National Aeronautics and Space Administration

THE ARMSTRONG X-PRESS

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Two first flights aced

Subscale glider flies

By Jay Levine
X-Press editor

The Preliminary Research Aerodynamic Design to Lower Drag, or Prandtl-D, No. 3 aircraft, completed a set of flight tests on Oct. 28.

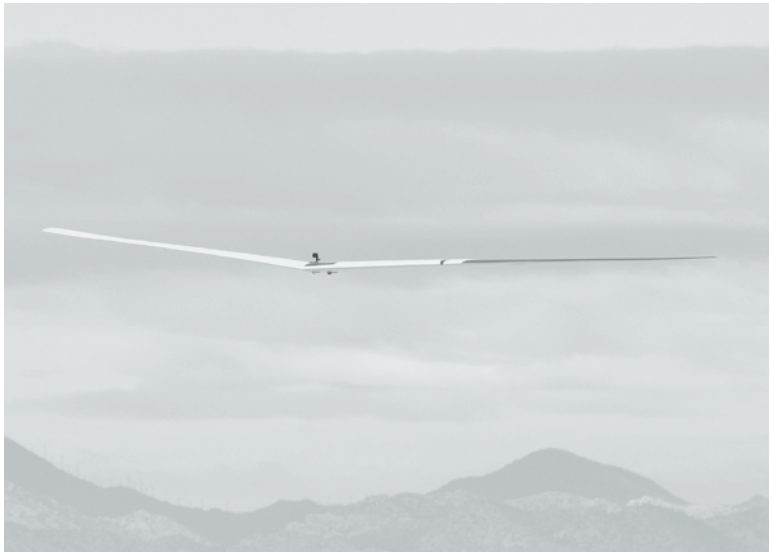
The remotely piloted aircraft gracefully glided following a bungee-like launch during a one minute, 33 second flight.

The Prandtl-D No. 3, which has a 25-foot wingspan, reached an altitude of about 160 feet during the first flight and cruised at 15 mph. Two additional flights resulted in a higher altitude of about 210 feet and a flight lasting two minutes, 55 seconds.

"It flew beautifully," said Albion Bowers, NASA Armstrong chief scientist and Prandtl-D project manager. "This is a slightly different design from the first two Prandtl-D aircraft with the correct twist that we want to optimize the aircraft's efficiency. Next we would like to get the University of Minnesota data-collection system onboard and fly it a few times."

Prandtl-D chief pilot Robert "Red" Jensen explained the

Prandtl-D, page20



ED15-0330-79 **NASA/Lauren Hughes**

NASA Armstrong's Prandtl-D No. 3 research aircraft made its first flight on Oct. 28.

ED15-0325-20 **NASA/Jim Ross**

NASA Armstrong's PTERA remotely piloted research aircraft made its first flight on Oct. 22. All flight test objectives were met.

PTERA is a success

By Peter W. Merlin
Armstrong Public Affairs

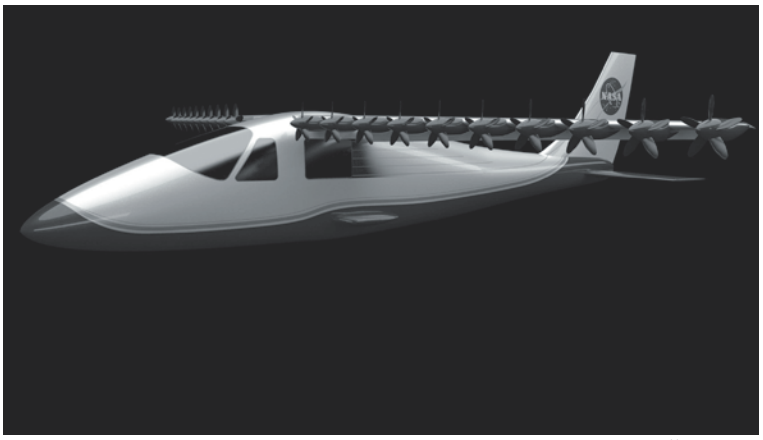
Armstrong researchers and Area-I Inc. of Kennesaw, Georgia, successfully conducted the maiden flight of a remotely piloted test bed for cutting edge aviation and space technologies Oct. 22. The Prototype-Technology Evaluation and Research Aircraft (PTERA) is a versatile flying laboratory bridging the gap between wind-tunnel experiments and crewed flight-testing.

All first flight test objectives were successfully accomplished according to team members from Armstrong's Dale Reed Subscale Flight Research Lab and Area-I. In 2012, the company flew the PTERA's sister ship at Middle Georgia State University's Eastman Campus. The maiden flight of Armstrong's PTERA followed two weeks of training and ground testing. The aircraft was flown under radio control by Area-I lead PTERA pilot

PTERA, page 12

NASA illustration

The D8 Series future aircraft design concept, nicknamed the Double Bubble, would be used for domestic flights and is designed to fly at Mach 0.74 carrying 180 passengers 3,000 nautical miles. This concept may be explored as part of the X-plane CAS sub-project.



NASA illustration

Under the Scalable Convergent Electric Propulsion Technology Operations Research (SCEPTOR) project, NASA plans to modify a Tecnam P2006T to explore the system level impacts of distributed electric propulsion.

Aeronautics's future

Armstrong hosted CAS Showcase

By Peter W. Merlin
Armstrong Public Affairs

Researchers from several NASA centers had an opportunity to share information about revolutionary new technologies at the Convergent Aeronautics Solutions (CAS) Showcase held at Armstrong on Oct. 22.

The CAS project, which funds NASA researchers for short-duration (2-3 years) activities, is part of NASA's Transformative Aeronautics Concepts Program (TACP). TACP provides an environment for researchers to experiment with new ideas, and to perform ground and small-scale flight tests that allow them to learn from failure but also to drive rapid turnover into potential future concepts that can transform commercial aviation and unmanned aircraft systems (UAS).

Aeronautics research challenges identified by NASA include global demand for mobility, significant energy and sustainability changes, and ongoing air-travel affordability. The research topics presented at the showcase are designed to converge innovation in aeronautics and non-aeronautics industries in order to address these problems. NASA principal investigators are leading CAS sub-project teams from Armstrong (AFRC); Glenn Research Center (GRC), Cleveland, Ohio; Langley Research Center (LaRC), Hampton, Virginia; and Ames Research Center (ARC), Moffett Field, California.

NASA illustration

In one CAS sub-project, a computer model will simulate and predict how an aircraft or its individual components are affected by aging and ongoing operations such that a "digital twin" of a particular airplane can be created. This could help predict when problems might arise in order to prevent them from developing.

The CAS sub-projects briefed at the showcase were:

• High Voltage Hybrid Electric Propulsion (led by GRC): Studies whether lightweight, efficient power distribution systems could replace petroleum fueled aircraft propulsion systems.

• Learn to Fly (led by LaRC): Explores whether aerodynamics modeling, adaptive controls, computers and sensors can shave years and dollars off designing, building, testing and certifying new aircraft.

• Multifunctional Structures for High Energy Lightweight Load-Bearing Storage (led by GRC): Evaluates whether it's possible to use nanotechnology to create aircraft structures that can also store electrical power.

• Digital Twin (led by LaRC): Explores developing a computer model that can more accurately predict how a future aircraft will perform over time, possibly accelerating its certification while still assuring safety and reliability.

• Autonomy Operating System for Unmanned Aerial Vehicles (led by ARC): Researches building a prototype open-standard platform that can verify and certify reusable soft-

Showcase, page 7

Kiriokos wins SFA Award

NASA Armstrong's aviation ground safety officer Nick Kiriokos recently was recognized with a Space Flight Awareness Award for his involvement in the Space Shuttle Program. The SFA Honoree Award is one of the highest and most prestigious awards available to employees of the NASA and industry human spaceflight team, recognizing their dedication to quality work and flight safety.

Kiriokos supported 20 space shuttle landings at Armstrong (then Dryden). He also had a role in 77 launches in case the shuttle needed to make an emergency landing on the Edwards Air Force Base runway. He staffed and operated the Crew Transport Vehicle and the Vehicle Integration Test Team trailer.

On missions that landed here, he had a number of roles including support of convoy runway operations involving crew extraction, flight crew post flight walk-around and transport to the Post Flight Support Facility. He also worked with Air Force airfield operations for Astronaut Office support and crew transport back to Johnson Space Center, Houston. Kiriokos assisted Johnson and Kennedy Space Center, Florida, personnel with equipment and logistics during shuttle data download. Between shuttle missions, he took part in emergency training.

ED15-0226-1 NASA/Lauren Hughes

Center Director David McBride, left, presents Nick Kiriokos with a Space Flight Awarewness Award.

Key highlights of the shuttle missions he worked on include the first flight of Space Shuttle Endeavor, two lakebed landings, the first International Space Station

SFA Award, page 6

WIA announce awardees

The Women in Aerospace organization recognized Arcata Associates photographer Carla Thomas and educator Kathleen Fredette.

Women in Aerospace celebrated its 30th anniversary Oct. 22 with an event in Arlington Virginia. Thomas and Fredette were each awarded the only WIA 30th Anniversary Commemorative Awards.

Thomas was recognized for her outstanding photographic skills and for acting as a role model for girls and young women in aerospace.

NASA Armstrong chief pilot David Nils Larson wrote a nomination letter about her excellence.

WIA, page 14

NASA/Tony Landis

Carla Thomas flies in the backseat of the F/A-18 aircraft and many other aircraft as part of her work as an aerial photographer.

News at NASA

Elachi plans retirement

Charles Elachi, the director of the Jet Propulsion Laboratory in Pasadena since 2001, is retiring at the end of June 2016. He will become professor emeritus at the California Institute of Technology, where he currently serves as a vice president and professor of electrical engineering and planetary science.

Elachi began his career at JPL in 1970. For 45 years, he has been an active researcher and science investigator on a number of space exploration missions and projects. He has authored more than 230 publications in the fields of active microwave remote sensing and electromagnetic theory, and he holds several patents in those fields. He taught the physics of remote sensing at Caltech from 1982 to 2001.

In 1988, the Los Angeles Times selected Elachi as one of "Southern California's rising stars who will make a difference in L.A."

JPL has achieved much in his tenure as director and he told employees the future also looks bright.

Originally from Lebanon, Elachi attended university in France. In the late 1960s, he moved to California to continue his graduate studies at Caltech. He holds several degrees in science, engineering and management. In 2006, U.S. News &World Report and the Center selected him as one of America's Best Leaders for Public Leadership at Harvard University's Kennedy School of Government.

NASA honors people, teams

The NASA Honor Awards for Armstrong employees was Aug. 21 and included 31 individual awards and seven group awards.

Distinguished Service Medal

William L. Ko

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

Outstanding Leadership Medal

Starr R. Ginn

For demonstrating highly effective leadership in strengthening Armstrong's aeronautics research program

Patrick M. Lloyd

For exceptional service as an aerospace technician and crew chief on several unique, highly modified aircraft and aerospace vehicles at Armstrong

Heather A. Maliska

For exemplary leadership of the first-ever, unmanned air system flight test significantly advancing the operational performance for integration into the national air system

ED15-0257-68 **NASA/Ken Ulbrich**

Heather Maliska, center, accepts a NASA Group Achievement Award for collaborative flight test of next generation collision avoidance and self-separation logic for unmanned aircraft systems from Deputy Director Patrick Stoliker, left, and Center Director David McBride.

ED15-0257-69 **NASA/Ken Ulbrich**

John Ryan, center, accepts a NASA Group Achievement Award for the development of a highly effective peak seeking control algorithm from Stoliker, left, and McBride, right.

ED15-0257-70 **NASA/Ken Ulbrich**

Mark Skoog, center, accepts a NASA Group Achievement Award for the development of an improved Ground Collision Avoidance System from Stoliker, left, and McBride, right.

Dana D. Purifoy

For sustained high performance both as a pilot across mission directorates and for continuous improvement of research aircraft and Flight Operations policies and practices

Mauricio A. Rivas

For outstanding leadership of the Ikhana Unmanned Aerial System (MQ-9 Predator B) Project team in the safe completion of several challenging missions of national importance

Alan P. Wallace

For outstanding leadership in the establishment of the Quality Inspection Branch within the Aircraft Operations Directorate

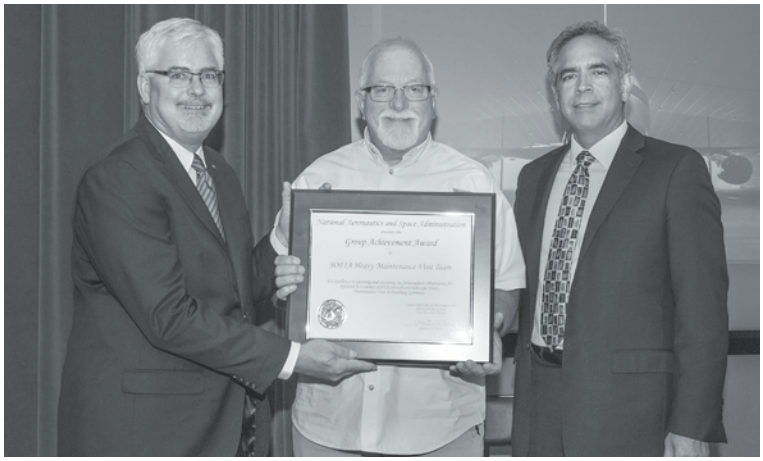
Outstanding Public Leadership Medal

Richard Shetter

For sustained support to strengthen and modernize NASA's Airborne Science Program assets and capabilities through engineering management, training, and outreach

ED15-0257-71 NASA/Ken Ulbrich

Steven Foster, center, accepts a NASA Group Achievement Award for harnessing NASA's Strategic Plan and applying it at the tactical level commensurate to Armstrong's mission from Stoliker, left, and McBride, right.



ED15-0257-69 NASA/Ken Ulbrich

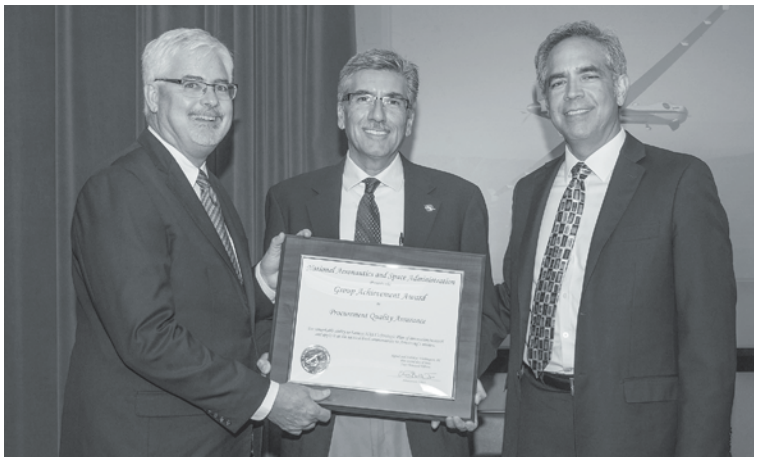
Arvid Knutson, center, accepts a NASA Group Achievement Award for excellence in planning and executing the SOFIA aircraft and telescope heavy maintenance in Hamburg, Germany, from Stoliker, left, and McBride, right.

Exceptional Service Medal

Cynthia A. Brandvig
For continued and consistent outstanding support to the NASA OCFO and Aeronautics projects contributing to the success of AFRC institutional and programmatic missions

Young C. Choi
For outstanding technical expertise during instrumentation buildups of many complex NASA Armstrong projects; Choi has been the go-to technician at AFRC for many years

Patricia R. Daws
For sustained, high-impact performance in business management and skillfully guiding the SOFIA Program through budgetary/schedule challenges into the full operations phase



ED15-0257-73 NASA/Ken Ulbrich

John Del Frate, center, accepts a NASA Group Achievement Award for first deployment of the Ikhana unmanned aerial system from Stoliker, left, and McBride, right.

ED15-0257-74 NASA/Ken Ulbrich

Steve Schmidt, center, accepts a NASA Group Achievement Award for the Center Redesignation Committee's devotion and can-do attitude ensuring a flawless celebration from Stoliker, right, and McBride, left.

Jan E. Purifoy
Her exceptional contributions to the Airborne Science Program have resulted in expansion of critical capability and capacity of NASA's Earth Science mission

Steven E. Spandorf
For exceptional service in Egress/Life Support, displaying both technical and professional skills

Edmund K. Swan
For outstanding technical and managerial leadership in the Experimental Fabrication Branch at the Armstrong Flight Research Center in support of the Agency's programs

NASA Awards, page 6

NASA Awards... from page 5

Exceptional Public Service Medal

Michael R. Yandell

For outstanding public service in the area of structural analysis and flight vehicle airworthiness

Exceptional Public Achievement Medal

Joseph C. Walters

For exceptional public achievement in supporting NASA Armstrong Simulation capability and advancement in significant improvements to key real-time Linux simulation equipment

Silver Achievement Medal

Keith A. Day

For outstanding dedication, teamwork, and integrity as a senior aerospace engineering technician assigned to the Experimental Fabrication Branch

Exceptional Engineering Achievement Medal

Phillip J. Hamory

For exceptional engineering achievement in development of the adaptive Wavelet Algorithm for Fiber Optic Sensing System to process data with variable spatial resolution

Exceptional Technology Achievement Medal

Anthony Piazza

For exceptional achievement in developing instrumentation and attachment techniques for thermal and mechanical testing of aerospace structures

Equal Employment Opportunity Medal

Keri L. Eliason

For exceptional leadership of the Equal Employment Opportunity office at AFRC leading to greatly improved opportunities and support for Armstrong employees

Exceptional Achievement Medal

Manuel P. Castro

For exceptional technology achievement in supporting NASA Armstrong simulation capability and advancement resulting in significant improvements of key simulation equipment

David K. Tow

For exceptional achievement in the development of encrypted and digitized flight termination coding technology resulting in Armstrong's Enhanced Flight Termination System

Duc N. Tran

For excellence in achievement on the ACAS-Xu Project and exceptional contributions in the promotion of Unmanned Aircraft Systems in the National Airspace System

Ronald Young

For outstanding leadership of the Flight Opportunities Program and cultivation of national suborbital technology activities on reusable vehicles

Early Career Achievement Medal

Christopher E. Baker

For outstanding contribution to the Flight Opportunities Program and cultivation of national suborbital technology activities on reusable vehicles

Daniela M. Cruzado

For exceptional performance improving the Agency's property management process which is an area that is vital to the Armstrong mission and to NASA

Jennifer F. Flavin

For exceptional environmental program improvements at the Armstrong Flight Research Center

Davis L. Hackenberg

For exceptional performance, dedication, and natural leadership ability resulting in technology advances across multiple NASA missions greatly benefiting NASA and the nation

Jin S. Oh

For exceptional engineering, project management, and technical leadership in implementing numerous facility infrastructure improvements

Kerri K. Tannert

For outstanding expertise, and logical and analytical ability in developing tracking for a Center contract with a high degree of accuracy at the Armstrong Flight Research Center

Zachary M. Wright

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

SFA Award

... from page 3

construction flights, the first six ISS Expedition flights, John Glenn's return to space and four of the five Hubble servicing missions.

As a member of the life support group he also assisted space shuttle research aircraft operations with the CV-990 shuttle tire and brake research, NB-52 Space Shuttle Drag Chute testing and the Lifting Insulating Foam Trajectory project on NASA's F-15B following the loss of Columbia.

Kiriokos also supported the shuttle program wrap up including Mate-Demate Device deconstruction, shuttle landing systems removal and shuttle warehouse and hangar reutilization. He was involved in the transport and storage of the shuttle rocket boosters to Armstrong for eventual public display.

Moon rocks and meteorites

Certification allows teachers to share space geology

By Leslie Williams
Armstrong news chief, acting

A Lunar and Meteorite Disk Certification workshop was recently held at the NASA Armstrong Office of Education's Resource Center located at the AERO Institute in Palmdale.

Twenty regional teachers participated in a professional development workshop that was presented by Barbie Buckner, education specialist for the center, Maria Chambers, NASA Ames Research Center, Moffett Field, California, education specialist, Peter Merlin, subject matter expert, and education resource center manager Sondra Geddes.

"I loved all of the hands-on activities that participants were able to do together," said Debra Bernacchi, a fourth grade teacher at Cummings Valley Elementary, Tehachapi, California. "Amazing and quite a humbling feeling to know that I was able to see lunar meteorite samples."

The workshop featured lunar disks with moon rock and soil samples brought back from the historic Apollo missions encapsulated in clear Lucite. Teachers engaged in hands-on, standards-based activities while learning about accretion, differentiation, cratering and volcanism.

ED15-0293-077 **NASA/Ken Ulbrich**

Kristy Mar, a teacher at J.H. Hull Middle School in Torrance, California, peers through a microscope to examine moon rocks encapsulated in clear Lucite.

Merlin's presentation on meteorites included his meteorites collection, including a sample from the latest meteorite fall in Russia. He also talked about the Rosetta spacecraft's mission to catch a comet.

Elementary teacher Maria Blue, Emblem Academy, Santa Clarita, California, exclaimed, "This was fantastic. The activities and learning opportunities will be something I can use immediately. I have been inspired. Great Job. Thanks for presenting an entertaining and educational workshop."

With the Lunar and Meteorite Disk Certification, educators can request to borrow the lunar or meteorite disk for use within their classroom. Equipped with activities, students will have access to view and explore small portions of these extraterrestrial materials.

"I learned so much and am excited to use these fun ideas in my classroom. Thank you for sharing your passion with me," said Emily Williams, a kindergarten teacher at Emblem Academy, Saugus, California. Bryan Jacobs, a sixth grade teacher at Sequoia Elementary, Shafter, California, added, "This was a fast moving, constantly changing day. The most interesting teacher development I've attended."

Showcase... from page 2

ware needed to develop smart UAV autonomy apps.

• Aeronautics Autonomy Testbed Capability (led by LaRC): Investigates new approaches for developing a UAS testbed capability that can address a variety of autonomy research questions.

• Mission Adaptive Digital Composite Aerostructure Technologies (led by ARC): Explores the idea of using emerging digital composite manufacturing methods to build an ultra-lightweight, adaptable wing.

• Design Environment for Novel Vertical Lift Vehicles (led by ARC): Demonstrates whether it's possible to apply current conceptual design tools to small and novel vertical lift vehicle designs, and to improve these tools with new technologies for usability, operability and community acceptance.

• X-Plane (led by AFRC): Develops a cost-effective approach to accomplishing flight research with large-scale experimental airplanes to test solutions to technical challenges associated with ultra-efficient, future aircraft designs.

• Scalable Convergent Electric Propulsion Technology Operations Research (led by LaRC and AFRC): Evaluates the impacts of using distributed electric propulsion through a rapid concept-to-flight demonstration of this alternate power source that enhances safety while also reducing costs, noise and emissions.

During the CAS Showcase, TACP Deputy Director Richard Barhydt said the project was off to a great start. He asked attendees to think of ways to push boundaries and develop ideas to overcome barriers, and urged them to start with the hardest problems from a feasibility standpoint.

"We need to think about a multi-discipline, multi-center approach to solve challenging problems," he said, "and be open to the potential that it might not meet (researchers) expectations and objectives."

For each CAS sub-project, team members propose ideas for overcoming key barriers associated with large-scale aeronautics problems. Teams then conduct feasibility studies, perform experiments, try out new ideas, identify failures, and try again. A review determines if the developed solutions have met their goals, established initial feasibility and identified real-world potential. The most promising capabilities are then considered for further development, or direct transfer to the aviation community.

ED15-0333-01 NASA/Lauren Hughes

Center Deputy Director Patrick Stoliker, left, presents the Director Award to Al Bowers, Armstrong chief scientist and Prandtl-D/Prandtl-M project manager.

ED15-0333-04 NASA/Lauren Hughes

Peer Awards host John Saltzman presents the Pride in NASA Award to Armstrong chief pilot David N. Larson.

Peers recognize 2015 standouts

NASA Armstrong Center Director Award
For groundbreaking research with the Prandtl-D and Prandtl-M aircraft.
Al Bowers

Pride in NASA (PIN) Awards
Given in recognition of an employee's example, set through their words and deeds, of what pride is within NASA Armstrong.
David N. Larson

Can-Do Attitude
Recognizes employees who regularly "get the job done" with a positive attitude.
Starla Carroll

Engineer/Scientist/Pilot
Recognizes an employee who applies fundamental principles, develops and tests new technologies or performs other outstanding contributions in their field.
Ethan Baumann

Rising Star
Recognizes an employee who makes critical contributions to NASA Armstrong's mission at an early stage in their career.
Kerri Tannert

ED15-0333-21 NASA/Lauren Hughes

Peer Awards host John Saltzman presents the Teamwork Award to Heather A. Maliska.

Mission Impossible
Recognizes an employee who succeeds using innovation and hard work despite difficult or challenging circumstances.
Lynette Jones

Henry Arnaiz Mentor Award
Recognizes an employee who demonstrates outstanding performance in mentoring new and established employees.
Allen R. Parker

Steven B. David Co-op/ Student Award
Recognizes a student participating in NASA Armstrong's sponsored student program who shows exceptional initiative, cooperation, excellence and exemplary performance during their term at the center.
Shideh Naderi

Supervisor/Manager/Leader
Recognizes outstanding leadership and/or management qualities that deliver exceptional results.
Alan P. Wallace

Technician/Mechanic
Recognizes an employee who exhibits technical expertise, significant performance, enthusiasm, determination and dedication to NASA Armstrong in a technical support area.
Edgar G. Aragon-Torres

Mission Support: Administrative Professional
Recognizes employees who perform exemplary professional administrative work.
Connie Bosworth

Mission Support: Administrative
Recognizes significant contributions in administrative or secretarial support.
Elizabeth Lara

Mission Support: IT Support
Recognizes significant information technology support contributions by an employee

Honor, page 18

ED15-0169-01 NASA/Ken Ulbrich

Armstrong summer students included, front row from left, Dhvani Patel, Yasmin Alkusari, Kelley Hashemi, William Alfano, Kassidy McLaughlin, Madison Washburn, Emily Nichols, Kaixi Wang, Lindsay Flasch, Darian Grisso, Nicholas Horn, Pamela Ruffner, Alexandra Ocasio, Rachael Saltzman, Savannah Shively, Jeremy Germita and Alexander Chen. Middle row from left are Robert Kotcher, Pablo Gonzales, Bryce Doerr, Patrick Sosa, Benjamin Cobleigh, Joaquin Martinez, Ryan Lyau, Rheanna Cowee, Olivia Bosma, Ivan Salazar, William Sitz, Jonathan Zur, Christopher Trumbull, John Freudinger and Karter Rohrer. Back row from left are Jacob Wilson, Benjamin Wright, John Giammarino, Tommy Pestolesi, Loren Newton, Caleb Lloyd.

Students learned on the job

By Jay Levine
X-Press editor

A record number of 115 college and university students assisted 18 NASA Armstrong branches as they gained valuable work experience, while learning to apply theories of the classroom. Students worked at Armstrong through opportunities from the Armstrong Office of Education, Armstrong Human Resources and Jacobs Technology. The students are listed alphabetically in the program in which they participated.

The Armstrong Office of Education provided the work through many internal and external funding sources. The Aerospace Education Research and Operations, or AERO, Institute, and the University Space Research Associates, or USRA, provided the means to recruit and place students.

Armstrong Office of Education students brought on through the AERO Institute and USRA included Christy Ailman, William Alfano, Yasmin Alkusari, Michael Arreola-Zamora, Sipanah Arutyunyan, Nathan Bell, Olivia Bosma and Christopher Bryan.

Also included were Alexander Chen, Tyler Clinkaberry, Benjamin Cobleigh, Rheanna Cowee, Or Dantsker, Bryce Doerr, Louis Edelman, Ana Escalera, Lindsay Flasch, Logan Francisco, John Freudinger, Jeremy Germita, Nicole Gillian, Pablo J. Gonzalez, Darian Grisso, E. Etan Halberg, James Hamory, Nicholas Horn, John Jackson, Saba Janamian, Victoria Jenne, Taylor Jensen, Waqqas H. Khan, David Kloesel, Michael Kloesel, Robert Kotcher, Heather Laffoon, Mandy Ledford, Caleb Lloyd, Jonathan Lokos, Kassidy McLaughlin, Orlando Mielke and William Morris.

Submitted photo

Summer students included, from left, Nicole Gillian, Raziq Noorali, Christian Pereira, Bogdan Pugach, Kira Headrick, Saba Janamian and Michael Kloesel.

In addition were Hussein Nasr, Emily Nichols, Dhvani Patel, Kurt Pauer, Harrison Pauer, Christian Pereira, Tommy Pestolesi, Alex Petrik, Joseph Piotrowski, Bogdan Pugach, Karter Rohrer, Emma Ruano,

Students, page 13

Prandtl-M

Students a big part of research on subscale glider

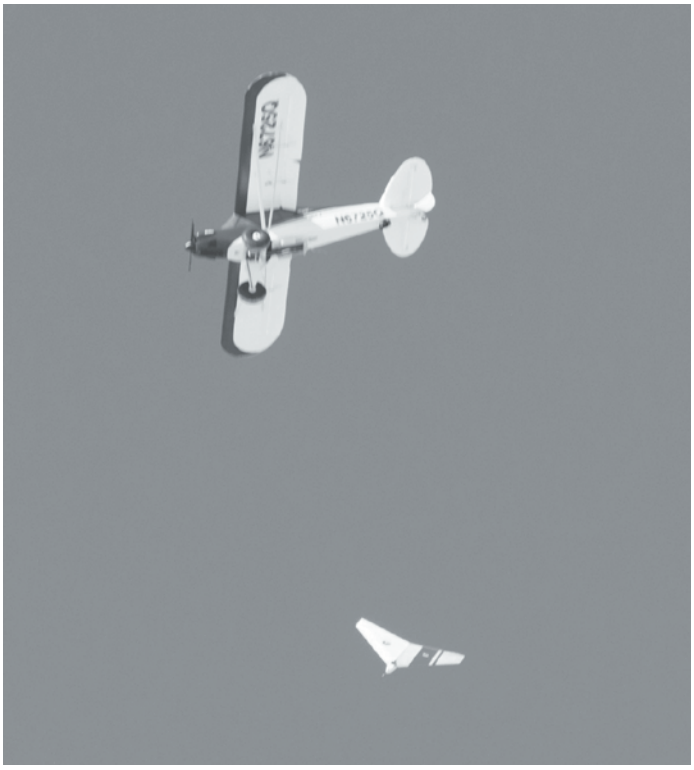
By Jay Levine
X-Press editor

When you're designing an airplane that could one day be the first to fly on Mars, the answer cannot be found in the back of the book.

That's one of many conclusions groups of students in two NASA-funded programs at NASA Armstrong realized this past summer. They worked on the Preliminary Research Aerodynamic Design to Land on Mars, or Prandtl-M aircraft. If the project is ultimately successful, it could collect and transmit valuable information about future Mars landing sites for human exploration.

The students' task was to use the skills learned in school and apply those to a research challenge. The two programs included the NASA Flight Scholars, which focuses on giving community college students an early opportunity to perform research, and the Education Small Unmanned Aerial Systems Center of Excellence, which provides college students an opportunity to work on NASA UAS projects. Both are funded mostly under the Minority University Research and Education Program that highlights minority-serving institutions.

The students started with a boomerang-shaped aircraft constructed of carbon fiber and researched it by flying it down the halls, in a conference room and then in an aircraft hangar. Flights progressed when students agreed on a launch system to obtain consistent results. Those flights allowed a look at the aircraft's aerodynamics before moving on to more complex tests and higher altitudes.



ED15-0248-35 **NASA/Lauren Hughes**

The Prandtl-M flies after release from the Carbon Cub radio-controlled aircraft.

ED15-0248-05 **NASA/Lauren Hughes**

Hussein Nasr, Orlando Mielke and Bogdan Pugach perform final checks on the Prandtl-M flight computer before a flight.

Tests didn't always turn out as expected, but setbacks didn't dampen the students' enthusiasm.

"There is a sense of independence here," said Joseph Piotrowski, a California State University at Long Beach mechanical engineering student. "You have mentors, but they allow you the free will to work on the challenge."

Michael Kloesel, a California State University at San Bernardino chemistry student, was excited.

"We are going to contribute to what may be the first aircraft on Mars," Kloesel said. "This is the best thing ever!"

Raziq Noorali, who studies physics at College of the Desert in Palm Desert, California, said the internship showed him that different skills and viewpoints are needed to solve aspects of the Prandtl-M work.

Sipanah Arutyunyan, who studies aerospace engineering at California State Polytechnic University in Pomona, expanded on that idea.

"In school we learn theory and equations on paper," Arutyunyan said. "Here we have to apply that to hardware and software in ways we don't usually get to do."

Students also worked on teams to build a case for convincing others their solution is the best.

"The presentations have to be good and you have to have skills in speaking and presenting ideas and be convincing to go through with a plan," said Eduardo Uribe-Saldana, a biomedical engineering student at Antelope Valley College in Lancaster, California.

Hussein Nasr, an aerospace engineering student at California State Polytechnic University, said the

road to success is long.

"Nothing ever works the way you want it to the first time," Nasr said. "You have to figure out what went wrong. When we reviewed why one of our tests didn't work, we found errors everywhere. In research, you have to ask questions."

For example, Arutyunyan explained one of the first boomerang-shaped Prandtl-M aircraft developed a crack. During a test, it crashed and the fatigue of multiple flight tests caused it to fail. The team was frustrated.

"It means we have to go back to the drawing board," Uribe-Saldana added.

That's exactly what the students did. A series of flight tests led them and their mentors to the conclusion that the aircraft's chord, the distance between the leading edge and trailing edge of the wing, needed enhancement to gain more lift and stability.

The changes led to a more delta-wing shape with a twist, explained Joshua Tanon, who is studying aerospace engineering at the University of Michigan in Ann Arbor.

The basic aerodynamic principles were sound, but a new shape and materials – it was made of balsa wood sandwiched between two pieces of fiberglass – needed a new launch method. It was determined a radio-controlled aircraft would take the research ship to the required altitude and release it.

ED15-0248-25 **NASA/Lauren Hughes**

Robert "Red" Jensen, left and William Morris, right center, install a high-speed camera on the Carbon Cub.

"You learn more from failure than from success," said Will Morris, an aerospace engineering student from California State Polytechnic University. "Experience is the best teacher because we can see what went wrong and refine our test project design."

The results – the aircraft crashed. Investigation of the incident showed a failed servo to be the cause. The students had to wait for another day to see if their aircraft would fly and it did. After launch it was controllable in flight. In a few months, a new design is expected to take flight based on the past test flights.

Armstrong's David Berger, a key driver of creating the experience for students, said it was a success.

"I saw the students excited about a topic and they went above and beyond what we asked of them," Berger said. "They became experts and ran with what they learned and owned the responsibility. They didn't see it as a task, but as a challenge to be solved."

Berger said the pilot program was intended to give college professors a research project to work through with their students and then travel to NASA Armstrong for the research flights to see the results.

Khalid Rubayi, an electronics instructor at Victor Valley College in Victorville, California, said his task is to put the students on a path, guide them and nudge them back on the path if they digress.

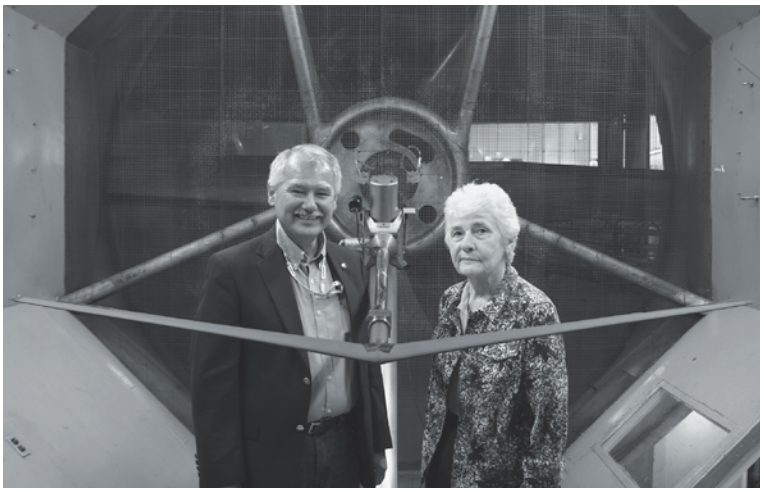
"I showed them how to approach a problem, analyze it and use critical thinking," Rubayi said. "They also learned teamwork, communication and how to integrate areas."

There were other lessons too.

"They gained an understanding that you can't have all of the answers and resources," Berger added.

There's a lot of work to do before a Prandtl-M might be scheduled for a flight on Mars, but students developed the foundation other groups of students can use to move the idea along. Maybe one day the student research will lead to the first aircraft on Mars.

Armstrong, Langley test new wing shape



Submitted photo courtesy of G. Lee Pollard

Al Bowers and Sue Grafton partnered to complete wind tunnel tests on a Prandtl-D model.

By Jay Levine
X-Press editor

Researchers at two NASA aeronautics centers validated elements of a wing design that could greatly improve the efficiency of future aircraft.

NASA Armstrong and Langley Research Center in Hampton, Virginia, recently collaborated on a series of thorough wind tunnel tests. Researchers investigated an aircraft aerodynamic wing scheme based on work from the 1930s that features a literal and metaphorical twist on conventional wing calculations.

Al Bowers, NASA Armstrong chief scientist and Preliminary Research Aerodynamic Design to Lower Drag or Prandtl-D, program manager, has been researching the wing configuration with increasingly complex boomerang-shaped, subscale aircraft. This summer he worked with groups of NASA Armstrong student interns on a related delta-wing-shaped aircraft with wing design twist principles that could one day lead to a Mars airplane.

Wing, page 12

Wing... from page 11

The shape chosen for the Langley-developed Prandtl-D wind tunnel model is an amalgamation of the Prandtl-D vehicles flown at NASA Armstrong. A third such vehicle is set to have a first flight later this year.

"The wing is very stable and well behaved," Bowers said. "Some of this we knew already, but there were parts that were a little surprising, like how the wing maintains control even when it is completely stalled. These things are hard to know from intuition, it's only having the data in hand that tells us about the real behavior."

The wind tunnel research also added key information.

"The flight data is very limited, but it's real data," Bowers said. "We can only surmise the aero characteristics in a very piecewise approximate way. The wind tunnel data show all the individual pieces that go into that data set. So we can see the nonlinear behaviors and model those, so the individual pieces can be assembled to the larger characteristics seen in flight. And then comparing the results from the wind tunnel data set to the flight data is the real proof if we've captured the characteristics well or not."

Coupled with the flight data, Bowers said the next step is clear.

"We're going to assemble a simulation database of the wing from this (wind tunnel data)," he said. "Then we will be able to assemble a full six-degree-of-freedom simulation to fly."

No further wind tunnel tests are planned, but some of the next flight tests will capture the aerodynamic pressures over the wing.

"So far we do not have that piece of the puzzle," Bowers said. "We have inferred that we have the correct flow because of the flight behavior of the wing."

The Armstrong and Langley partnership has been in the planning stages for some time. The collaboration took a big step forward earlier this year when Bowers' perseverance resulted in NASA's Aeronautics Research Mission Directorate agreeing to provide funding for Langley to build the wind tunnel model using composite materials, including polycarbonate, and test it in the center's 12-Foot, Low-Speed Wind Tunnel operated by the Flight Dynamics Branch.

Bowers and Langley senior research engineer Sue Grafton previously worked together on such projects as the highly successful F-18 High Alpha Research Vehicle, or HARV. During the nine-year project that investigated a new flight control system at high angles of attack, the two centers compared flight and wind tunnel data. Prandtl-D was an opportunity to partner again.

"It was great working with Langley engineers again," Bowers said. "They are brilliant professionals. We deeply appreciate the support we have from ARMD and Langley in making this happen."

Based on information from the first two test flight vehicles, Langley engineers designed and built a six-foot-span wind tunnel model, Grafton explained. Some modifications were needed at the center of the wing to accommodate the addition of strain gauges and properly balance the model to accurately collect forces and moments data.

The testing, particularly the smoke portions that illustrated the airflow over the wing, confirmed Bowers' assumptions.

"We have some observations indicating that the wing vortices are not at the wingtips, but are in fact located at about the 70 percent span location," Bowers explained. "In the smoke visualization from the wind tunnel, we could see that outboard (closer to the tips) the smoke would make a "C" shape above the wing, then at the approximate vortex location the smoke had a characteristic "O" shape, and inboard of the 70 percent location we could see the smoke make a reverse "C" shape below the wing. This is consistent with what we believe is happening in the flow from the analysis."

Grafton said she has worked on a number of unique configurations, but not with twist like this wind tunnel model exhibited.

"I don't think I have ever before seen these exact flow patterns that we saw with this test," she said. "How the vortices started and changed, where they went and their makeup. It seemed to look a lot different from the typical airplane wing that I have seen the vortices on before. I had a laser installed (in the wind tunnel) and we could see the flow pattern of the vortices. That tells us why the flow behaves the way it does."

Langley will keep the model should any future questions arise, Grafton said.

"That was an approach on the F-18 HARV program when Al (who was the HARV chief engineer), the Navy or McDonnell Douglas would make a change," she recalled. "They would explain the changes and I would modify the wind tunnel model and test what difference it made."

As the case for the new wing configuration grows with additional flight tests and wind tunnel data, it could be that future aircraft wings might benefit from a twist.

Looking sharp

ED15-0275-18 **NASA/Jim Ross**

An F-15D flies with its new colors. The aircraft was an Air Force jet in its previous assignment and now reflects its new location wih the NASA logo and the familiar white and blue paint scheme.

PTERA

... from page 1

David Stuart, as well as under the control of a Cloud Cap Piccolo autopilot. A maximum speed of 145 knots was obtained making this the fastest PTERA flight to date. Intensive post-flight inspections of the aircraft revealed no problems.

"The first flight provided a wealth of insight into what it takes to fly and maintain the PTERA aircraft, and allowed us to identify areas for improvements that will increase safety and efficiency," said Bruce Cogan, NASA project manager for PTERA.

ED15-0169-02 **NASA/Ken Ulbrich**

Armstrong summer students included, front row from left, Emma Ruano, Timothy Nunez, Shelby Worrell, Nicole Lopez, Eduardo Uribe-Saldana, Ana Escalera, Sipanah Arutyunyan, Hussein Nasr, Orlando Mielke, Michael Arreola-Zamora, Benjamin Martins, Victor Ruiz and David Kloesel. Second row from left are Mandy Ledford, Kurt Pauer, Jonathan Lokos, Waqqas Khan, Kyle Lukacovic, Tyler Clinkaberry, John Jackson, Logan Francisco, Joseph Piotrowski, William Morris, Troy Kuhns, Alex Petrik, Keenan Albee, Clement Li and E. Etan Halberg. Back row from left are Taylor Jensen, Heather Laffoon, Lynn Valkov, Christy Ailman, Joseph Martinez, Louis Edelman, Christopher Bryan, Kevin Collins, Nathan Bell, James Hamory, Harrison Pauer and Joshua Tanon.

Students... from page 9

Pamela Ruffner, Victor Gabriel Ruiz, Ivan Salazar, Rachel Saltzman, Savannah Shively, William Sitz, Patrick Sosa, Nicholas Souza, Kyler Stephens, Joshua Tanon, Eduardo Uribe-Saldana, Lynn Valkov, Madison Washburn, Ethan Williams, Jacob Wilson, Shelby Worrell, and Benjamin Wright.

In addition, NASA's Aeronautics Research Mission Directorate, or ARMD, provided college students opportunities for intense training in aeronautics that included research, leadership development and broad exposure to the nation's aeronautics enterprise. ARMD Aeronautics Scholars included John Giammarino, Joaquin Martinez and Benjamin Martins.

Armstrong also supported a graduate student fellowship. Kelley Hashemi was awarded with the Harriet G. Jenkins Pre-Doctoral Fellowship.

Eight students were part of the Multi-Disciplinary Aeronautics Research Team Initiative, or MARTI, program, which included Keenan Albee, Kira Headrick, Clement Li, Kyle Lukacovic, Alexandra Ocasio, Christopher Trumbull, Kaixi Wang and Jonathan Zur.

The California Space Grant Consortium provided Nicole Lopez and Loren Newton the opportunity to be a summer student at Armstrong.

Three students participated in the Curriculum Improvements Partnership Award for the Integration of Research at Armstrong, which included Kevin Collins, Joseph Martinez and Raziq Noorali.

The National Science Foundation Centers of Research Excellence in Science and Technology, or NSF CREST, program had two participants at Armstrong including Troy T. Kuhns and Timothy Nunez.

NASA Human Resources provide opportunities for consideration for federal employment thorugh the NASA Pathways program. It provides employment opportunities for college and university students and recent graduates. Students who worked at Armstrong as part of the program included Justin Behling, Rose Blomquist, Jesse Brady, Andrew Burrell, Taylor Huneycutt, Do Ki, Cody Lent, Ryan Lyau, Aaron McAtee, Lucas Moxey, Shideh Naderi, Martins Nnoham, Christine Olson, Nicholas Pontius, Coral Reyes, Robert Reyes, Troy Robillos, Erick Rossi de la Fuente, Curtis Stump and Christopher Witte.

NASA Armstrong contractor Jacobs Technology works with the center's technical branches to fill summer engineering assistant positions. This past summer, those jobs went to Wyatt Carr, Nathan Hutchins, Ashraf Al-Hajjeh, Kyle Halloran and Kathleen Lopez.

Sandra Evans, Becky Flick and Cindy Neufeld contributed.

Volk, former clerk, passes

Dee Volk, a former NASA Dryden (now Armstrong) contractor for about three decades, died Aug. 14. She was 80.

Volk was a stock clerk in the warehouse and maintained store stock and program stock inventories. At times in her career she was a mail clerk and delivered throughout the center.

People who knew her described Volk as very pleasant and friendly. She had an easy time making friends and developed good working relationships with coworkers.

NASA, industry complete aviation first

By Peter W. Merlin
Armstrong Public Affairs

Evolving technologies necessary for Unmanned Aircraft Systems (UAS) to safely avoid other aircraft while moving through the nation's skies recently were put to the test using NASA's remotely piloted Ikhana aircraft.

Equipped with a prototype system of Detect-and-Avoid (DAA) sensors working in concert with airborne and ground-based computers, Ikhana made 11 flights involving more than 200 scripted encounters with approaching aircraft.

Depending on the specific scenario, either Ikhana detected one or more approaching aircraft and sent an alert to its remote pilot to take action, or Ikhana itself took action on its own by flying a programmed maneuver to avoid a collision – an aviation first.

"We recorded some valuable data that will take some time to analyze fully, and we expect we'll need to make some minor refinements to our

Aviation first, page 18

ED15-0184-05 **NASA/Carla Thomas**

The Ikhana soars over the Mojave Desert during a flight from Armstrong.

WIA... from page 3

"There are not many professional aerial photographers in the world and Ms. Thomas is one of the best," he wrote. "She is to aerial photography what Julie Clark is to airshow aerobatics."

"She works behind the scenes inspiring people through her work and then steps out to meet the public and show them this unique and fascinating job," he said. "She shares her stories and inspires everyone to follow his or her dreams, talents and passions. She is more than just a photographer, she's an aviation ambassador, showing people that there are other careers you've never even dreamed of in aerospace and yes…you'll find women there too."

Thomas has flown 17 different types of aircraft and logged more than 800 hours of flight time. Her work has appeared in a number of aeronautics publications, including four Aviation Week and Space Technology covers. Her photo of Space Shuttle Endeavour flying over the Golden Gate Bridge was one of the 10 most downloaded images of 2012. Her images of Endeavour's last flight atop the NASA 747 Shuttle Carrier Aircraft also were published as a two-page spread in National Geographic magazine.

Thomas has been honored for her work with a number of awards including a NASA Silver Snoopy from the NASA Astronaut Office for outstanding support, OAO Corporation Employee of the Year 2003, NASA Public Service Medal 2008 (highest honor NASA bestows on contract employees), NASA Manned Space Flight Awareness Award 2012 (for space shuttle support), 2012 NASA Peer Award (technical support), a 2014 Pride in NASA Award and a number of group achievement awards involving NASA and its partners.

NASA/Carla Thomas

Kathleen Fredette, right, and Pamela Harman, from left, and Margaret Piper, work on a SOFIA mission. Fredette was recently chosen for a special honor.

Fredette was one of the first science ambassadors to fly aboard the Stratospheric Observatory for Infrared Astronomy (SOFIA).

She was recognized for her exceptional ability to impact girls and young women's lives and inspire them to learn and to stay in school. She is the director of the science, technology engineering and mathematics initiative for the iLead Charter School system in the Antelope Valley.

Fredette was a teacher at Desert Willows Intermediate School in Palmdale and in 2011 was chosen as one of the first teachers to fly on the SOFIA as part of the Airborne Astronomy Ambassador program. She flew twice as part of the AAA program that allows educators to compete for a chance to fly infrared astronomy missions on the aircraft and bring the experience and knowledge back to the classroom to energize students' interest in science, technology, engineering and mathematics.

Her other honors include the 2015 Endeavor Blue Ribbon STEM (science, technology, engineering and mathematics) Leadership Certificate, Holy Land Democracy Project Israel Trip Grant 2013, and Teacher of the Year twice at Desert Willow Intermediate School 2012-2013 and 2013-2014.

WIA seeks to expand women's opportunities for leadership and increase their visibility. The organization was established for both men and women in support of WIA's mission, by providing programs and professional development opportunities.

The WIA Awards celebrate women's professional excellence in aerospace and recognize female leaders who have made outstanding contributions.

Ground-based schlieren technique looks to the

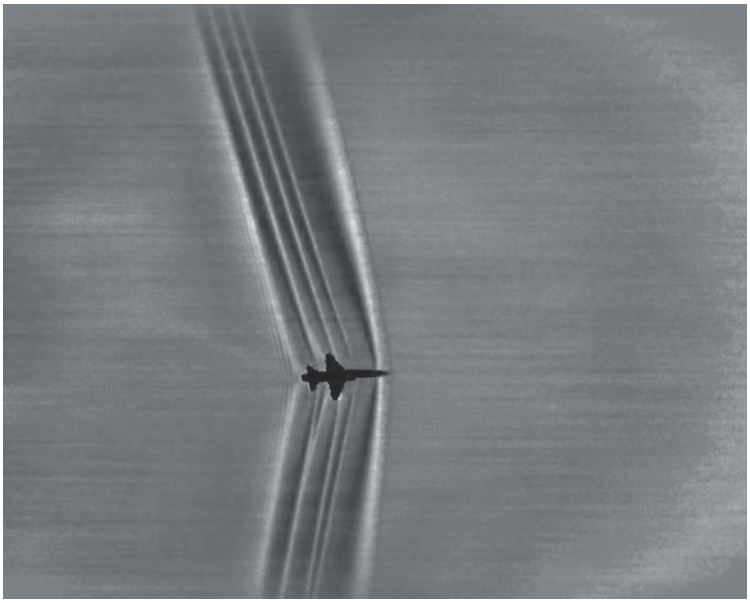
Sun and moon

By Peter W. Merlin
Armstrong Public Affairs

In the wake of recent success with air-to-air schlieren photography using the speckled desert floor as a background, researchers at NASA Armstrong are now looking to the heavens for backgrounds upon which to capture images of supersonic shock waves using ground-based cameras. A bright light source and/or speckled background – such as the sun or moon – is necessary for visualizing aerodynamic flow phenomena generated by aircraft or other objects passing between the observer's camera and the backdrop. This patent-pending method, made possible by improved image processing technology, is called Background-Oriented Schlieren using Celestial Objects, or BOSCO.

Flow visualization is one of the fundamental tools of aeronautics research, and schlieren photography has been used for many years to visualize air density gradients caused by aerodynamic flow. Traditionally, this method has required complex and precisely aligned optics as well as a bright light source. Refracted light rays revealed the intensity of air density gradients around the test object, usually a model in a wind tunnel. Capturing schlieren images of a full-scale aircraft in flight was even more challenging due to the need for precise alignment of the plane with the camera and the sun.

Until recently, ground-based schlieren systems, using the sun's edge as a light source, have produced adequate results, but only two observations of each shockwave could be made as the target aircraft crossed the left and right sides of the sun. Armstrong engineer Edward Haering, originator of the BOSCO concept, noticed that the shockwaves also distorted any visible sunspots. Although the unfiltered solar disk is relatively featureless, astronomers have long known that a calcium-K (CaK) optical filter may be used to reveal the granulated texture of the sun's chromosphere.



NASA photo

This schlieren image of a T-38C was captured using the patent-pending Background-Oriented Schlieren using Celestial Objects *technique and then processed with NASA-developed code to reveal shock wave structures.*

"Using this naturally speckled background," said Haering, "we could make hundreds of observations of each shockwave, greatly increasing the acuity of the camera system."

Researchers at Armstrong and NASA's Ames Research Center at Moffett Field, California, have developed new schlieren techniques based on modern image processing methods. Shock waves, represented by distortions of the background pattern in a series of images, are accentuated using special mathematical equations. This method requires only simple optics and a featured background, that is one with a speckled appearance such as the cratered lunar surface or the mottled appearance of the sun when viewed through certain filters, such as the CaK filter.

One recent demonstration of this technique was called Calcium-K Eclipse Background Oriented Schlieren (CaKEBOS). According to Armstrong principal investigator Michael Hill, CaKEBOS was a proof of concept test to see how effectively the sun could be used for background oriented schlieren photography.

"Using a celestial object like the sun for a background has a lot of advantages when photographing a flying aircraft," Hill said. "With the imaging system on the ground, the target aircraft can be at any altitude as long as it is far enough away to be in focus."

Researchers found the ground-based method to be significantly more economical than air-to-air methods. Merely eliminating the requirement for an airborne camera platform reduced operational costs and complexity, as did the use of off-the-shelf equipment.

"The CaKEBOS imaging system was very simple, consisting of consumer grade astronomy equipment we had from previous tests," said Hill. He further noted, "Someone could probably build a system that would get similar results for around $3000."

The Air Force Test Pilot School at Edwards provided a supersonic T-38C to serve as a target aircraft. Air Force test pilots Maj. Jonathan Orso and Col. Glenn Graham worked with NASA in planning how to precisely align the jet's flight path to capture the schlieren images. The aircraft needed to be in the right place at the right time in order to eclipse the sun relative to the imaging system on the ground. The pilots had to hand fly the airplane to hit a specific point in the sky to within approximately 300 feet, while travelling faster than the speed of sound. This had to be accomplished within a two-minute window as the sun's relative position in the sky changed due to Earth's rotation.

"We would like to try to use the BOSCO system on things other than aircraft," Hill said. "We could potentially perform schlieren photography on anything we could get between our camera and the sun."

The background oriented schlieren technique shows not only supersonic shock waves, but all density changes including wing vortices and engine plume effects. Future research may involve imaging subsonic aircraft flow fields and those generated by wind turbines or vehicles moving along a highway, using an upgraded imaging system to capture higher resolution images.

"Each of these techniques, using the desert floor or the speckled sun, imaging from the ground or from a nearby aircraft, has its strengths and limitations. We plan on combining elements of all these to visualize the complex flow patterns on future aircraft that will allow quiet supersonic overland flight for all," Haering said.

Orion: Pilots, photographers and videographers play key role in testing

By Jay Levine
X-Press editor

Seconds matter in documenting flight tests of a new system intended to travel to space and back.

Just ask a group of pilots, photographers and videographers who have been documenting parachute tests in the Arizona desert aimed at ensuring the successful descent of the future Orion spacecraft as it comes back to Earth from deep space destinations.

Photographers and videographers from Armstrong and the agency's Johnson Space Center in Houston, only have moments to capture critical imagery engineers need to analyze the performance of the parachute system. It's their job to document how the parachute system performs as a test version of Orion is extracted from a C-17 aircraft at about 25,000 feet altitude.

"The countdown is critical because I have 10 seconds to capture it, or I have nothing," said Armstrong photographer Carla Thomas of the key sequence she is responsible for documenting. She can shoot as many as 200 frames during a test flight.

Photographer James Blair of Johnson agreed time is short.

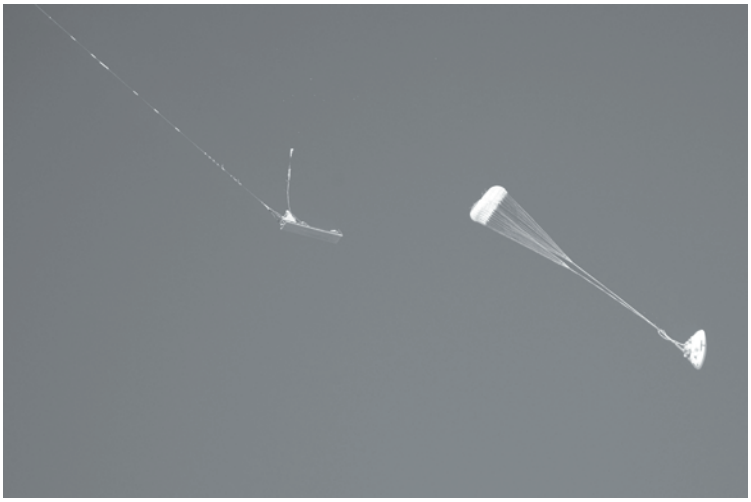
"It would be accurate to say fractions of a second count," he said. "The various stages of chute deployment can be over in a blink of an eye."

"There are no do overs and it's all in the timing," added Lori Losey, Armstrong's NASA TV producer.

Thomas, Blair and Losey supported Orion parachute development tests at the U.S. Army Yuma Proving Ground near Yuma, Arizona, where NASA performs the tests, most recently on Aug. 26. One more in this development series is planned for January 2016 leading to testing of the final design later in the year.

NASA/Harold Robertson

Lori Losey and Jim Ross, from left, gather imagery on the Orion parachute tests as the system is prepared for a drop test from a C-17.



ED14-0375-165 NASA/Jim Ross

An Orion parachute test enters a new phase following separation from a platform.

Harold Robertson, deputy for test operations for the Capsule Parachute Assembly System project, explained the role of chase, photo and video support. Chase is a term used to describe an aircraft that accompanies the test aircraft to observe how events unfold.

"It's extremely valuable. Parachutes are very difficult to instrument. A lot of the evaluation of the performance is watching how they fly," Robertson said. "It's really important for the engineers to be able to see the video and augment that with still photos for key events such as deployment and inflation."

The engineering development tests have demonstrated the robust nature of the system by showing how it works in a number of deliberately

Orion, page 17

Orion... from page 16

arranged failures, such as when two parachutes were deliberately set to fail in the recent test. Each demonstration builds on and develops confidence in the overall system and answers questions that just can't be modeled in the laboratory, Robertson said. The system has proven robust, but the documentation has been helpful for maturing several test techniques.

"We found two key issues from the video we collected from the chase aircraft," Robertson said, referring to challenges the team discovered years ago. "One is called extraction line whip. Essentially, when extraction parachutes used to pull the test article out of the airplane, it was like someone took a jump rope and whipped it all the way back to the system's attach points causing some minor damage to the floor of the aircraft. Video taken from chase aircraft during the airdrop testing, and the tow tests we did in December 2013 at Edwards Air Force Base, helped resolve that issue."

The second challenge involved higher loads on the reposition test equipment after the U.S. Air Force C-17 carried and dropped the mockup of Orion. The C-17 was based at the Air Force Test Center at Edwards Air Force Base.

"There is a single attachment point for the two extraction chutes and a deployment mechanism that changes the attachment from a single point to a dual point suspension," Robertson explained. "That mechanism failed – it opened prematurely – even though it was a successful test. The platform parachutes deployed early and that was undesirable even though we were able to recover the platform successfully. The video we collected on that test was helpful in understanding what the problem was and working toward an engineering solution and to keep that from happening again."

Extraction parachutes are parachutes used to pull the platform that the Orion mockup sits on in the aircraft away from it before the mockup is subsequently separated from the platform and the parachute system for the spacecraft begins deploying. The platform parachutes are then deployed later to slow it down and land the platform which allows for test equipment reuse.

ED12-0223-203 **NASA/Carla Thomas**

The Orion parachute system enters another phase of its descent from a C-17 aircraft.

Armstrong research pilot Denis Steele and associate director for Flight Operations Frank Batteas made a considerable contribution to obtaining documentation, Robertson said. Steele and Batteas determined a flying pattern and altitudes for as many as five aircraft involved in each test that would allow photographers and videographers to keep the test article in view longer to gather the most documentation.

"Within 10-15 seconds after the test article comes off the platform, the next five seconds are critical," said Jim Ross, Armstrong photo chief. "It is easier to take images because the aircraft is at the same altitude as the C-17. I shoot until I can't see the parachute system."

Batteas explained development of a detailed timeline of key events from the point the platform is dropped from the C-17 was an important job for the team.

"We try to capture all of that in the first 18 seconds with high speed video by turning our aircraft so the parachute system is in sight as it exits the airplane," Batteas said. "We capture the very first part that they are looking for which is the exit of the platform and test article from the C-17. After that, anything we can get is good for them because there are a lot of dynamics that happens as the platform separates from the test article."

Blair has supported the Orion parachute tests since 2008 and described his first time as a photographer in the UH-1 chase helicopter.

"I was placed in the back seat known as the 'hell hole' because of the extreme wind and vibration that position experiences," he recalled. "It lived up to its reputation with my hands going numb from cold. Looking through the camera's viewfinder and spotting the test article was also a challenge due to the camera movement."

His experience in Yuma paid off during the Orion flight test in December 2014, as he documented Orion's re-entry from space from a U.S. Navy SH-60S Seahawk during the recovery efforts. "It was an experience of a lifetime," he said.

Flight testing of the parachute system began in 2007. The final round of Orion qualification parachute tests are scheduled to be complete in 2019, when the system will be ready to provide the Orion spacecraft and its crew a safe return from space.

Johnson's Engineering Directorate manages the Capsule Parachute Assembly System project for Orion. Team members include NASA, Jacobs Engineering, Lockheed Martin, Fox Parachute Services and Airborne Systems of Santa Ana, California, where the parachutes are manufactured and packed.

Aviation first... from page 14

algorithms, but from what we saw during the tests, the results look promising," said Dennis Hines, NASA's director for programs for Armstrong.

Staged from Armstrong and flown over the high desert of California, the DAA research was designated FT3, the third in a series of flight test campaigns for NASA's Unmanned Aircraft Systems Integration in the National Airspace System (UAS-NAS) project.

"The successful completion of this flight test campaign represents the maturity of our detect-and-avoid system," said Frank Pace, president of Aircraft Systems for General Atomics Aeronautical Systems Inc.

As a NASA industry partner, the company developed one of the three primary DAA sensors flown on Ikhana, in this case a prototype radar system. The company also contributed the Ikhana system and self-separation and collision avoidance alerting logic software.

The other two sensors included an Automatic Dependent Surveillance – Broadcast (ADS-B) from BAE Systems, and a second generation Traffic alert and Collision Avoidance System (TCAS) from Honeywell International Inc.

ADS-B is a satellite-based navigation tool in which an aircraft determines its position and then broadcasts that information, enabling other nearby airplanes equipped with the same tool to know where everyone is at in the sky.

As its name implies, TCAS keeps an electronic eye on the sky immediately surrounding an airplane. Should another airplane with a similar device fly too close, an alert will prompt the pilot to take action.

Honeywell also provided software that enabled the three sensors to work together, as well as a specially instrumented aircraft to play the role of an intruder encroaching on Ikhana's airspace.

"This phase of flight tests, and our ability to meet the challenge of integrating UAS into the NAS, wouldn't be possible without the strong partnership that exists between NASA and its aeronautical industry partners," Hines said.

Knowledge gleaned from the data recorded during this third phase of UAS-NAS flight tests not only will help researchers plan the next phase of flight tests – now targeted for next spring – but also will help inform organizations developing UAS-related operating standards.

Honor... from page 8

who is enthusiastic, creative, quick and successful at creating solutions for customers. **Joseph C. Walters**

Mission Support: Financial/ Resources Support
Recognizes an employee performing exemplary financial or resources-management work.
Lesa R. Brady

Mission Support: Other Support Services
Recognizes an employee performing exemplary support services in an enthusiastic manner.
Rosalia Toberman

Unsung Hero
Recognizes employees who make critical contributions to the NASA Armstrong Mission in a behind-the-scenes role.
Marlin D. Pickett

Create Your Own Award
"VIP Treatment Award"
Heidi H. Boyden

Teamwork
Recognizes a high-performing team that collaborates to successfully achieve common goals.
UAS Integration in the NAS Test and Evaluation Team

Veteran award

NASA Armstrong was recently recognized with the National Veteran Small Business Coalition's Champions of Veteran Enterprise Award for meeting or exceeding goals for providing opportunities to veteran-owned and service-disabled veteran-owned small businesses. From left are Robert Medina, Armstrong Small Business specialist, Richard Mann, NASA Headquarters Office of Small Business Programs manager, David McBride, Armstrong center director and Jim Eastman, Armstrong procurement officer.

ED15-0251-1 **NASA/Lauren Hughes**

Open hearts

NASA Armstrong collected 1,287 pounds of food for Grace Resource Center. The wide variety of food was delivered on Oct. 8.

Haley, former public affairs specialist, passes

Don Haley, a former public affairs officer at NASA Dryden (now Armstrong) died Oct. 24. He was 81.

Haley, a public affairs specialist for the Ames-Dryden Flight Research Facility and the NASA Dryden Flight Research Center in the 1980s and 1990s, also began the first educator resource center.

He is described by people who new him as intelligent, patient, fun, a great teacher and with a great sense of humor.

Haley's decision and coordination allowed a space shuttle landing to be a Dryden open house expected to attract 5,000 people – more than 10,000 visitors were tallied.

He was a staff writer for the Antelope Valley Press for 11 years following his military retirement as a master sergeant in the U.S. Marine Corps. He was the first from the Valley Press to officially be called an aerospace reporter.

In 1981, Haley left the Antelope Valley Press to be a public affairs officer for the Air Force Flight Test Center at Edwards and later Dryden. He volunteered for the Salvation Army and Special Olympics.

The winners are...

Submitted photo

Kurt Sanner, second from left, recently earned the Federal Laboratory Consortium's Outstanding Technology Development Award for his work on the Low-Cost, Portable Platform for Mounting Antennas for Automatic UAV Tracking. Sanner and intern Evan Kaiser developed the antenna platform that will address an unmet need in the UAV market by integrating multiple capabilities on one low-cost platform. The technology allows for the capability to point four or more interchangeable antennas of any type at a moving target in the air or on the ground. The FLC is the nationwide network of federal laboratories that provides the forum to develop strategies and opportunities for linking laboratory mission technologies and the expertise with the marketplace. From left to right are Brian Suh, FLC Far West Regional coordinator, Kurt Sanner, Laura Fobel, Armstrong Technology Transfer chief and Jennifer Stewart, FLC Far West Rgional deputy coordinator.

Submitted photo

Mark Skoog, second from left, recently earned the Federal Laboratory Consortium's Outstanding Technology Development Award for his work on A Proven System for Preventing Ground Collisions of Aircraft. The award team included Mark Skoog, Loyd Hook, Kevin Prosser, Shaun McWherter and Jamie Willhite. The technology is laying a foundation for a system that would automatically take control of an aircraft should the pilot be disoriented or unable to use the navigation system for the plane. From left to right are Suh, Skoog, Fobel and Stewart.

Publishing results of center research

Armstrong research resulted in 10 technical publications and one award.

June

Chan-gi Pak wrote, "Aeroelastic Tailoring Study of an N+2 Low-boom Supersonic Commercial Transport Aircraft," presented at the 16th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, Dallas, June 22-26, 2015.

Van Tran Fleischer authored, "Proportional and Integral Thermal Control System for Large Scale Heating Tests," NASA/TM-2015-218721.

Paul Sorokowski, Mark Skoog, Capt. Scott Burrows and SarahKatie Thomas collaborated on, "Small UAV Automatic Ground Collision Avoidance System Design Considerations and Flight Test Results," NASA/TM-2015-218732.

July

Larry J. Cliatt, Michael A. Hill, Edward A. Haering Jr. and Sarah R. Arnac collaborated on, "A Summary of the Lateral Cutoff Analysis and Results from NASA's Farfield Investigation of No-boom Thresholds," presented at the 20th ISNA (International Symposium on NonLinear Acoustics), Lyon, France, June 29-July 3, 2015.

Aamod Samuel and Yohan Lin co-authored, "Airvolt Aircraft Electric Propulsion Test Stand," presented at the AIAA Propulsion and Energy Forum, Orlando, Florida, July 27-29, 2015.

August

Juliet Page, Ken Plotkin, Chris Hobbs, Vic Sparrow, Joe Salamone, Robbie Cowart, et al. (POCs Ed Haering and Samuel Cantor) collaborated on, "Superboom Caustic Analysis and Measurement Program (SCAMP) Final Report," NASA/CR-2015-218871.

September

Claudia Y. Herrera, Natalie D. Spivey, Shun-fat Lung, Gregory Ervin, and Peter Flick co-authored, "Aeroelastic Airworthiness Assessment of the Adaptive Compliant Trailing Edge Flaps," presented at the 46th Society of Flight Test Engineers International Symposium, Lancaster, Sept. 15-18, 2015.

Eric J. Miller, William A. Lokos, Josue Cruz, Glen H. Crampton, Craig A. Stephens, Sridhar Kota, Gregory Ervin, and Pete Flick collaborated on, "Approach for Structurally Clearing an Adaptive Compliant Trailing Edge (ACTE) Flap for Flight," presented at the 46th Society of Flight Test Engineers International Symposium, Lancaster, Sept. 15-18, 2015.

Peter M. Suh, Howard J. Conyers, and Dimitri N. Mavris co-authored, "Rapid State Space Modeling Tool for Rectangular Wing Aeroservoelastic Studies," NASA/TM-2015-218875.

Honored

The Fused Reality team's publication entitled, "Flight Testing of Fused Reality Visual Simulation System," received the best paper award from the Society of Flight Test Engineers.

Fused Reality is a new technology that combines real-world video with an interactive, computer-generated environment to create an immersive training environment for complex tasks such as landing, formation flying and aerial refueling. Fused Reality can also be used to develop realistic and repeatable handling qualities tasks.

Prandtl-D... from page 1

smoothness of the third Prandtl-D's flight.

"It's double the weight and double the wing span of the previous two vehicles, but it's half the wing loading so it flies very, very nice, very majestic and very stable," he explained. Wing loading refers to the relationship of the aircraft's weight to its wing area.

The flights were intended to validate the subscale aircraft's aerodynamics before adding instrumentation and flying data collection missions. The two previous Prandtl-D vehicles had a wingspan of 12.5 feet and flew for about one minute, 30 seconds.

The Prandtl-D was fabricated from carbon fiber, fiberglass and foam at NASA Armstrong and launched by a bungee cord. Future flights may include release from a remote controlled tow plane.

Continued success of the Prandtl-D aircraft could validate future aircraft designs using the same wing loading, resulting in an 11-percent fuel savings. Another 30-percent fuel savings could be achieved if future designers use the controls benefits of this new wing design to eliminate the use of aircraft tails, thus flying more like birds.

ED15-0330-84 **NASA/Lauren Hughes**

David Lee, Golda Nguyen and Scott Gleason recover the Prandtl-D No. 3 after one of its flights.

SpaceFest is a success

ED15-0337-21 **NASA/Lauren Hughes**

Armstrong's Scott Gleason talks to students attending the SpaceFest at the California Science Center in Los Angeles. He discussed the Joby Aviation motor and propeller that were part of an experiment for a future electric aircraft.

Halloween and Chili

ED15-0334-13 **NASA/Lauren Hughes**

The annual Chili Cookoff and bake sale raised $1,348, while some attendees participated in the costume element of the Halloween event. Perhaps this fellow should have been wary of the cook. Who knows what (who) she was brewing?

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