National Aeronautics and Space Administration

THE ARMSTRONG X-PRESS

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# Experimental airplane!

## Electric propulsion Sceptor set to fly in 2 years

**By Jay Levine**
X-Press editor

NASA is researching ideas that could lead to developing an electric propulsion-powered aircraft that would be quieter, more efficient and environmentally friendly than today's commuter aircraft.

The proposed piloted experimental airplane is called Sceptor, short for the Scalable Convergent Electric Propulsion Technology and Operations Research. The concept involves removing the wing from an Italian-built Tecnam P2006T aircraft and replacing it with an experimental wing integrated with electric motors.

An advantage of modifying an existing aircraft is engineers will be able to compare the performance of the proposed experimental airplane with the original configuration, said Sean Clarke, Sceptor co-principal investigator at NASA Armstrong. The Tecnam, currently under construction, is expected to be at the center in about a year for integration of the wing with the fuselage. Armstrong flew a different Tecnam P2006T in September to gather performance data on the original configuration.


**ED15-0290-39** **NASA/Carla Thomas**

*NASA Armstrong pilots flew an Italian-built Tecnam P2006T aircraft in September to collect comparative data for a modified aircraft that is under development for the agency. Once complete, Armstrong staff will integrate a specially developed wing with electric motors on the aircraft for research flights.*

NASA researchers ultimately envision a nine-passenger aircraft with a 500-kilowatt power system in 2019. To put that in perspective, 500 kilowatts (nearly 700 horsepower) is about five times as powerful as an average modern passenger car engine.

However, to reach that goal NASA researchers intend to fly the Aeronautics Research Mission

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# Major aeronautics initiative proposed

**By Jay Levine**
X-Press editor

NASA aeronautics could see its biggest boost in more than a decade if a $3.7 billion plan is approved that would bring agency-matured technology to flight during the next 10 years.

The New Aviation Horizons initiative would include, if approved by both houses of Congress, demonstration and validation of new technologies to dramatically reduce fuel consumption, emissions and noise and open new markets for industry. The initiative would include $150 million in the proposed fiscal year 2017 budget for the Aeronautics Research Mission Directorate. The aeronautics budget would then increase every year to a total of nearly $1.3 billion in 2021.

The initiative aims to develop aeronautics research for transformative capabilities to enable the U.S. aviation industry to maintain and advance its global leadership and continue the nation's economic growth and job creation through aviation. Included in the plan are ultra-efficient aircraft such as a hybrid wing body aircraft, a hybrid electric airplane and a low-boom flight demonstrator. Multiple human-piloted demonstrators are planned in each of the categories.

"All the credit goes to Jaiwon

**Initiative, page 11**

# Flick awarded presidential award

**By Jay Levine**
X-Press editor

Bradley C. Flick, NASA Armstrong's director for Research and Engineering, has been recognized as a recipient of the 2015 Meritorious Executive Presidential Rank Award.

The Presidential Rank Awards were established in 1978 to recognize a select group of career members of the Senior Executive Service (SES) for sustained exceptional performance. No more than five percent of career SES or senior career government employees can receive the award.

As director for Research and Engineering he is responsible for the technical and administrative management of the directorate's engineering workforce. Flick began his 29-year career at the Dryden Flight Research Center (now Armstrong) in 1986 as a flight systems engineer on the F-18 High Alpha Research Vehicle (HARV) project.

He transferred to the Operations Engineering Branch in 1988, where he continued work on the HARV project with a lead role in the development of several experimental systems, including the thrust vectoring control system, emergency electrical and hydraulic systems, the spin recovery parachute system and an actuated nose strake system. He served as mission controller on approximately 100 HARV research flights.

*Bradley C. Flick*

Flick's management career started when he served as Flight Systems Branch chief from 1998-2001. From 2001 to 2005 he served in an acting capacity as associate director for Flight Operations, deputy director for Research Engineering and director of Engineering.

Prior to his current position, Flick served as the center's chief engineer, where he was responsible for providing independent technical guidance and oversight to flight projects to ensure conformance with Center and Agency standards, policies and processes. As the chair of the Airworthiness and Flight Safety Review Board, he was responsible for determining and providing the appropriate level of independent technical review for each project prior to flight. Flick served as acting chief engineer from October 2005 until his permanent appointment to the post in January 2008.

Some of the accomplishments of the Research and Engineering director under Flick's tenure include the maturation of Stratospheric Observatory for Infrared Astronomy through the flight envelope expansion and mission system development to full operational capability and system integration, instrumentation and successful test of the Orion Pad Abort-1 flight test. He also led the organization during the development of the Live Virtual Construct Distributed Environment and integrated flight tests in support of the Uninhabited Air Systems integration in the National Airspace System Project.

In addition, Flick led the organization through numerous Aeronautics Research Mission Directorate projects including the Advanced Compliant Trailing Edge on the G-III subsonic testbed, integrated ground and air collision avoidance and control of flexible structures research on the X-56 Multi-Utility Technology Testbed aircraft.

Flick is also credited with management support and encouragement that has led to significant expansion of technology, such as Fiber Optic Strain Sensing, and initiation of research in emerging areas such as vehicle/system autonomy and electric/hybrid propulsion.

He reorganized the directorate to better align skills and increase overall engineering effectiveness. Flick created a stand-alone organization for project chief engineers to provide more consistency in project technical leadership and emphasized the development of systems engineering skills to improve overall technical leadership performance.

Flick chaired the mishap investigation board in 2012 for the Taurus XL/Glory following the second consecutive failure of the launch system. For that work, he received a NASA Exceptional Achievement Medal.

During his career, he also received the NASA Exceptional Service Medal in 2004 for his contributions to aeronautical research programs.

Flick received a bachelor's degree in electrical and computer engineering from Clarkson University, Potsdam, New York, in 1986 and a master's degree in engineering management from Rochester Institute of Technology, Rochester, New York, in 1997.

# Women@NASA recognizes Bixby, McMurtry, in feature

Cynthia (C.J.) Bixby and Kate McMurtry, two NASA Armstrong managers, are featured in the agency's Women@NASA Website.

*Cynthia Bixby*

*Kate McMurtry*

Bixby is the chief of the Systems Engineering and Integration branch at Armstrong. Bixby supervises and advises both project chief and system engineers working with other branch chiefs around Armstrong to ensure a healthy pipeline of engineering management candidates. Women@NASA 2015 CJ Bixby / AFRC

McMurtry is the branch chief of Operations Engineering at Armstrong. McMurtry is responsible for planning, directing and coordinating the technical and administrative functions for the branch. The mission of the branch is to provide sound engineering to ensure airworthiness throughout planning, integration, and flight of unique systems and flight vehicles.

Women@NASA 2015 - Kate McMurtry / AFRC - YouTube

# Scholarship deadline near

The Armstrong Employee Exchange is accepting applications for the 2016 Thomas W. Finch Memorial Scholarship until May 31. Finch was a research scientist at the NACA High-Speed Flight Station (now NASA Armstrong). He authored and co-authored technical reports on handling qualities and stability and control of the Bell X-5 and North American X-15 research aircraft during the 1950s. High school seniors graduating between January and June 2016 and enrolling at a four-year college or university, or a two-year community college are eligible.



# Vince Chacon retires

**By Jay Levine**
X-Press editor

Vince Chacon, who worked at NASA Armstrong for 37 years, retired on Jan. 2 as the center's associate director.

"I worked with a lot of good people and I always looked forward to coming into work and taking on whatever challenge," Chacon said. "Any time there was a daunting task, I would talk with people and a solution would work its way out. I never assumed I had all the right answers."

**ED16-0025-64** **NASA/Ken Ulbrich**

*NASA Armstrong researcher Bruce Cogan, right, congratulated Vince Chacon on his recent retirement.*

Chacon's Armstrong career included technical and managerial assignments. As associate director he assisted in the overall management of Armstrong operations including planning, directing and evaluating programs, formulating and executing policy and developing, reviewing and directing integrated strategic plans.

Chacon developed methods to improve the efficiency and effectiveness of Armstrong services, identified challenges to center strategies, partnerships and operations and developed methods to overcome them. He also developed and implemented systems for measuring the success of strategy, tactics, partnership and influence on NASA's strategic goals.

He began his work career in 1976 at Rockwell International in Palmdale after graduating with a Bachelor of Science degree in electrical engineering from the University of New Mexico in Albuquerque. At Rockwell he installed and tested instrumentation systems on Space Shuttle Enterprise.

From 1977 to 1978, he worked at the Naval Electronics Systems Engineering Center in San Diego, where he developed automated test systems. He had a co-operative education assignment at the then NASA Dryden while attending the University of New Mexico and was offered a job as an electronics engineer in 1978 that set the course for his career.

Chacon worked his way up to supervisor and then had a number of management positions that included chief of Flight Systems from 1990 to 1995, chief of the Systems Engineering Branch from 1995-2000 and Safety and Mission Assurance director from 2000-2002. He also served as associate director for Business Systems from 2002-2003, deputy director for Research Systems from 2003-2004, chief of the business office from 2004-2009 and director of

**Retirement, page 12**

# NASA officials talk policy

*NASA Associate Administrator Robert Lightfoot, center, and NASA Deputy Associate Administrator Lesa Roe, right, recently updated NASA Armstrong employees on the NASA Operating Model and how they continue to fit the various puzzle pieces of the agency together. Armstrong Center Director David McBride, left, was also on hand to answer questions.*


**ED16-0031-03** **NASA/Ken Ulbrich**

# News at NASA

## Kelly back from space

NASA astronaut and Expedition 46 Commander Scott Kelly and his Russian counterpart Mikhail Kornienko returned to Earth Tuesday after a historic 340-day mission aboard the International Space Station. They landed in Kazakhstan March 2.

Joining their return trip aboard a Soyuz TMA-18M spacecraft was Sergey Volkov, also of the Russian space agency Roscosmos, who arrived on the station Sept. 4, 2015. The crew touched down southeast of the remote town of Dzhezkazgan.

"Scott Kelly's one-year mission aboard the International Space Station has helped to advance deep space exploration and America's Journey to Mars," said NASA Administrator Charles Bolden. "Scott has become the first American astronaut to spend a year in space, and in so doing, helped us take one giant leap toward putting boots on Mars."

During the record-setting One-Year mission, the station crew conducted almost 400 investigations. Kelly and Kornienko specifically participated in a number of studies to inform NASA's Journey to Mars, including research into how the human body adjusts to weightlessness, isolation, radiation and the stress of long-duration spaceflight. Kelly made three spacewalks during his mission. With the end of this mission, Kelly now has spent 520 days in space, the most among U.S. astronauts.

# Hypersonic research pioneer passes

**By Jay Levine**
X-Press editor

NASA Armstrong employees, retirees and family gathered Feb. 9 to honor the life and career of Kenneth W. Iliff, a driving force of modern methods of parameter identification and estimation and a pioneer in hypersonic research. Iliff died Jan. 4. He was 75.

Mary Shafer Iliff, a former Armstrong aerospace research engineer and a senior flying qualities engineer on the SR-71 research project, was married to Iliff. Prior to Iliff's passing, the couple had celebrated their 45th anniversary.

"He loved Dryden, he loved Armstrong and he loved the people here," Shafer said. "He thought this was the greatest place in the world because of the people. I am going to really miss him, but we had a lot of fun."

Many employees and retirees said Iliff was one-of-a-kind.

"Dr. Ken Iliff, was amazing, insightful and brilliant," said Al Bowers, NASA Armstrong chief scientist. "He was my friend. Ken was a key player in the X-15 and the lifting body flight research, and he had a deep love of hypersonic flight. Ken's greatest work was his parameter identification techniques, which are still used today (and formally coded by his two most brilliant engineering protégés Rich Maine and Jim Murray). His sense of humor and mischievous smile will be sorely missed."

Iliff was key in formulating, perfecting and advancing the science and technology of aircraft parameter estimation – how to formulate questions about aircraft performance once the answers are known, or how to determine "why" when the "what happens" is known.

His methodology on parameter estimation is one of the most significant analytical advances in flight research and testing, and his codes are used by virtually all flight test organizations. The codes are also used for identification of other dynamic systems, including submarines, economic models and biomedical models. He is also renowned for his contributions to model structure determination for high angles of attack flight.

EC89-0281-01 NASA

*Ken Iliff worked at NASA for four decades on revolutionary aircraft and spacecraft, including the X-29 forward swept wing aircraft behind him.*

ED16-0045-07 NASA/Lauren Hughes

*Center Director David McBride presents Mary Shafer Iliff with a NASA flag flown at the center.*

"Parameter Estimation technology was a breakthrough in digitally analyzing the motions of an aircraft and the control surface inputs and extracting the characteristics of the vehicle in flight," said former center director Ken Szalai. "His work directly contributed to safer and more efficient flight test, flight control design and simulation development."

Iliff's contributions didn't end with technical brilliance.

"Ken constantly encouraged people to innovate, create and ask *why* something is happening," Szalai said. "He promoted the idea that every flight is an opportunity to do scientific research to increase the understanding of flight in the *real* environment. He challenged people at every level to remember that the mission of NASA and the center was exploration and discovery and to act boldly. He also reminded managers that *people* were the most valuable asset of NASA and to treat them accordingly."

His peers recognized his many skills.

"Ken had a thorough understanding of flight research, and I respected his ability to work with diverse groups to achieve NASA's goals," said Patrick Stoliker, NASA Armstrong's deputy director. "He was the consummate professional."

Iliff joined the Flight Research Center (now Armstrong) in 1962, when flight data were recorded on film and measurements were made with a slide ruler. He began his career studying the handling qualities of the X-15 and a heating study and analysis of proposed modifications. Iliff spent his career at Armstrong and became the center's chief scientist in 1994, a position he held until his retirement in 2002.

He accelerated work on the M2-F1's controls and demonstrated the advantages and pitfalls of different configurations. He worked on the M2-F2 heavyweight lifting body aircraft, transferred to the XB-70 program and provided support on the HL-10 lifting body aircraft.

Iliff also worked on the X-24A, M2-F3 and X-24B lifting body aircraft and early studies of the space shuttle, including computer simulations of the re-entry and landing of various shuttle designs.

**Iliff, page 12**



ED15-0137-32 NASA/Tom Tschida

*Engineers work on a wing equipped with electric motors that is part of an integrated experimental testbed. From left are Sean Clarke, Kurt Papathakis at upper right and Anthony Cash in the foreground.*

ED15-0373-32 NASA/Lauren Hughes

*Engineers gather aerodynamic data on the integrated experimental testbed without the electric motor propellers.*

## Sceptor... from page 1

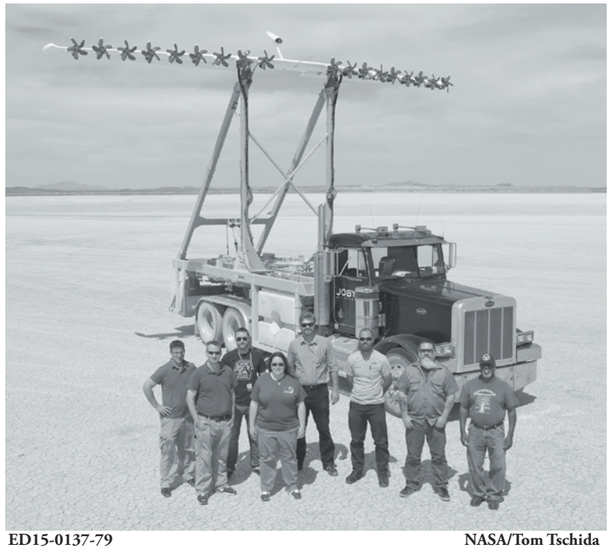
Directorate-funded Sceptor in about two years. Progress in three areas is happening now to enable that timeline, Clarke said.

Those areas include testing of an experimental wing on a truck, developing and using a new simulator to look at controls and handling characteristics of an electric airplane and verifying tools that will enable NASA's aeronautical innovators to design and build Sceptor. Sceptor also is part of NASA's efforts to help pioneer low-carbon propulsion and transition it to industry.

The first area is the Hybrid Electric Integrated Systems Testbed, or HEIST, an experimental wing initially mounted on a specially modified truck. It is used for a series of research projects intended to integrate complex electric propulsion systems.

The testbed functions like a wind tunnel on the ground, accelerating to as fast as 73 mph to gather data, Clarke explained. Researchers have used the testbed to measure lift, drag, pitching moment and rolling moment that can validate research tools, Clarke said.

"By evaluating what we measured, versus what the computational fluid dynamics, or CFD, predicted, we will know if the predictions make sense," he added. "Since Sceptor is a new design, we need to validate we have good answers for the Sceptor experimental wing," Clarke said.



ED15-0137-79 NASA/Tom Tschida

*Team members of the Leading Edge Asynchronous Propeller Technology Ground Test team include from left Brian Soukup, Sean Clarke, Douglas Howe, Dena Gruca, Kurt Papathakis, Jason Denman, Vincent Bayne and Freddie Graham.*

HEIST's first experiment was called the Leading Edge Asynchronous Propeller Technology, or Leaptech. The experiment began in May at Armstrong and consisted of 18 electric motors integrated into the carbon composite wing with lithium iron phosphate batteries.

Tests so far show the distribution of power among the 18 motors creates more than double the lift at lower speeds than traditional systems, he said. Leaptech is a collaboration of Armstrong and NASA Langley Research Center in Hampton, Virginia, and California companies Empirical Systems Aerospace of Pismo Beach and Joby Aviation of Santa Cruz.

Developing and refining research tools is another major effort.

For example, researchers are integrating Sceptor aircraft systems with an Armstrong flight simulator for pilots to evaluate handling qualities. Engineers also will be able to study balancing the power demands of the motors with batteries and then a turbine, Clarke explained. Researchers are interested if a hybrid of distributed electric motors and gas-powered turbines could provide power to extend the aircraft's range and enable the envisioned nine-place concept aircraft, Clarke explained.

Sceptor could be a solution to greater fuel efficiency, improved performance and ride quality and aircraft noise reduction. NASA will be key in developing those technologies that will be with people when they fly.

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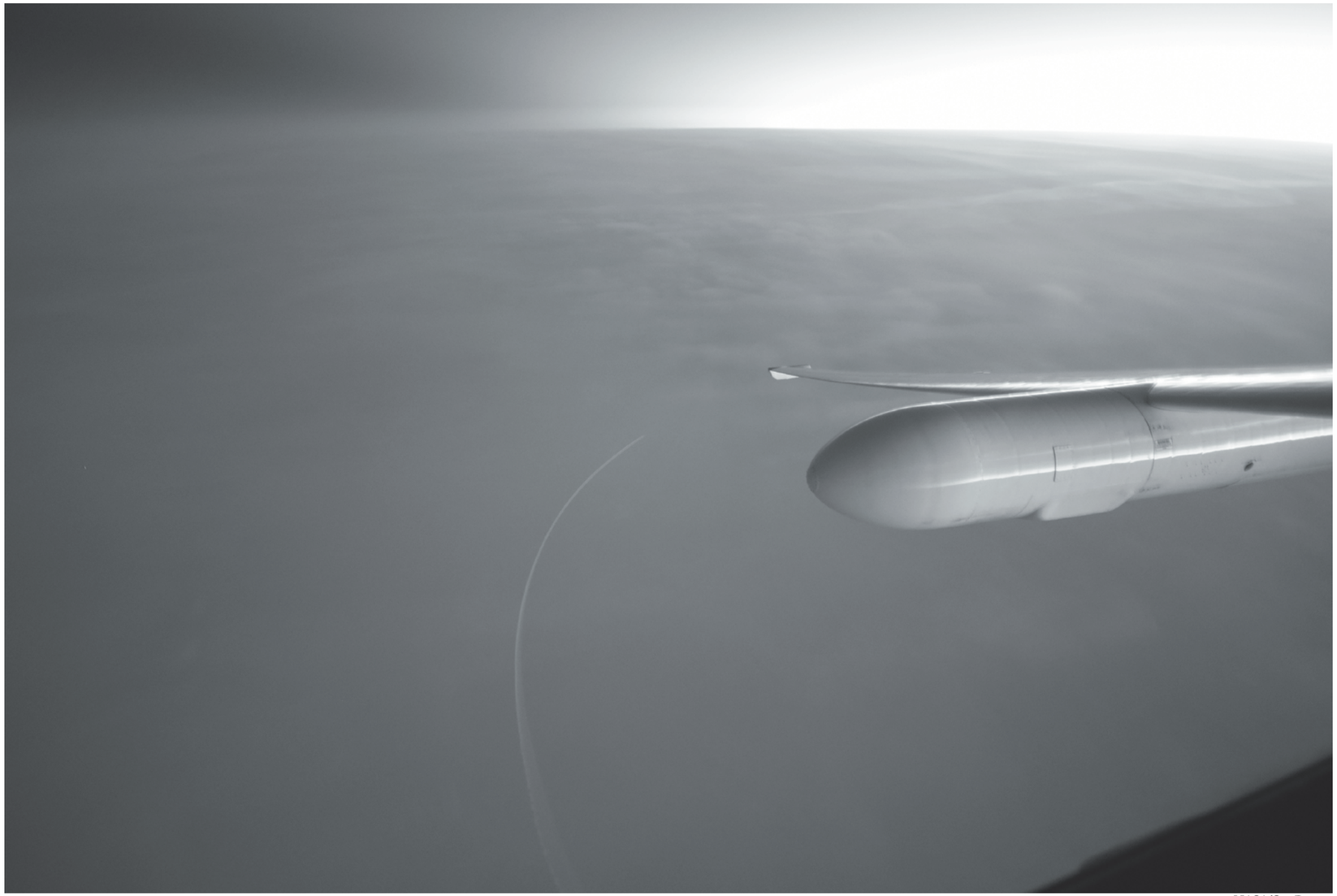
ED15-0345-386 NASA/Ken Ulbrich

ED15-0345-342 NASA/Ken Ulbrich



NASA/Stu Broce

***Top**, the DC-8 begins one of its missions for the Olympex campaign. **Above**, Chris Jensen, left, and Matt Berry work aboard the DC-8.*

***Above**, ER-2 pilot Donald "Stu" Broce captured the DC-8 flying a mission during the Olympex campaign. **At right**, NASA's weather radar on the Quinault Indian Reservation in Taholah, Washington, is one of two fully transportable research-grade S-band radars in the world.*

# Olympex

## NASA-led field campaign verifies rain and snowfall observations, studies precipitation

**By Jay Levine**
X-Press editor

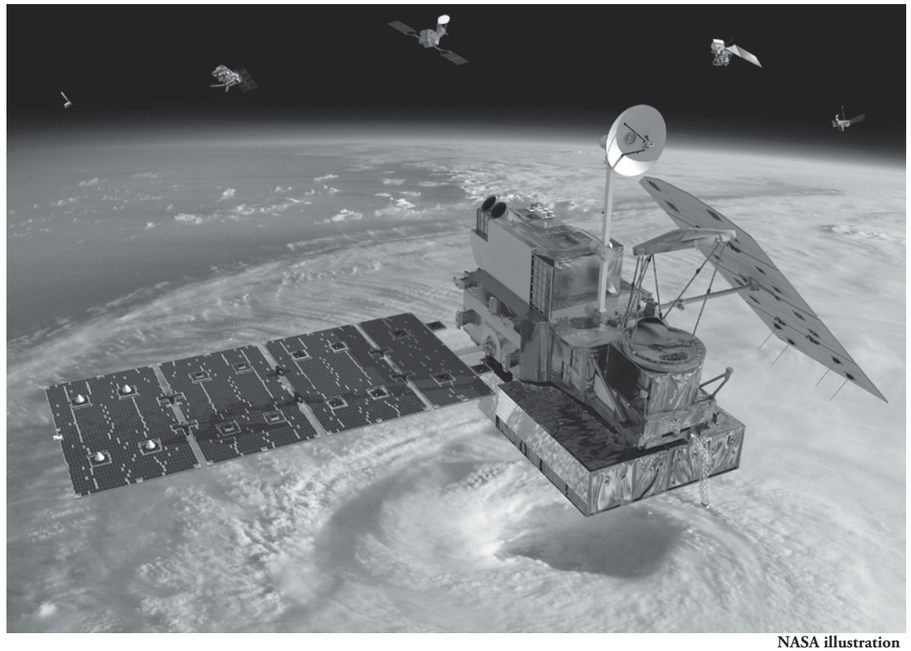
NASA and university scientists studied the wet winter weather near Seattle as part of the Olympic Mountain Experiment, or Olympex, NASA-led field campaign.

NASA's DC-8 and ER-2 aircraft based at NASA Armstrong contributed to the campaign that began Nov. 10, 2015, and ended in mid-January. In addition to the aircraft, the science team used weather radars, weather balloons, and specialized ground instruments to verify rain and snowfall observations made by the Global Precipitation Measurement (GPM) satellite mission.

NASA precipitation science and mission work included inter-center coordination between

**Olympex, page 8**

ED15-0345-342 NASA/Ken Ulbrich

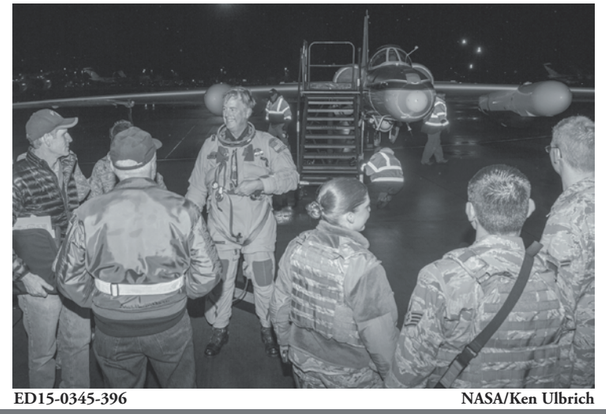


NASA illustration

Aircraft, weather radars, weather balloons and specialized ground instruments were used to verify rain and snowfall observations made by the Global Precipitation Measurement satellite, which is illustrated above.

ED15-0345-352 NASA/Ken Ulbrich

ED15-0345-365 NASA/Ken Ulbrich



ED15-0345-396 NASA/Ken Ulbrich

***Above**, scientists observe data collected by instruments aboard the DC-8.*

***At top right**, a scientist confers with a DC-8 crew member about the flight.*

***At right**, NASA Armstrong pilot Stu Broce arrives at McChord Field in Washington, south of Tacoma, with the ER-2 as onlookers greet him.*

ED15-0345-356 NASA/Ken Ulbrich

*Laura Tudor on the DC-8 prepares a paper towel roll-sized dropsonde to collect precipitation data.*

## Olympex

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NASA Armstrong, NASA's Goddard Space Flight Center in Greenbelt, Maryland, NASA's Wallops Flight Facility in Virginia, NASA's Jet Propulsion Laboratory in Pasadena and a partnership with the University of Washington. The 62nd Airlift Wing and base public affairs office at Joint Base Lewis-McChord, Washington, Olympic National Park Service and Quinault Indian Nation also supported the effort.

The campaign was part of NASA's work to study precipitation and the water cycle. The GPM is the first coordinated international satellite network that will provide near real-time estimates of rain and snow every three hours, at any location.

On a media day and NASA Social held Nov. 11-12, people were invited to tour the DC-8 and visit ground sites located in the Olympic National Park. The public affairs team also supported media flights on the DC-8 during the early part of the campaign, which included The Weather Channel and USA Today online. The campaign attracted a number of news and social media representatives that resulted in nation-wide coverage, reaching an estimated audience of more than 100 million viewers and readers.

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ED16-0043-12 NASA/Ken Ulbrich

*Center Director David McBride, left, presented Michael Ritchson with the Exceptional Space Act Award signed by NASA Administrator Charlie Bolden.*

# Employees earn Space Act Awards

NASA Armstrong innovators recently were honored for work that led to three separate Space Act Awards. The NASA awards recognize scientific and technical contributions that have helped to achieve the agency's aeronautical, space and commercialization goals.

• Michael Ritchson earned an Exceptional Space Act Award for his Enterprise Middleware Solution software that received honorable mention in NASA's Software of the Year competition. The software allows the combination of information from separate databases and in different formats to be combined without the need for creating a new architecture. The software also permits the means to collaborate numerous data resources from various locations and display the data in a single access point or portal.

• Allen Parker, William Ko, Lance Richards, Anthony Piazza and Hon Chan received Space Act Awards for the Real-Time Fiber Optic Sensing System that was entered in the NASA Invention of the Year competition. This system can make thousands of measurements simultaneously, all along a wire less than the diameter of a human hair.

• Mark Skoog, Loyd Hook, Shaun McWherter and Jamie Willhite received Major Space Act Awards for the Continental Digital Elevation Map Compression and Decompression software entered in NASA's Software of the Year competition. The software has assisted F-16 Air Force pilots in situations that previously could have resulted in serious injury or death.

ED16-0043-14 NASA/Ken Ulbrich

*McBride congratulated William Ko, center, and Lance Richards for the Space Act Awards earned by the Real-Time Fiber Optic Sensing System team.*

ED16-0043-13 NASA/Ken Ulbrich

*McBride recognized Mark Skoog, second from left, Shaun McWherter, and Jamie Willhite with the Major Space Act Award.*

# Hubert Drake, engineering pioneer, dies at 94

Hubert Drake, a member of the original NACA contingent that came to the Mojave Desert for X-1 flight tests, died Jan. 13. He was 94.

The stability and controls engineer came to the NACA Muroc Test Unit (now Armstrong) in 1947 from the NACA's Langley Aeronautical Laboratory in Virginia. He spent about two decades working on a diverse range of experimental aircraft beginning with the X-1, D-588-I, D-558-II, X-2, X-5, X-15, the lifting body aircraft and was a driving force in the NASA selection and research of the Lunar Landing Research Vehicle. He also served on NACA advisory committees.

Drake is credited with originating the idea of researching the LLRV, while Donald Bellman and Gene Matranga were senior engineers on the project. The research was part of a NASA-wide effort to develop the experience and techniques necessary for a successful moon landing.

In 1958, when the NACA became NASA, Hubert was selected as advanced planner. He then spent a month in a NASA headquarters study group to select the right approach to a moon landing. The LLRV flight testing was at the NASA Flight Research Center (now Armstrong) and the LLRV was evolved into the Lunar Landing Training Vehicle used by the astronauts to train for lunar landings.

In 1965 Drake became chief of advanced aeronautical studies at NASA's Ames Research Center in Moffett Field, California. In 1970 he was chief of the Aeronautics Division at Ames, a position he held until his retirement in Jan 1975.

# Global Hawk flew El Niño missions

**By Jay Levine**
X-Press editor

Extreme weather predictions on the West Coast could become more accurate with help from NASA's remotely piloted Global Hawk. Flights observed El Niño Pacific storms as they developed.

The mission demonstrated how a Global Hawk could augment satellites and routinely fly vast areas of the ocean, said Robbie Hood, director of the National Oceanic and Atmospheric Administration (NOAA) Unmanned Aircraft Systems program.

"How do you use Global Hawks and actually chase storms?" Hood asked. "That's what we are looking at with these missions."

NOAA, NASA and the National Weather Service are partnering on an El Niño field research campaign "to get data in the hands of forecasters and for our weather models," said Robert Webb, Physical Science Division director of the Office of Oceanic and Atmospheric Research for NOAA.

Webb and a panel of experts from NASA, NOAA and the National Weather Service detailed elements of the campaign at NASA Armstrong Feb. 5.

The observation flights are part of an ongoing NOAA mission called Sensing Hazards with Operational Unmanned Technology, or SHOUT. The multi-year mission plans to show how the use of autonomous vehicles can fill in gaps in weather modeling and as a potential backup in case a satellite is unable to capture data.

This SHOUT mission is being conducted in collaboration with NOAA's larger El Niño Rapid Response Field campaign. In addition to the Global Hawk, NOAA also used a Gulfstream IV research plane and the NOAA ship Ronald H. Brown.

El Niño is a recurring climate phenomenon, characterized by unusually warm ocean temperatures in the equatorial Pacific, which increases the odds for warm and dry winters across the Northern United States and cool, wet winters across the South.

ED12-0012-54 NASA/Carla Thomas

*NASA's Global Hawk was part of a mission to track storms developing in the Pacific Ocean to better predict severe West Coast weather.*

ED16-0038-48 NASA/Ken Ulbrich

*Frank Cutler, NASA Armstrong's Global Hawk project manager, talks to media about the Global Hawk and its current mission.*

Based at NASA Armstrong, the Global Hawk flew four to six, 24-hour flights in February at 60,000 feet altitude. The aircraft provided detailed meteorological measurements from a region in the Pacific that is known to be the origin point of El Niño storms and particularly critical for interactions linked to West Coast storms and rainfall.

The Global Hawk can help fill a void over the Pacific Ocean that other assets, like satellites, cannot easily study, especially in the upper atmosphere where clouds can obscure observations, Webb said.

"It gives us a chance to really get ahead of the storm," he added.

Some of that data is collected through the use of tools resembling paper towel tubes called dropsondes. These devices are dropped from the Global Hawk into the weather to gather temperature, moisture and wind speed and direction, Webb said.

Also onboard the Global Hawk is the High Altitude Imaging Wind and Rain Airborne Profiler (HIWRAP) instrument, operated and managed by NASA's Goddard Space Flight Center and the High Altitude MMIC Sounding Radiometer (HAMSR) instrument, managed by NASA's Jet Propulsion Laboratory. The instruments collected remote observations of the area, producing data similar to satellite observations.

The final instrument, NOAA-O3, measured ozone at the altitude the aircraft is flying. Doppler radar was also used to track wind speed and direction.

"Every place the Global Hawk flies is like a layer cake and we see how it stacks up," Hood said. "The data can be cross referenced and map areas in and around the storm, and we can watch how it develops. We are interested in understanding the data that can improve our ability to predict extreme weather."

Gary Wick, lead NOAA scientist for the SHOUT mission, said the long-endurance flights provide information over a large area of the ocean like satellites do, but with greater resolution because the instruments are closer to the weather.

"The SHOUT campaign provided unprecedented information that will improve hurricane predictions and add to weather models in areas of prediction that the models just don't get right," said Jason Sippel, a National Weather Service scientist.

Frank Cutler, the Armstrong Global Hawk project manager, said the centers's role extends beyond providing the aircraft. Staff members are responsible for integrating the instruments into the aircraft, planning the missions as directed by the science team and then flying those missions.

**Missions, page 12**



## Initiative... from page 1

Shin (Aeronautics Research Mission Directorate associate administrator) and his strategic planning team for putting together six strategic thrusts and having a consistent, obtainable method for getting there," said David McBride, NASA Armstrong center director.

Armstrong has validated through flight a number of the concepts leading up to the plan, said McBride, who has been an advocate for demonstrator aircraft.

For example, the X-48 flew at Armstrong showing increased fuel efficiency and reduction of air and noise pollution, McBride said. Armstrong researchers are working on development and integration of a hybrid electric aircraft. In addition efforts are ongoing on reducing the signature, or directing sonic booms, he explained.

"It is time for new experimental aircraft to prove integrated systems work as the research has shown so far," McBride said. "The proposed budget initiative is a logical step to validate and demonstrate these technologies for industry to use in reducing noise and air pollution and increasing fuel efficiency."

The proposed budget also permits the continuation of NextGen to deliver major benefits to airlines and travelers with the development and transfer of revolutionary air traffic management tools that increase the efficiency of operations while enabling more prognostic system-wide safety.

In addition, the proposal increases investments in Uninhabited Air Systems integration, such as small UAS operation at low altitude, enabling U.S. leadership in safe, scalable applications.

Another element of NASA's work is expanding innovative university research and increasing student involvement in implementing the NASA Aeronautics vision and strategy.

NASA Armstrong's proposed budget is $273 million, which does not include funds from the aeronautics initiative until roles and responsibilities of the centers are detailed, McBride said. It does include $84 million for aeronautics, which includes contributions to aviation safety, advanced air vehicle research and aeronautics test capabilities related to flight operations and test architecture.


NASA Illustration

*A proposed $3.7 billion 10-year aeronautics initiative includes development of technology demonstrators. From left, clockwise, are concepts of a hybrid wing airplane, a supersonic demonstrator and an electric propulsion aircraft. The faded figure is former NASA Dryden (now Armstrong) test pilot Bill Dana.*

Also included is $66 million for Earth science, airborne research and full funding for the Stratospheric Observatory for Infrared Astronomy. Space Technology accounts for $17 million in the budget, which includes Armstrong's management of Space Technology's Flight Opportunities Program. That program facilitates access to flight testbeds for researchers using commercial reusable suborbital providers.

In addition, Armstrong manages Small Business Innovative Research and Small Business Technology Transfer program awards aligned with the center's technical expertise. Armstrong also will continue to develop center-based capabilities through the Center Innovation Fund and support the Office of the Chief Technologist's technology transfer and strategic integration activities at the center level.

Exploration has $25 million for testing of the Orion Crew Vehicle. The funding also covers advanced exploration systems like Armstrong's launch support and pilot, photo and video support of the Orion parachute landing system to be used for the vehicle's return from space.

Education is proposed at $1 million for NASA's education efforts. In addition, $62 million is proposed for safety, security and mission services that ensure the facilities, tools and services needed for conducting NASA's missions are available and $18 million for construction and environmental compliance restoration.

The NASA budget supports developing the technologies that will make future space missions more capable and affordable, partnering with the private sector to transport crew and cargo to the International Space Station, continuing the development of the Orion crew vehicle, Space Launch System and Exploration Ground Systems that will one day send astronauts beyond low Earth orbit. The budget also keeps the Webb Telescope on track for 2018 and builds on scientific discoveries and achievements in space. In addition, the budget supports the Administration's commitment to serve as a catalyst for the growth of a vibrant American commercial space industry.

The $19 billion 2017 NASA budget includes $5.6 billion for Science, $8.4 billion for Human Exploration Operations, $827 million for Space technology, $790 million for Aeronautics research, $100 million for Education and about $3.3 billion for NASA infrastructure called the safety, security and mission services and construction and environmental compliance and restoration budget category.

## Retirement... from page 3

Safety and Mission Assurance from 2010 until accepting the position he retired from in early 2012.

During his Armstrong career, he was twice recognized for excellence. He received the NASA Leadership Medal in 1994 for his work as leading systems engineer on the CV-990 project. That project was used to match the dynamics of a space shuttle landing on a runway and investigated the tires and braking systems for the space shuttles. The work resulted in resurfacing the runway at the Kennedy Space Center in Florida and a change on the crosswind limits acceptable for landing an orbiter.

He also was awarded NASA's Exceptional Achievement Medal in 2005 for his work on evolving the center's business systems following an agency-wide move to full-cost accounting at the same time the information technology infrastructure was changing.

Chacon earned his Master of Science in systems design and management from the Massachusetts Institute of Technology in Cambridge. He is the author of five technical papers.

If there is one bit of advice Chacon said he would pass on to a successor, it would be to, "make sure people are involved and don't expect the first idea to work out. A first solution usually doesn't pan out."

Chacon said the sunset of his satisfying career is expected to turn into the dawn of a retirement involving travel and more time with his grandkids.

## Missions... from page 10

Although the aircraft is autonomous, the Global Hawk can be sent instructions in flight to alter course to better observe items of interest based on changing conditions and "complete the mission with a perfect landing every time," Cutler explained.

As the current El Niño situation evolved, the Global Hawk helped determine what the storms looked like and provided information for models to help better predict how the big storms develop.

## Keith Rossman dies at 56

Keith Rossman, a NASA Armstrong quality assurance inspector, died Jan. 26. He was 56.

Rossman began working at Armstrong in 2007. He was hired as a quality assurance contractor for the Computer Science Corporation and supported the Pad Abort 1 buildup and launch of the escape system for Orion.

Following that effort, Rossman supported the ER-2 high altitude aircraft, F-15s and the Stratospheric Observatory for Infrared Astronomy as a quality assurance and operations inspector.

## Here today, gone tomorrow


ED16-0027-24 NASA/Lauren Hughes

*NASA Armstrong's campaign to demolish older facilities included T-42 near the Armstrong Gift Shop. That building at one time was home to the public affairs team, as was Building 4839, which also was recently leveled. Building 4839 was located near the entrance to the center where the historic aircraft are displayed. Facilities that once housed the space shuttle program offices also were demolished.*

## Iliff... from page 4

He was instrumental in assembling the shuttle's Aerodynamic Data Book, a collection of aerodynamic data from wind tunnels and flight tests used in predicting the shuttle's flight characteristics. Once the shuttle was making orbital flights, Iliff analyzed the re-entry data. He also worked on the X-29 forward swept wing, the F-18 High Angle of Attack Research Vehicle program and the F-15 Spin Research Vehicle.

He received a number of honors and recognitions during his career, including NASA's highest scientific honor, the Exceptional Scientific Achievement Award in 1976. He also was a recipient of the Society of Flight Test Engineers Kelly Johnson Award in 1989 for his significant contributions to the fields of flight testing and flight research. He was inducted into the National Hall of Fame for Persons with Disabilities in 1987. Iliff authored more than 100 technical papers.

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