Stoliker.

Jacob R. Schaefer
For excellent engineering achievement in controls, dynamics and flight research

Winter Preciado
For outstanding support, expertise and initiative as a reimbursable resources analyst in making substantial improvements in that area of Armstrong

IceBridge

Mission documents changes in polar ice

NASA/John Sonntag

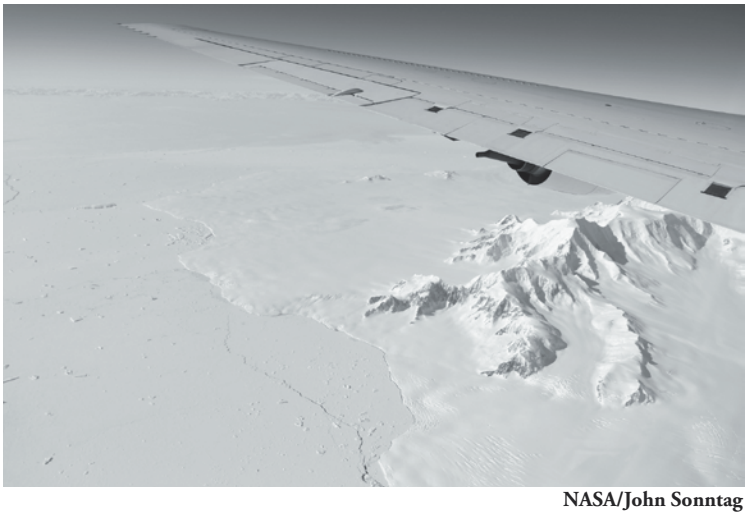
The majestic mountains of northern Alexander Island in the Antarctic Peninsula are captured during an Operation IceBridge mission. The curious feature near the floor of the valley at center may be a small patch of fog, or it may be an avalanche in progress.

By Maria-José Viñas
NASA's Earth Science News Team

A team of scientists and a sophisticated instrument suite traveling on NASA's DC-8 are studying ice for an eighth straight year through surveys of Antarctica. The mission is called Operation IceBridge and it documents how polar ice is evolving in an ever-changing environment.

The information IceBridge has gathered in the Antarctic, which includes data on the thickness and shape of snow and ice, as well as the topography of the land and ocean floor beneath the ocean and the ice, has allowed scientists to determine that the West Antarctic Ice Sheet may be in irreversible decline. Researchers have also used IceBridge data to evaluate climate models of Antarctica and map the bedrock underneath Antarctic ice.

IceBridge completed the first research flight of its 2016 Antarctic campaign Oct. 14 and will continue through Nov. 19. The mission is based in Punta Arenas, a city at the southern tip of Chile. From there, IceBridge is making 12-hour flights back and forth to Antarctica, covering most of the western section of the frozen continent – the region that is experiencing the fastest changes and is Antarctica's biggest contributor to sea level rise.



NASA/John Sonntag

The mountains of northern Alexander Island in the Antarctic Peninsula, passing under the left wing of the DC-8 aircraft Oct. 14.

"We have 46 flight lines to choose from this year," said John Sonntag, IceBridge mission scientist. "If we're lucky – the weather is very tricky in Antarctica – we'll fly around half of them for 300 flight hours."

IceBridge's flights mostly revisit areas flown in previous years to monitor how the ice has evolved since the last time it was measured. There are some variations and additions to this year's plans. IceBridge intends to carry out a new flight in the Bellingshausen Sea that will mimic some of the tracks that an upcoming NASA satellite mission – the Ice, Cloud and land Elevation Satellite-2, or ICESat-2 – will follow. The data collected during this flight will help calibrate ICESat-2's future measurements.

The IceBridge missions have provided good coverage of the sea ice cover in the Weddell and Bellingshausen seas, said Nathan Kurtz, IceBridge's project scientist and a sea ice researcher at NASA Goddard Space Flight Center.

For land ice, IceBridge has adjusted some of its planned

IceBridge, page 11

Optimal position

Spanwise Adaptive Wing idea could lead to new efficiencies

By Matt Kamlet
Armstrong Public Affairs

NASA is exploring the feasibility of a system that will allow part of an aircraft's wing to fold in flight to increase efficiency through wing adaptation.

Engineers at Armstrong, Langley Research Center and Glenn Research Center are working on the Spanwise Adaptive Wing concept, or SAW. The concept, if feasible, would permit the outboard portions of the wings to move to the optimal position during operation. This could potentially result in an increase in efficiency by reducing drag and increasing lift and performance.

Through advanced actuation SAW aims to use control surfaces to allow the outboard portions of wings to adapt as much as 75 degrees to optimally meet the demands of the various conditions throughout a flight. A mechanical joint, acting as a hinge line for rotation, makes the freedom of movement possible.

"Ideally, we would be able to take that portion of the wing, and articulate it up or down to the optimal flight condition that you're in," NASA Armstrong principal investigator for SAW Matt Moholt said. "So let's say you're in a condition that requires a climb-out. The optimal position might be up 15 degrees or down 15 degrees, and you would be able to get that."

The ability to achieve an optimal wing position for different aspects of flight may also produce enough yaw control to allow for rudder reduction on subsonic and supersonic aircraft, which may provide additional benefits to aircraft efficiency, such as reduced drag and weight.

Folding-wing capabilities have been around for decades. However, wing-folding articulation or shaping, has generally been used as a method for the conservation of deck space on aircraft carriers and aircraft storage areas. NASA is looking at ways to apply these methods to aircraft in flight, for the advancement of aviation. While the XB-70 Valkyrie examined wing articulation 50 years ago, modern actuator technology makes it possible to explore deeper into its potential benefits, says Moholt.

NASA

The objectives of testing on PTERA include the development of tools and vetting of system integration, evaluation of vehicle control law and analysis of SAW airworthiness to examine benefits to in-flight efficiency.

"We are revisiting folding-wing aircraft because new technologies that did not exist in the 1960s allow actuation to be put in tighter wings, in smaller volumes," said Moholt. "Now you can articulate a very small, thin air foil, whereas before the actuator technology didn't exist."

The increase in the size of aircraft, including the integration of higher aspect ratio wings, has made wing articulation more practical in areas of heavy aircraft ground operation. Moholt says NASA seeks to examine the feasibility of unlocking further benefits from the technology, by applying it to flight. This testing is made possible, he says, through the use of advanced actuators.

"Some wings are so long that to clear infrastructure they have to fold on the ground. If we're going to be articulating wings, let's explore the use of an advanced actuator that could enable them to articulate in flight as well, then you can really put the wing in an ideal setting," said Moholt. "Further, why just take the ground benefit of it? Let's see if there's a flight benefit of it as well."

Advanced actuation could make possible a design that is both compact and lightweight, minimizing stress on the wing and allowing for more compact packaging. Conventional systems have proven to be heavy, bulky systems, too large for practical use on an aircraft. These have included gear boxes and hydraulic, pneumatic or magnetic motors. NASA engineers believe actuator technology has advanced and may be dramatically reduced in size and weight.

Additionally, these solid-state actuators can be driven by an all-electric mechanism, contributing to NASA's goal of exploring the benefits of low-carbon propulsion under the agency's Aeronautics Research Mission Directorate.

Moholt says that the benefits of wing articulation span across several regimes, from taxiing on the ground, to take off, to cruise and even to supersonic flight.

"In supersonic flight, yaw stability becomes a big issue," said Moholt. "If you're flying supersonically, you have tons of lift. Let's say you need more yaw control. Well, if I fold the wing portion all the way down, I may be able to trade lift in favor of more yaw control where I need it and less lift where I don't need it."

The concept may be flight tested on the subscale Prototype-Technology Evaluation and Research Aircraft, or PTERA, as early as spring 2017. Concept research will be augmented by ground tests of much larger actuators, capable of relevant scale wing actuation. The objectives of testing would include the validation of tools and vetting of the system's integration, vehicle control law evaluation, and analysis of SAW's airworthiness and potential benefits to in-flight efficiency.

PTERA, developed by Area-I of Kennesaw, Georgia, is an ideal test platform because it is outfitted with full research instrumentation. The research vehicle gives the team a chance to apply real air loads in a real air environment to vet the control system.

SAW is a collaboration between NASA, The Boeing Company and Area-I, and is part of NASA's Convergent Aeronautics Solutions' (CAS) activities for rapid feasibility assessment. CAS is a project under the agency's Transformative Aeronautics Concepts Program.

AFRC2016-0174 NASA/Lauren Hughes

Two waves totaling 78 students had internships at Armstrong. The first row, from left, included Mandy Ledford, Melanie Thatcher, Jeffrey Salazar, Jason Tran, Caitlin Kennedy, Dana Coppernoll-Houston, Amanda Roberts, Kyle Fong, Deborah Jackson, Kelley Hashemi, Nazneen Peracha, Joyce Le, Russel Manalo, Jonathan Lokos and Miranda Pickett. In the back row, from left, are Jacob Terry, Louis Edelman, Joshua Tanon, Kyle Lanni, Zachary Hewitt, Anthony Olguin, Troy Kuhns, Harrison Pauer, Emerson Baker, Alexander Franco, Mohammad Reza and Kyler Stephens.

Students

... from page 8

of academia from current high school and graduating high school students, undergraduates, masters' students and doctoral students. These student opportunities were funded through 13 different sources allowing them to intern at Armstrong for a hands-on science, technology, engineering and mathematics, or STEM, experience.

Students had the opportunity to engage with NASA mentors, other students and be a part of NASA's mission. Activities during the summer session, such as tours and brown bag seminars, also were designed to enhance experiences for students at the center and assist in career development.

Future teachers explore material

AFRC2016-0239-5 NASA/Lauren Hughes

California State University student Jazmyne Bartee holds a plane she built while learning about the three axes and control surfaces for aircraft.

By Barbie Buckner
Texas State University, NASA Armstrong

Future educators learned about NASA education resources and practiced using these resources to teach students at a MUREP Education Institute, MEI, workshop held June 13 through June 17 by Armstrong's Office of Education.

Presented through NASA's Minority University Research and Education Program, or MUREP, the MEI institute gathered 47 future educators and current faculty representing six minority-

Education, page 11

AFRC2016-0159 NASA/Lauren Hughes

A contingent of 78 students participated in internship opportunities. Front row, from left, are Brendan Holland, Emma Neal, Kayla Shy, Carley Reta, Annalise Giuliani, Kira Headrick, Logan Francisco, Ethan Czuppa, Ariel Prabawa, Ethan Purtee, Rachel Haering, Trevor Sattler, Maria Stone, Kylie Vandenson, Alex QuyenVo, Sarah Mace-Rodon, Emma Ruano, Jessyca Berman, Kyria Luxon, Emma Kleiner and Lakirah Walker. In the second row, from left, are Jackson Wright, Alex Flock, Wyman Smith, Samuel Jimenez, Jennifer Briggs, Joshua Peterson, Dante Duran, Haley Stumvoll, Barkha Scherp, Lydia Hantsche, Sean Luna, Thomas Noel, Rosio Reyes, Margaret Dube, Andrew Smith, James Hamory, Thomas Musgrove, Shelby Pfeifer and Jonathan Adams. The third row includes Loren Newton, Juan Alvarez, Kevin Williams, William Machemer, Mason Bivens, John Bodylski and Noah Edwards.

Students learn on the job at Armstrong

Summer is a break from school and studying for a number of students. However, more than 100 trainees used the time to get ahead in a potential future career.

The NASA Armstrong Flight Research Center Office of Education hosted 78 student interns this past summer, who worked in 13 organizations across the center. More than 30 percent of the summer workers come from a minority serving institution and 40 percent of the total awardees were women.

In addition, the Armstrong Office of Human Resource Management and Development hosted 25 Pathways students. Pathways is an agencywide student internship program that provides opportunities for consideration for federal employment.

The students represented a wide range

Students, page 9

AFRC2016-0239-5 NASA/Lauren Hughes

Pathways coordinator Rene Holland is in the first row. Row two includes, from left, Kumaar Ramia, Neil Malik, Marshall Murphy, Lenny Gartenberg, Karter Rohrer, Azzam Tabbal, Andrew Burrell, Jack Ly and Nicholas Pontius. In the back row, from left, are Kassidy McLaughlin, Breanna Hanson, Rachel Saltzman, Jillian Boetsch, Cynthia "Marie" Rose, Shideh Naderi and Rebecca Richardson.

Armstrong research recognized

NASA Armstrong research resulted in technical publications.

May

Trong T. Bui, Seung Y. Yoo, Christian A. Garcia, Christopher R. Acuff and Andrew I. Burrell collaborated on, "Computational Fluid Dynamics Study of Nozzle Plume Effects on the Tail Shock of a Supersonic Aircraft," an ITAR meeting paper presented at the 35th Joint Army-Navy-NASA-Air Force Exhaust Plume and Signatures Joint Subcommittee Meeting, Newport News, Virginia, May 16-20.

Michael Frederick and James W. Fenbert co-authored, "Feasibility Study on using an F-15 Airplane for Supersonic Towing of a Sub-scale Shaped Sonic Boom Configuration," ITAR; U.S. government agencies only; SBU; NASA/TM-2016-218957.

June

Ricardo Arteaga, Robert Kotcher, Moshe B. Cavalin and Mohammad Dandachy collaborated on, "Application of an ADS-B Sense and Avoid Algorithm," AIAA-2016-3651, prepared for presentation at the AIAA Aviation 2016 Conference, Washington, District of Columbia, June 13-17.

Trong T. Bui wrote, "Analysis of Low-Speed Stall Aerodynamics of a Swept Wing with Seamless Flaps," AIAA-2017-3720, prepared for presentation at the 34th AIAA Applied Aerodynamics Conference, Washington, District of Columbia, June 13-17.

Larry J. Cliatt II, Michael A. Hill and Edward A. Haering Jr. co-authored, "Mach Cutoff Analysis and Results from NASA's Farfield Investigation of No-boom Thresholds," AIAA-2016-3011, prepared for presentation at the 22nd AIAA/CEAS Aeroacoustics Conference, Lyon, France, May 30-June 1.

Stephen B. Cumming, Mark S. Smith, Aliyah N. Ali, Trong T. Bui, Joel C. Ellsworth and Christian A. Garcia collaborated on, "Aerodynamic Flight Test Results for the Adaptive Compliant Trailing Edge," AIAA-2016-3855, prepared for presentation at the AIAA Aviation 2016 Conference, Washington, District of Columbia, June 13-17.

Larry D. Hudson and Craig A. Stephens co-authored, "NASA Aeronautics Research Mission Directorate Hypersonics Project Materials and Structures Discipline: Carbon SiliconCarbide Ruddervator Subcomponent Test Article Final Report," ITAR, NASA/TM-2016-218477.

Mark S. Smith, Trong T. Bui, Christian A. Garcia and Stephen B. Cumming collaborated on, "Longitudinal Aerodynamic Modeling of the Adaptive Compliant Trailing Edge Flaps on a GIII Aircraft and Comparisons to Flight Data," AIAA-2016-3703, prepared for presentation at the AIAA Aviation 2016 Conference, Washington, District of Columbia, June 13-17, 2016.

July

Chan-gi Pak wrote, "Unsteady Aerodynamic Force Sensing from Strain Data," a journal article for publication in an AIAA journal.

Kurt V. Papathakis, Kurt J. Kloesel, Yohan Lin, Sean Clarke, Jacob J. Ediger and Starr Ginn collaborated on, "Design and Development of a 200-kW Turbo-electric Distributed Propulsion Testbed," AIAA-2016-4611, prepared for presentation at the 52nd AIAA/SAE/ASEE Joint Propulsion Conference, Salt Lake City, Utah, July 25-27.

Timothy K. Risch wrote, "User's Manual: Routines for Radiative Heat Transfer and Thermometry," NASA/TM-2016-219103.

September

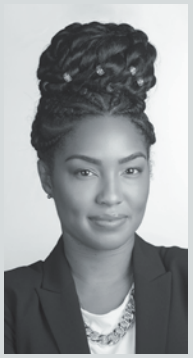
Wesley Li and Tony Chen authored,

Research, page 11

AFRC2016-0287-2 **NASA/Lauren Hughes**

Best in the (far) west

The Federal Laboratory Consortium for Technology Transfer's (FLC's) Far West Region has honored two technologies developed at Armstrong and an individual as its top representative.



NASA's Towed Glider Air-Launch System received FLC's Outstanding Technology Development award. Gerald Budd, at top, receives the honor from Center Director David McBride.

Also recognized was NASA's Sense-and-Avoid System with ADS-B Avionics for Unmanned Aerial Systems, which received the Outstanding Commercialization Success award. Below, Ricardo Arteaga receives the award from McBride. Arteaga's partners on the project include Kraettli L. Epperson of Vigilant Aerospace Systems and Robert Heard of Cimarron Capital Partners.

Janeya Griffin, at right, was honored as the FLC Far West Laboratory Representative of the Year 2016.

AFRC2016-0287-1 **NASA/Lauren Hughes**

IceBridge... from page 6

flights to allow scientists to better understand rapidly changing areas that are still relatively unexplored, such as the Smith, Pope and Kohler glaciers and the Getz Ice Shelf. For flights elsewhere in Antarctica, the IceBridge team is also coordinating with a group of scientists from the British Antarctic Survey, who will also be conducting aerial surveys of West Antarctica in some of the areas that IceBridge studies.

"We're interested in knowing the differences between our radar and laser systems and theirs and making best use of finite flight time," said Joe MacGregor, IceBridge's deputy project scientist and a land ice researcher at Goddard. "If we fly portions of their flights, we'll be able to compare the data and collaborate in our efforts to understand the future of the West Antarctic Ice Sheet. If we fly in between their tracks, then the combination of our datasets and theirs can produce a more complete picture of a changing Antarctica."

This campaign's flights are again conducted aboard NASA's DC-8 airborne science laboratory, which allows the mission to carry its full instrument suite. The main instrument is a laser altimeter that records minute changes in the height of the ice surface from one year to the next. Accompanying the laser are three radars that analyze the elevation and layer composition of the snow and ice, as well as the shape of the land underneath, and a high-resolution camera system. The DC-8 also carries a gravimeter and magnetometer that measure small variations in gravity and the Earth's magnetic field to map the ocean cavity underneath Antarctica's ice edges, which is essential for improving understanding of how the ice and ocean interact. For the first time in the Antarctic, IceBridge will also be using an infrared camera to measure the surface temperature of the ice.

A high school teacher from Colorado, a handful of professors and students from Universidad de Magallanes, Chile, and several media teams, among other visitors, will be flying with IceBridge during the Antarctic campaign.

Operation IceBridge's mission is to collect data on changing polar land and sea ice and maintain continuity of measurements between ICESat missions. The original ICESat mission ended in 2009, and its successor, ICESat-2, is scheduled for launch in 2018. Operation IceBridge is currently funded until 2019. The planned overlap with ICESat-2 will help scientists validate the satellite's measurements. NASA Wallops Flight Facility provided the laser altimeter and the infrared camera for IceBridge's 2016 Antarctic spring campaign. The DC-8 research aircraft's home base is at NASA Armstrong. IceBridge's three radar instruments come from the Center for Remote Sensing of Ice Sheets at the University of Kansas, while NASA Ames Research Center provided the Digital Mapping System and Columbia University manages the gravimeter and magnetometer onboard.

Education... from page 9

serving institutions located in California and Arizona.

The future educators visited NASA Armstrong's hangars, mission control rooms, subscale flight research lab, life support facilities and fiber optic sensing systems lab. Armstrong's subject matter experts, including Chief Scientist Al Bowers, Aircraft Maintenance Chief Tom Grindle, and Meteorologist Luke Bard, gave participants an overview of Armstrong's current projects and NASA's agency-wide initiatives.

Molly Alexander, a student teacher at California State University San Marcos, said the Armstrong facilities tour improved her understanding of NASA's work in science, technology, engineering and mathematics, or STEM, subjects.

"The NASA tour helped me to better understand how STEM careers are needed for NASA Missions," she said.

The institute participants also planned and taught STEM-focused lessons for students at the local YMCA and Boys and Girls Club in Lancaster.

Ellen Dale, a University of Arizona student teacher, said she realized how her work showing students where to find NASA resources could contribute to the agency's upcoming projects.

"My big ah-ha moment happened when I made the connection that I will educate the future engineers who one day will make impacts at NASA," she said.

After the workshop, participants wrote thank-you letters to the NASA experts who spoke to them about what they do for NASA and how important a STEM education was for their careers.

"Your work exemplifies creativity, innovation and determination, and I am eager to share what I have learned about these qualities from you with my students," wrote Jessica Bhatt, a CSU San Marcos student teacher, in a letter to Al Bowers.

Research... from page 10

"VIPR III VADR SPIDER Structural Design and Analysis," NASA/TM-2016-219166.

October

Chan-gi Pak authored, "Unsteady Aerodynamic Force Sensing from Measured Strain," a meeting paper presented at the 30th Congress of the International Council of the Aeronautical Sciences (ICAS), Daejeon, Korea, Sept. 25-30.

Crawford, former Armstrong electrician, passes

Timothy Hugh Crawford, a former Lockheed Martin electrician at Armstrong (then Dryden) in the shuttle area for more than two decades died July 6. He was 69.

He worked as an electrician for several large contractors such as General Dynamics (Egypt), GE, RCA, Martin Marietta and Lockheed Martin at NASA, where he was dedicated to the space shuttles, the shuttle area and the shuttle recovery team.

The Space Shuttle Program held a special place in his heart. According to friends and family, He would always say, "We are part of history. This is a first and this time will never come again." He took great pride in being part of this experience.

Crawford is described by friends and family as having a very charismatic personality. He enjoyed people and could make conversation with anyone.

Jensen, former budget analyst, dies

Doug Jensen, a former Armstrong (then Dryden) resources analyst, passed away on Aug. 10. He was 71.

Before he retired in January 2007, he worked in the chief financial officer organization.

Friends and family described Jensen as a man of kindness and integrity who always had a joke or pun. He also shared his photographs of people, flowers, scenery and wildlife.

Matthew... from page 1

The "swaths" are about 30 miles (48 kilometers) wide. The temperature of the upper atmosphere above Matthew's core was proportional to the storm's intensity – the higher the temperature over the core relative to the environment, the more intense the storm.

The HAMSR data was overlaid atop a ground-based radar image and satellite visible image. Warm areas without clouds and very cold areas representing scattering due to ice in the atmosphere and heavy precipitation were detailed.

The aircraft also carried a dropsonde system developed by the National Center for Atmospheric Research and the NASA Goddard Space Flight Center managed High Altitude Imaging, Wind and Rain Profile instrument.

As the Global Hawk prepared to return home, it captured one last look inside Matthew's spiral cloud bands. Red colors showed cloud bands without precipitation, while blue colors showed rain bands. The Global Hawk's location was just past the eye (the red circle in the center of the image).

The data were transmitted in real time via a communications satellite to the ground, where they were immediately processed and shared with the SHOUT scientists, who use them for situational awareness. Images and data were also shared with forecasters at the NOAA/ National Weather Service's National Hurricane Center.

Hurricane forecasters use many different types of data to forecast a storm's intensity and track. NASA satellites and airborne instruments contribute to scientists' understanding of tropical cyclones and help improve forecasts.

Students... from page 2

flight project were exciting.

"They went through the whole process of manufacturing a carbon fiber vehicle and a lot of the R/C (remote control) aircraft testing. Prandtl-M had a number of rough flights before this one. There are so many positive people working on the project that when something didn't go well, we would laugh about it and try something new that now is working."

One student altered her career path as a result of the program.

"I was planning to be a teacher and changed my mind once I had an internship here and found out how fun engineering could be," said Kirsten Fogg, who was an intern and now is an Armstrong operations engineer. "I am also currently in a master's program for engineering."

The designs began last summer with students flying a number of different hand-held carbon aircraft down the halls at the NASA center. The complexity of the aircraft increased as carbon fiber molds were used to create new iterations of the aircraft.

Before the successful test flight, the student crew and their mentors devised a steel construction launcher and tested six different flight vehicle shapes to determine which worked best and use the design for the next flight vehicle.

"We could give them the answers, but we give them the room to make their own discoveries and their own mistakes," said Robert "Red" Jensen, who is the Small Unmanned Aircraft Systems chief pilot and master technician for the Dale Reed Subscale Flight Research Lab.

In addition to developing a Prandtl-M testbed aircraft, groups of students also worked on guidance and navigation, autonomous systems and sensors, said Al Bowers, NASA Armstrong chief scientist and Prandtl-M project manager.

AFRC2016-0212-85 **NASA/Ken Ulbrich**

Derek Abramson, from left, Justin Hall, and Alexander Flock position the Prandtl-M onto the Carbon Cub that drops the research aircraft from 500 feet altitude.

The next steps will be to continue development and integration of the airframe and autonomous systems and meeting the challenges that happen when such systems are incorporated, he added.

With hard work and perseverance, the students believe the Prandtl-M and the systems they helped develop and validate will one day fly the skies of Mars.

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