



THE NEIL A. ARMSTRONG FLIGHT RESEARCH CENTER X-**XPRESS**

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System fit check is a success

Towed glider closing in on research flight

By Peter W. Merlin

NASA Armstrong Public Affairs

NASA Armstrong took another step toward developing a novel rocket-launching technique called the Towed Glider Air-Launch System (TGALS) by fit-checking a subscale twin-hulled glider with its experimental rocket payload. This was the first time the two vehicles had been mated using actual flight hardware.

Project advocates hope an operational system based on the TGALS might significantly reduce the cost and improve the efficiency of sending small satellites into space.

According to project manager Gerald Budd, the ultimate goal is to build a relatively inexpensive remotely or optionally piloted glider that will be towed aloft by a large transport aircraft. Following release at around 40,000 feet, the glider will launch a booster rocket into an optimal trajectory to place its payload into low Earth orbit.

Armstrong's TGALS project is a proof-of-concept demonstration using radio-controlled one-third scale models of both glider and rocket. NASA researchers constructed a 27-foot- wingspan,



ED14-0210-044

NASA/Tom Tschida

Controls engineer Ryan Dibley captures the moment as Ian Whittinghill, Red Jensen and Mark Collard attach the Mini Sprite rocket to NASA Armstrong's one-third scale, twin-fuselage sailplane during recent fit checks.

twin-hulled glider in Armstrong's Small Unmanned Aircraft Systems Research Lab – the model shop – and expect to fly it later this year, towed aloft by one of the center's small DROID – for Dryden

Remotely Operated Integrated Drone – unmanned aircraft. The sailplane will eventually carry the scale-model Mini Sprite rocket, designed and built by Whittinghill Aerospace of Camarillo, California,

under the Small Business Innovation Research (SBIR) program.

In January, the DROID towed a single-hulled sailplane model

Towed Glider, page 7

Ikhana completes two missions

By Beth Hagenauer

NASA Armstrong Public Affairs

NASA's MQ-9 remotely piloted aircraft, named "Ikhana," recently completed a deployment to Hawaii in support of two diverse flight opportunities and returned to its base at NASA Armstrong.

The Ikhana project completed its first deployment in early August when new aircraft systems were tested that may allow the plane to fly future missions into the Arctic Circle region and collect information on ice sheets and caps as part of NASA's commitment to better understand our Earth.

The aircraft carried an optical imaging sensor and a maritime radar for the Hawaiian flights. Remote operation from a command and control center was verified to enable future support of scientific missions in isolated geographical locations.

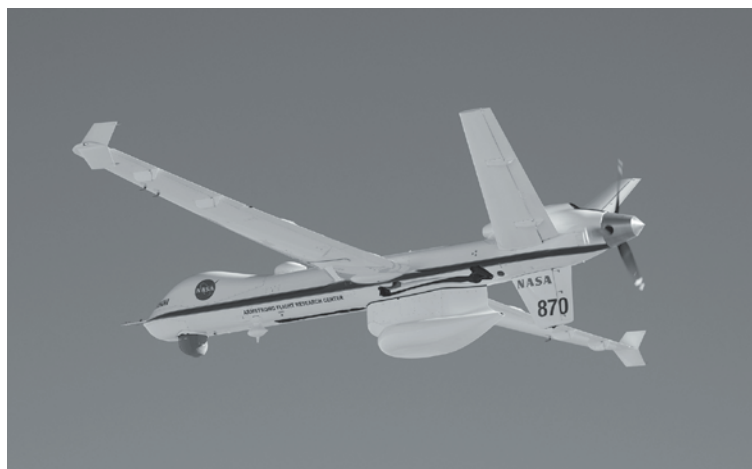
Ikhana collected scientific and environmental data in Hawaii on two flights totaling more than 19 hours over northwest areas of the island state. NASA worked

with scientists from the National Oceanic and Atmospheric Administration and the U.S. Fish and Wildlife Service to perform surveys of monk seals, sea turtles, sea birds and vegetation. Sensors on the aircraft searched for marine debris in Papahānaumokuākea Marine National Monument.

NASA's MQ-9 also flew four missions for the U.S. Navy to provide visual and radar imagery for an effective and safe Rim of the Pacific (RIMPAC) military maritime training exercise. Ikhana's imaging sensor and the radar provided ocean range clearance, situational awareness of ship movement, humanitarian assistance and disaster relief training aid during more than 32 hours of flight time.

Ikhana conducted flight operations from the Navy's Pacific Missile Range Facility (PMRF) on Kaua'i. The pilots operated the aircraft from a specially equipped NASA ground control station, also located at PMRF.

While the aircraft was in



ED14-0159-69

NASA/Carla Thomas

NASA's MQ-9 remotely piloted research aircraft called Ikhana carries a maritime radar in a specialized centerline pod during a flight to check out systems prior to the aircraft's deployment to Hawaii in July 2014.

Hawaii, education specialists from Armstrong's Office of Education engaged educators, students and parents in Ikhana-related activities on Kaua'i. These activities included PMRF's Stars and Stripes Freedom Celebration on July 3. In cooperation with Kaua'i Community College, the

education team, with support from Ikhana pilots, engineers and a NOAA scientist, conducted a hands-on science, technology, engineering and math workshop for elementary and secondary students.

The name "Ikhana" is a Native American Choctaw word meaning intelligent, conscious or aware.

F-15B gets new engines, new life

By Peter W. Merlin

NASA Armstrong Public Affairs

NASA Armstrong's F-15B aeronautics research test bed, a workhorse at the center since 1993, has received an engine upgrade that will keep the airplane flying well into the foreseeable future.

Prior to this work Armstrong officials were considering retiring the F-15B, which carries NASA No. 836, and replacing it with a newer F-15D model. An advanced data acquisition system gives the F-15B a capability that makes it one of the most versatile research aircraft NASA flies, but transferring the extensive research instrumentation to the newer aircraft would be very costly and time-consuming, and result in delays to projects needing the aircraft's capabilities.



ED13-0108-13

NASA/Carla Thomas

NASA's F-15B No. 836 received an engine upgrade that will extend its use as a flight research aircraft.

NASA's F-15B is the oldest F-15 still flying and maintenance support for the airplane's engines was becoming increasingly difficult. However, NASA Armstrong's recent acquisition of six new engines with digital controls will greatly extend the F-15B's service life.

The U.S. Air Force has retired all early model F-15A and F-15B aircraft, all of which, including NASA 836, were powered by Pratt & Whitney F100-PW-100 engines. As a result, the Air Force no longer supported the engines. In the hope of keeping NASA 836 flying and eventually replacing it with a newer model, Armstrong acquired three F-15D aircraft from Tyndall Air Force Base, Florida that were surplus

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ED14-0220-28

NASA/Ken Ulbrich

Sustainable and efficient

Southern California Edison representatives Dave Intner and Peter Giannotti presented a check for \$120,493.23 to Center Director David McBride July 28. As part of Edison's Savings by Design program, the check represents three years of anticipated savings from energy efficient features designed and built into the Facilities Support Center. The cost of those features will be recovered in less than four years and save 255,000-kilowatt hours – the amount of energy used annually by 37 average California homes.

News at NASA

Spacewalk a success

Two Expedition 40 spacewalkers, clad in Russian Orlan spacesuits, wrapped up a 5-hour, 11-minute excursion outside the International Space Station at Aug. 18. Flight Engineers Alexander Skvortsov and Oleg Artemyev deployed a small science satellite, retrieved and installed experiment packages and inspected components on the exterior of the orbital laboratory.

Shortly after the spacewalk began, Artemyev manually deployed Chasqui 1, a Peruvian nanosatellite designed to take pictures of Earth with a pair of cameras and transmit the images to a ground station. The project is part of an effort by the National University of Engineering in Peru to gain experience in satellite technology and emerging information and communication technologies.

The spacewalkers installed the EXPOSE-R2 experiment package, a European Space Agency-sponsored suite of experiments, on the exterior of the Zvezda service module. The package includes two astrobiology studies that will investigate biomaterials and extremophiles – organisms that are tolerant of environmental extremes. Results from these experiments may contribute to life-detection strategies for future robotic exploration of Mars.

While on the conical section of Zvezda, they attached a handrail clamp holder for the Automatic Phased Array antenna. Skvortsov and Artemyev set up that communication systems antenna during their first spacewalk on June 19.

Armstrong wins NASA challenge

NASA Armstrong placed first in the NASA Moves Count Your Steps Challenge. The primary goal of this activity was to inspire people to move a little more and to enhance their health and wellness. From left are Roger Truax, Gaby Olson, Ashley Prueitt, David McBride, David Boyle and Melissa Hoffmann.



ED14-0223-1

NASA/Tom Tschida

Inspiration at Night on the Square

A family takes advantage of flight suit cutouts for an unusual portrait during a recent Thursday Night on the Square festival at the Palmdale Civic Center. NASA Armstrong and AERO Institute employees focused their efforts on promoting science, technology, engineering and mathematics, utilizing a variety of displays and exhibits in the institute's Aerospace Exploration Gallery.



ED14-0241-19

NASA/Tom Tschida

Student workforce gains experience at NASA Armstrong

By Jay Levine

X-Press editor

More than 80 college and university students in nine different NASA programs gained valuable work experience at NASA Armstrong, while learning to apply theories of the classroom. The students are listed alphabetically under the program in which they participated.

In addition, three university researchers had opportunities to work at NASA Armstrong this summer. The Science Teacher and Researcher, or STAR, program provides that work experience. This year's awardees include Gary Jaffe, Dulce Ramirez and Nurdeen Salami.

Aeronautics Research Mission Directorate, or ARMD, Aeronautics Academy provides college students opportunities for intense training in aeronautics that includes research, leadership development and broad exposure to the nation's aeronautics enterprise. Students who participated at the center were Bryce Doerr, Katherine Glasheen, Benjamin Martins, Anthony Millican, Anachristina Morino, Alexander Patterson, Brian Plank and Steven Vo.

The Aerospace Education Research and Operations, or AERO, Institute awards internships to students for work assignments that are made based on the needs of the center's branches or an internship for which they competed. AERO Associates are those chosen for specific jobs, while AERO Scholars, or Aeronautics Scholars, are students participating in work assignments as part of an ARMD scholarship they have been awarded.

This year's AERO Associates included Erika Fedorko, Lizxandra Flores-Rivera, Jacob Gustafson, Madison Jacobson, David Joe, David Kun, Richard Maldonado, Russell McLellan, Patrick Moholt, Emily Nichols and Harrison Pauer. AERO Associates also



ED14-0164-01

NASA/Ken Ulbrich

It was a busy summer for the student workforce at NASA Armstrong. Some of those students included, front row, from left, Jack Toth, Lizxandra Flores-Rivera, Madison Jacobson, Pamela Ruffner, Rachael Saltzman, Emily Nichols, Kassidy McLaughlin, Erika Fedorko, Nancy Pinon, Kelley Hashemi, Cecilia King, Heather Laffoon, Anachristina Morino, Max Feagle, William Sitz, Matthew Loren and Cynthia Farr. In the back row, from left, are Donald Widdicombe, Bryce Doerr, Hunter Thomas, Jason Watkins, Jacob Gustafson, Katherine Glasheen, Benjamin Martins, Joseph Lorenzetti, Patrick Moholt, David Kun, Benjamin Sunderland, Russell McLellan and Brian Plank.



ED14-0164-02

NASA/Tom Tschida

More than 80 students in nine different programs worked at NASA Armstrong. Front row, from right, are Brooke Neufeld, Dulce Ramirez, Daniel Vegerano, Nicholas Ross, Christopher Bryan, Krishna Ventakaraman, Ashraf Al-Hajjeh, Alexander Patterson, Anthony Millican, Nurdeen Salami and Michael Replan. Back row, from right, are Casey Long, Jacob Wilson, Gary Jaffe, Ryan Flick, Harrison Pauer, David Joe, Richard Maldonado, Steven Vo and Leo Banuelos.

featured Christian Pereira, Nicholas Pontius, Antoine Radford, Michael Replan, Victor Ruiz, William Sitz, Benjamin Sunderland, Hunter Thomas, Krishna Venkataraman, Jason Watkins and Jacob Wilson.

The AERO Scholars were Ashraf Al-Hajjeh and Joseph Lorenzetti.

Seven students participated in the Curriculum Improvements Partnership Award for the Integration of Research at NASA Armstrong. The program is structured to assist two- and four-year minority serving institutions to strengthen science, technology, engineering and mathematics, or STEM, and technical programs. Funding is used to integrate project management methodology to add real world experiences with theoretical knowledge to enhance STEM and technical classes. The aim is to increase the number of underrepresented and underserved students who attain degrees in science, technology, engineering and mathematics.

Selected for this program were Christopher Bryan, Michael Butros, Cynthia Farr, Max Feagle, Matthew Loren, Alec Sim and Daniel Vegerano.

The NASA Pathways programs were established to streamline several staples of the student employment opportunities programs. For example, the Pathways programs replace the Student Temporary Employment Program, or STEP, and the Student Career Experience Program, which was formerly known as the Cooperative Education Program.

NASA Pathways programs provide employment opportunities for college and university students and recent graduates. People who worked at NASA Armstrong as part of these programs included Ryan Alexin, Stephanie Andrade, Justin Behling, Rose Blomquist, Andrew

Students, page 6



Students in the Pathways programs included, from left, Justin Behling, Ryan Alexin, Elizabeth Feeney, Rose Blomquist, Stephanie Andrade, Patipan Pipatinyopong, Andrew Burell, Taylor Huneycutt, Lucas Moxey, Erick Rossi De La Fuente, Samuel Kantor, Erhan Nieman and Andrew Mahon.

ED14-0228-1
NASA/Tom Tschida

Students in the fall Pathways programs included, front from left, Meghan Burns, Erin Carroll, Coral Reyes, Cynthia Rose and Troy Robillos. Back from left are Patipan Pipatinyopong, Erick Rossi De La Fuente, Taylor Huneycutt, Andrew Mahon and Jacob Ediger.



ED14-0256-1
NASA/Tom Tschida

Student engineering assistants employed by NASA Armstrong contractor Jacobs Technology included, from left, Stephen Bacon, Austin Eslinger (hired through Jacobs' subcontractor Inqu), Cameron Law, Jessica Pilgram and Jamell Jordan.

ED14-0231-03
NASA/Tom Tschida



Flight Opportunities makes awards

NASA's Flight Opportunities Program, managed by NASA Armstrong, funded a series of parabolic flights to evaluate eight space-technology experiments conducted by a like number of teams in late July.

Three universities and NASA's Glenn Research Center in Cleveland, Ohio, tested their experiments in microgravity onboard NASA's C-9 reduced gravity airplane during the first flights that began on July 22.

Eight flights were conducted over a weeklong period out of Ellington Field near NASA's Johnson Space Center in Houston.

Experiments tested during the parabolic microgravity flights included:

- John Hopkins University of Medicine is evaluating a new handheld, smart device for assessment and rehabilitation of crewmembers on the surfaces of the moon and Mars.

- The University of Central Florida experiment is testing low-velocity collisions between particles that simulate conditions relevant to planetary ring systems.

- The University of Puerto Rico is testing an alkaline fuel cell for water reclamation and energy applications.

- NASA Glenn is assessing an exercise device that maintains strength and endurance for future space travelers.

- A second set of parabolic flights on the agency's C-9 was conducted from July 28 through July 30. Selected through an agency Announcement of Flight Opportunities, three universities and NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, tested their experiments during the second round.

Awards, page 8

Scholarship awarded



ED14-0208-1

NASA/Carla Thomas

Katherine Lott, the recipient of the 2014 NASA Armstrong Employee Exchange Council Joseph R. Vensel Memorial Scholarship, is congratulated by NASA Armstrong Center Director David McBride. Flanking the pair are Katherine's parents, Darryl and Boon Lott.

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ED14-0192-52

NASA/Tom Tschida

Retired NASA F/A-18A No. 842 is back on exhibit in front of The Hangar, the Lancaster Municipal Stadium that is home to the JetHawks California League baseball team. The aircraft was refurbished and reattached to its perch June 24.

Students ... from page 2

Burell, Meghan Burns, Erin Caroll, Jacob Ediger, Elizabeth Feeney, Erick Rossi De La Fuente, Karen Green, Janet Hoover and Taylor Huneycutt. Participants also were Samuel Kantor, Andrew Mahon, Lucas Moxey, Devonon Nash, Ethan Nieman, Christine Olsen, Lucio Ortiz, Patipan Pipatinyopong, Nicholas Pontius, Jeff Requist, Coral Reyes, Robert Reyes, Troy Robillos, Cynthia Rose, Sam Smith, Elizabeth Tomsik and Nydia Wilkinson. NASA Armstrong contractor Jacobs Technology works with the center's technical branches to fill summer engineering assistant positions. This summer, those jobs went to Stephen Bacon, Jamell Jordan, Cameron Law, Jessica Pilgram and Ethan Williams. Jacobs Technology subcontractor Inqu also had an engineering assistant, Austin Eslinger.

The University Space Research Associates, or USRA, offers internship opportunities for undergraduate science and engineering students at all 10 NASA centers and additional partner facilities.

USRA students at the center included Leo Banuelos, Ryan Flick, Cecilia King, Heather Laffoon, Casey Long, Kassidy McLaughlin, Brooke Neufeld, Nancy Pinon,

Nicholas Ross, Pamela Ruffner, Rachael Saltzman, Jack Toth and Donald Widdicombe.

NASA Armstrong also supported a graduate student fellowship this summer. Kelley Hashemi was awarded with the Harriet G. Jenkins Pre-Doctoral Fellowship. Heather Kline also spent her summer at NASA Armstrong as a participant in the NASA Space Technology Research Fellowship.

Scheduled maintenance begins



NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA) is shown inside the Lufthansa Technik hangar in Hamburg, Germany, where it is undergoing its decadal inspection. Aircraft maintenance and science personnel from NASA's Armstrong and Ames research centers are working alongside Lufthansa's 747SP specialists to perform a wide range of inspections and major maintenance over the next few months, while specialists from the German SOFIA Institute (DSI) will perform upgrades to the flying observatory's infrared telescope.

NASA/Jeff Doughty

Armstrong researchers publish

NASA Armstrong researchers have recorded the results of their work in technical publications released in July.

Devin K. Boyle published, "Acoustic Identification of Faults Experienced by a High-Bypass Turbofan Engine During Vehicle Integrated Propulsion Research Testing," AIAA-2014-3106, presented at the 20th AIAA/CEAS Aeroacoustics Conference, Atlanta, Georgia, June 16-20, 2014.

Larry J. Cliatt II, Edward A. Haering Jr., Thomas P. Jones, Erin K. Waggoner, Ashley K. Flattery and Scott L. Wiley collaborated on, "A Flight Research Overview of WSPR, a Pilot Project for Sonic Boom Community Response," AIAA-2014-2268, presented at the 32nd AIAA Applied Aerodynamics Conference, Atlanta, Georgia, June 16-20, 2014.

Michael A. Frederick, Daniel

W. Banks, G.A. Garzon and J.R. Matischeck published, "Flight Tests of a Supersonic Natural Laminar Flow Airfoil," ISFV16-1035, presented at the 16th International Symposium on Flow Visualization (ISFV16), Okinawa, Japan, June 24-28, 2014.

William L. Ko and Van Tran Fleischer collaborated on, Modified Displacement Transfer Functions for Deformed Shape Predictions of Slender Curved Structures with Varying Curvatures," NASA/TM-2014-216660.

Wesley W. Li and Chang-i Pak published, "Aeroelastic Optimization Study Based on X-56A Model," AIAA-2014-2052, presented at the AIAA Atmospheric Flight Mechanics Conference, Atlanta, Georgia, June 16-20, 2014.

Chan-gi Pak and Samson Truong collaborated on, "Creating Test

Validated Structural Dynamic Finite Element Model of X-56A," AIAA-2014-3157, presented at the 15th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, June 16-20, 2014, Atlanta, Georgia.

Peter M. Suh, Alexander W.

Towed Glider... from page 1

aloft from the north end of Rogers Dry Lake at Edwards Air Force Base to validate TGALS demonstration systems and procedures. Flight objectives included validation of towing techniques, tests of the tow release system and autopilot, transition from manual to autonomous flight, and demonstration of the remote pilot's ability to fly the glider from a ground-based cockpit using visual input from a miniature video camera on board the aircraft.

Chin and Dimitri N. Mavris published, "Robust Modal Filtering and Control of the X-56A Model with Simulated Fiber Optic Sensor Failures," AIAA-2014-2053, presented at the AIAA Atmospheric Flight Mechanics Conference, Atlanta, Georgia, June 16-20, 2014.

Researchers will use the results of those tests and lessons learned during the next phase of the project, which involves tow tests of the twin-fuselage sailplane model that is representative of the proposed TGALS configuration.

Initial research and development is being internally funded through NASA Armstrong's Center Innovation Fund. Potential Department of Defense and industry partnerships are also being explored.

Awards... from page 6

- Northwestern University is using the microgravity environment to create superior quality titanium-based, nanoporous metallic foams and explain the difference of those tested in reduced-gravity flight from ground-based samples.
- Carthage College's experiment is evaluating propellant mass modal resolution data for unsettled fuel states such as microgravity.
- The Massachusetts Institute of Technology tested a docking and undocking system called the Universal Docking Point.
- The JPL team tested a tool for grappling small floating objects.

The Flight Opportunities Program is part of the Space Technology Program administered by the agency's Space Technology Mission Directorate. The program provides opportunities for promising space technologies to be demonstrated and validated on a variety of sub-orbital platforms in relevant reduced- and micro-gravity space environments so they may be matured from concept to operational use.



Submitted photo

Members of a JPL team test their grappling tool for small floating objects during a parabolic maneuver on NASA's C-9 reduced-gravity aircraft.

F-15B... from page 2

to Air Force needs. One of these was put on flight status while the other two were primarily used to provide spare engines.

Around the same time, according to F-15 crew chief Walter Kondracki, two F-100-PW-229 engines were removed from NASA's highly modified NF-15B No. 837, which had been retired from service. Both powerplants required full teardown and rebuild following long years of service. In the meantime maintenance crews struggled to keep NASA 836 flying for the next few years.

"By the summer of 2012 we had removed and replaced six engines in 836," Kondracki said. "It decimated our spare engine supply and replacement parts were \$300K,

plus labor, with little or no funding available for repairs."

Then, through a fortuitous set of circumstances, Armstrong acquired some F100-PW-220 engines, which are equipped with more advanced technology than in the -100 including digital electronic controls, as well as improved durability and reliability. Tom Grindle, Armstrong's chief of maintenance, learned that the Air Force needed a set of -229 engines for an F-15E and arranged to swap the two rebuilt powerplants from NASA 837 for six -220 engines.

Adapting the F-15B to accept the new engines required modifying the airplane's electrical wiring system. Ron Rohe, lead F-15B avionics technician, learned

that engine wiring harnesses for the -220 were no longer available from the Air Force so he developed a plan to modify the airplane's electrical system. After comparing the original -100 wiring configuration against that of the -220 he developed a hybrid solution using the existing wiring and incorporating changes that allowed the -220 engines to function properly.

The F-15B project team then contracted Boeing to review the proposed wiring modifications and, with only minor changes, the plan was approved in March 2014. Rohe and L-3 avionics technician Chris Brookes completed the modifications in less than three weeks.

Kondracki's F-15 maintenance crew then installed the new engines and NASA research pilot Nils Larson conducted a ground run to ensure the engines were fully functional from idle power to full afterburner. Research pilot Jim Less and flight-test engineer Tom Jones performed a functional check flight on June 4 and found that the engines and their associated electronics performed flawlessly.

Project officials expect this engine upgrade to extend the F-15B's service life for several more years and allow for continued supersonic research. High Speed Project support manager Brett Pauer said the new engines will increase reliability and decrease maintenance downtime between flights.

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