



# THE ARMSTRONG XPRESS

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## QSF18 on target

By **Matt Kamlet**

Armstrong Public Affairs

An upcoming NASA supersonic research flight series will examine methodology and technology to be used in future community response testing with the agency's Low-Boom Flight Demonstrator aircraft, or Lbfd.

The flight series, called Quiet Supersonic Flights 2018, or QSF18, will use a NASA F/A-18 research aircraft performing a unique supersonic dive maneuver that produces a sound similar to a soft "thump" in comparison to the sonic boom typically associated with supersonic flight. The goal of the flights is to study techniques for obtaining accurate community response data, using surveys, to the reduced sounds of supersonic flight over a community that is relatively unfamiliar with these sounds.

The flights will be conducted by teams from Armstrong, Langley Research Center in Virginia and Johnson Space Center in Texas and will take place in the area of Galveston, Texas, in November.

This effort will provide key information to support planning for the future Lbfd community response flights, which will begin as early as 2022. The Lbfd flights in turn will provide data supporting new noise standards for supersonic flight over land. These new standards



NASA

*The F/A-18 is a key part of an upcoming sonic boom response survey in Texas.*



AFRC2017-0111-35

NASA/Lauren Hughes

*Bob Hunte, an engineer at Applied Physical Sciences Corp. of Groton, Connecticut, calibrates one of several microphones used for Waveforms and Sonic boom Perception and Response Risk Reduction, which advanced technology for gathering community response to sonic booms. The Quiet Supersonic Flights 2018 series will include the use of similar microphone technology.*

will replace current restrictions, which are in place due to the sonic boom produced by aircraft that fly faster than the speed of sound.

"We are doing important research that is a precursor to a national effort to understand how people react to the sound of a quiet supersonic aircraft flying overhead," said Commercial Supersonic Technology Project Manager Peter Coen. "We are learning about the best ways to engage communities, collect acoustic data and conduct surveys in response to sounds that people in a community normally do not hear."

NASA has conducted similar research in the past to develop and advance community response technology and methods. The Waveforms and Sonic boom Perception and Response project, or WSPR, took place in 2011 at Edwards Air Force Base, where sonic booms are relatively common.

In that research project, 100 volunteer residents of Edwards used a questionnaire to provide feedback on low-amplitude "thumps" created with the F/A-18 quiet dive maneuver. WSPR and subsequent research flight series at Edwards further developed data collection methods and test protocols.

In QSF18, NASA will put those techniques to the test over a

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# ATom continues sampling mission

By Ellen Gray

NASA's Earth Science News Team

Two thirds of Earth's surface are covered by water – and two thirds of Earth's atmosphere reside over the oceans, far from land and the traditional ways that people measure the gases and pollutants that cycle through the air and around the globe. While satellites in space measuring the major gases can close some of that gap, it takes an aircraft to find out what's really happening in the chemistry of the air above the oceans. That's where NASA's Atmospheric Tomography (ATom) mission comes in.

Since 2016, a team of scientists with 25 advanced instruments aboard NASA's DC-8 research aircraft has sampled over 400 different gases and a broad range of airborne particles on month-long excursions from Alaska down the Pacific to New Zealand, then over to South America and up the Atlantic to Greenland, and across the Arctic Ocean. Far from land, the atmosphere above the ocean is where to find the cleanest air on the planet – at least in theory. Over the course of three deployments, and with their fourth and final trek beginning in late April, the team has found surprising levels of pollutants above the Pacific, Atlantic and Arctic oceans.

"It is astounding to see such dense pollution in the middle of the ocean, so far from the source regions," said ATom's principal investigator Steve Wofsy of Harvard University, recalling their flight up the center of the Atlantic and their stop at Ascension Island halfway between Africa and South America, just south of the equator.

"As we descended the first time, we were stunned to find ourselves in a thick haze of smoke and dust that originated in Africa, thousands of kilometers to the east. The haze had an unappealing yellow-brown hue and was so thick we couldn't see the ocean. All of the hundreds



NASA/Róisín Commane

*Sea ice in the Arctic is seen from NASA's DC-8 in January 2017.*



NASA/National Center for Atmospheric Research/Sam Hall

*A researcher photographed the sea ice as the DC-8 flew over the Arctic in January 2017.*

of pollutant chemicals we measure had very high amounts. On each revisit since that first one, we have found a similar pall extending for thousands of kilometers, spanning the entire tropical Atlantic Ocean," he said.

Computer models that simulate the movement of the major gases such as carbon monoxide, created

by incomplete combustion from fires, are one of the tools used by the ATom team to get an idea of what they might see on each leg of their flight. It's also one of the tools they are evaluating.

"One of the great things about ATom is showing how well the model generally works," said Paul Newman, chief scientist of

Earth science at NASA's Goddard Space Flight Center in Greenbelt, Maryland. The model combines weather forecasts with known atmospheric chemistry to tell them where and when a pollution plume will intersect the flight path. "But it misses a lot of the detail. It's giving you an understanding of where the stuff is coming from, and that allows you to refine your science. So we're not out there discovering uncharted lands, but it's like, I have a map of Iowa, and I'll drive around there, and that map is probably, depending on how old it is, 95 percent right. It's the 5 percent wrong that's interesting."

One of those interesting deviations occurred over the Arctic, according to atmospheric scientist and ATom team researcher Róisín Commane at Columbia University in New York City. "One of the largest pollution plumes we've seen wasn't predicted by the models, which came from fires in Siberia. So ATom has given us a snapshot of what we might be missing," she said.

Tracking plumes is only the first step. The next is getting a better understanding of how they change as they linger over the ocean. For example, the hydrocarbons from smoke plumes react in sunlight with other gases to form ozone, a greenhouse gas and air pollutant best known as the main ingredient in city smog. The instruments aboard the DC-8 can detect both ozone itself and all the gases that produce ozone by chemical reactions. This means that in addition to tracking ozone in plumes from land, the ATom team can also determine how much is produced from other gases over the ocean.

The center of the Pacific Ocean is much farther from land than is the center of the Atlantic. There, ATom observed generally low ozone levels, but the production of new ozone

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AFRC2018-0071-8

NASA/Lauren Hughes

*Shin spoke about the bright future for NASA aeronautics and the world outlook on aviation.*

## Shin talks aeronautics, honors teams

NASA Aeronautics Research Mission Directorate Associate Administrator Jaiwon Shin visited Armstrong April 10 to talk about how it's going and award two 2017 AA awards to Armstrong team leads.

Lockheed Martin was selected April 3 to build the Low Boom Flight Demonstrator, which was a good day for NASA. The future for NASA aeronautics, which includes the X-57 that will arrive at Armstrong later this year, looks good, he added.

John Carter accepted an AA award recognizing Cheng Moua and the X-56 team for recovering from substantial initial challenges to the X-plane's current successes.

Also awarded was Matt Kamlet, who led the Sonic Booms in Atmospheric Turbulence Community Response Campaign Team. The campaign prepared and educated people about a NASA F/A-18 research aircraft and the reasons for the sonic boom study.



AFRC2018-0071-3

NASA/Lauren Hughes

*John Carter accepts an AA award from Jaiwon Shin and David McBride.*



AFRC2018-0071-2

NASA/Lauren Hughes

*Matt Kamlet accepts an AA award from Jaiwon Shin and David McBride.*

# News at NASA

## Bridenstine is new NASA administrator

Jim Bridenstine became NASA's 13th administrator April 23.

"NASA represents the best of the United States of America," he said. "We lead, we discover, we pioneer, and we inspire. I look forward to our journey together."

As part of the swearing-in ceremony, Vice President Mike Pence and Bridenstine spoke live with NASA astronauts Scott Tingle, Drew Feustel and Ricky Arnold, who currently are living and working 250 miles above the Earth aboard the International Space Station. The astronauts offered congratulations and shared stories of their experiences on the orbiting laboratory.

"The appropriations bill that is now law renews focus on human spaceflight activities and expands our commercial and international partnerships. It also continues our pursuit of cutting-edge science and aeronautics breakthroughs," Bridenstine told agency leadership.

Bridenstine was confirmed by the U.S. Senate April 19, to serve as the agency's administrator. Before this position, he served in the U.S. House of Representatives for the state of Oklahoma, where he held positions on the House Armed Services Committee and the Science, Space and Technology Committee.

Bridenstine also is a pilot in the U.S. Navy Reserve and the former executive director of the Tulsa Air and Space Museum & Planetarium.

# Safety Day focused on awareness, vigilance

By Jay Levine  
X-Press editor

Armstrong does a solid job promoting a safe workplace and committing to safely accomplishing its tasks, said Center Director David McBride at Armstrong's Safety Day April 4.

As staff prepares for flight testing X-planes, completes science missions around the world, produces cutting edge technology and assists the agency with its diverse work portfolio, the need for vigilance and commitment to safety is vital, he said.

"We have to approach every flight with an eye on safety," McBride said. "Safety is one of our most important values and we want people to go home in as good, or better, shape than when they arrived in the morning. It takes all of us. It is worth doing and we take it seriously."

There is room for improvement and it will take every employee to do it, he said.

Glenn Graham, director of Safety and Mission Assurance, said much like the Clint Eastwood film "The Good, The Bad and The Ugly," there is a little of each reflected in the safety record of the past year.

First the good – Armstrong staff is completing more high value missions at a tempo unmatched in the agency, he said.

"We safely completed 988 flights representing 45 projects and more than 3,000 flight hours," Graham said. "Additionally, we executed 16 major deployments around the world."

The bad: "The center is still seeing preventable injuries and mishaps on the ground and the numbers are on the rise compared to the same point last year," Graham said. "From 33 reportable injuries in 2015, the center's number declined to 27 in 2016 and to 23 in 2017. So far this fiscal year there have been 11 reportable accidents. Fiscal year 2017 had 14 close calls and there are 13 to date for fiscal 2018."



AFRC2018-0065-55

NASA/Ken Ulbrich

"The ugly part of the safety story is the Building 703 fire deluge mishap July 27, from which the center is still recovering," he added. "The bill is close to \$2.5 million to rebuild the destroyed office spaces on the south side of the building."

Fiscal 2017 was costly, he added. In addition to the fire deluge incident, a bird strike caused \$400,000 in damage to a research aircraft and \$17,260 was spent on close calls.

"We are all irreplaceable,"

Graham said. "Nothing we do in this center as part of NASA requires us to risk life or limb. If you feel there is a safety challenge, say 'knock it off.' People and equipment resources are scarce and a major mishap can cost lives, millions of dollars and



AFRC2018-0065-12

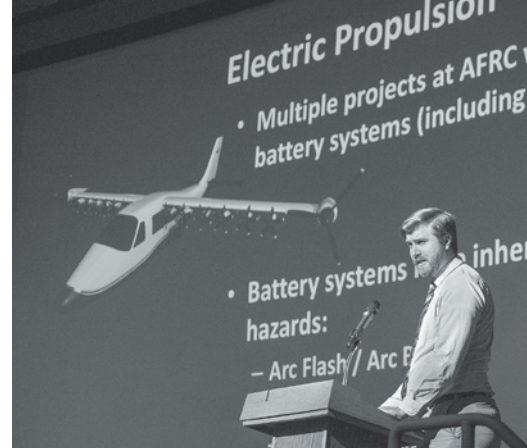
NASA/Ken Ulbrich

Armstrong employees heard Safety Day presentations by David McBride, above, Glenn Graham, below and Kurt Papathakis, bottom.



AFRC2018-0065-19

NASA/Ken Ulbrich



AFRC2018-0065-65

NASA/Ken Ulbrich

commander of the 461st Flight Test Squadron at Edwards, said vigilance and resilience are key to survival. A F-15C practice mission at Eglin Air Force Base in Florida unfolded in an unexpected manner that changed his life.

One second away from impact with another F-15C, wingman and pilot 1st Lt. Ali "Kong" Jivanjee saved Hamilton's life, but died instantly doing so by purposely colliding with the mid-body section of Hamilton's aircraft to avoid a head-on collision.

Hamilton recalled massive disorientation and failing vision. As his aircraft tumbled, he grabbed the control stick as all the warning lights flashed. He tried to shut down the engines, but he couldn't. The jet was engulfed in flames as he ejected. Hamilton knew pertinent procedures, nevertheless he accidentally detached the kit that contained his survival equipment – particularly unfortunate because he landed in the ocean. A fishing boat rescued him.

Hamilton knows the value of a system that can automatically save a pilot when collision is imminent and he worked with the Air Force Test Pilot School at Edwards on the Ground Collision Avoidance System team. He advocated successfully for the system to be installed in F-15 aircraft and lives have been saved as a result, he added.

Many situations can become dangerous when fatigue is involved. That topic was a main emphasis of Brad Neal, NASA Armstrong's chief engineer, who discussed an accident with his riding mower that he believes was preventable. Another factor in his accident was that he was not familiar with the safety features of his riding mower.

Neal was tired and was mowing his heavy grass in the evening when the mower became plugged. He disengaged the blade, but did not

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AFRC2018-0065-117

NASA/Ken Ulbrich

Alma Soliz practices using a fire extinguisher during Safety Day activities.



AFRC2018-0065-90

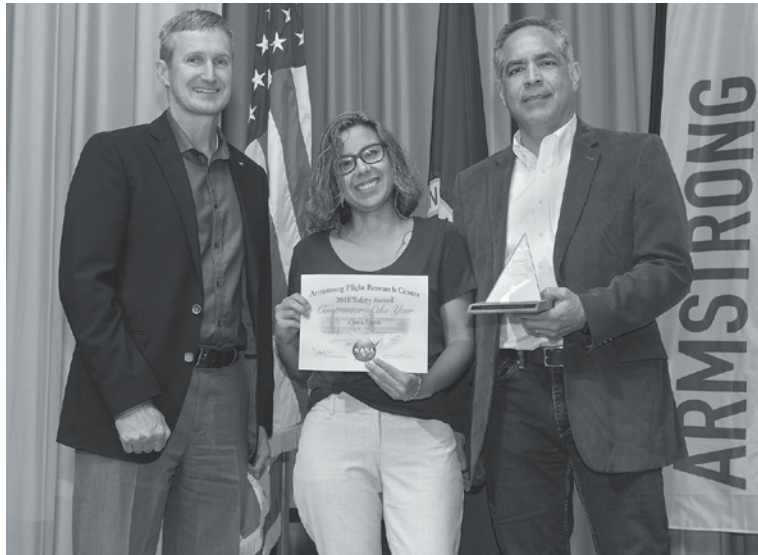
NASA/Ken Ulbrich

Dean LeBret, right, explains some of the many kinds of hand protection that are available to safely perform a number of jobs.



AFRC2018-0065-75 NASA/Ken Ulbrich

*Terrance Dilworth, center, was awarded the Annual Safety Award in the Civil Servant category for his vigilance during the DC-8 wiring and instrumentation installation that led to the discovery of cracking on a fuel line.*



AFRC2018-0065-76 NASA/Ken Ulbrich

*Diana Marin, who was awarded the Annual Safety Award in the contractor category, proactively corrected identified safety findings, educated personnel on prevention and provided periodic safety monitoring.*

## Safety Day... from page 5

turn the mower off. The blades claimed his fingernail, broke the end of his finger and caused a compound fracture. It required six months to recuperate.

“Don’t do things in a rush and understand the conditions,” he said. “Be aware of safety features, wear equipment and realize if you are fatigued you are impaired. Also, if you get hurt, don’t wait to go to

the doctor.”

Kurt Papathakis, an electrical engineer on the Hybrid-Electric Integrated Systems Testbed, detailed challenges with the batteries intended to power electric propulsion systems.

Potential battery hazards include an arc flash, or a blast that can cause severe burns – or worse. The large batteries were retrofitted from

one project to another June 6, 2016. Engineers were changing the voltage and reconfiguring the battery for the new use. The configuration was confusing and it was a complex maneuver to get everything right. The team was lucky, as the flash burn was minor and as a result of the mishap the design of the setup was improved.

“We were working with

things we didn’t fully appreciate,” Papathakis said. “We learned to be more careful with high voltage systems, design for safety, have a second set of eyes and wear the right protective equipment.”

Motorcycles can present safety challenges and two speakers explained the value of wearing

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AFRC2018-0065-77 NASA/Ken Ulbrich

*Donna Williams called the Health Unit when one of her colleagues did not look well. The medical team provided immediate assistance, including transportation to the emergency room. The medical team was recognized with the Annual Safety Award in the group category including, holding certificates from left, Doris Jones, Sonja Hubbard and Dr. Dwight Peake.*



AFRC2018-0065-78 NASA/Ken Ulbrich

*Terry Luallen’s proactive and tenacious pursuit of correcting challenges and re-drafting necessary documentation culminated in updates to the mishap response Code OF/410 checklists. Luallen accomplished this task as an additional duty for the Armstrong Aviation Safety Office, which earned him the Annual Safety Award in the safety representative category.*

# Scientists study currents and winds

By **Kate Squires**

Armstrong Public Affairs

NASA scientists are hard at work trying to unlock mysteries of our planet's ocean surface currents and winds using a new Earth science radar instrument called DopplerScatt.

Ocean currents and winds form a never-ending feedback loop: winds blow over the ocean's surface, creating currents. At the same time, the hot or cold water in these currents influences the wind's speed.

Understanding the relationship between the two phenomena is crucial to understanding Earth's changing climate. Gathering data on this interaction can also help people track oil spills, plan shipping routes and understand ocean productivity in relation to fisheries.

NASA has been studying winds for decades using NASA's NSCAT, QuickScat and RapidScat instruments. However, DopplerScatt, developed by NASA's Jet Propulsion Laboratory in Pasadena, California, provides a new capability to measure both winds and currents simultaneously.

Flying aboard a B200 King Air aircraft, DopplerScatt is a spinning radar that "pings" the ocean's surface, allowing measurements to be taken from multiple directions at one time. It's a step up from previous technology, which could simultaneously measure currents from one or two directions at the most and couldn't measure the properties of the sea surface as completely.

Like a speed gun, the DopplerScatt instrument calculates the Doppler effect of a radar signal bouncing off an object. As that object moves closer or farther away, it detects these changes and figures out its speed and trajectory. Those measurements are combined with data from a scatterometer, which detects the reflection of the radar signal from the ocean's surface.

The more "scattering" the radar observes, the rougher the waves. From the roughness and orientation of the waves, wind speed and direction can be calculated.

DopplerScatt is funded and managed by the Earth Science Technology Office at NASA Headquarters in Washington D.C. The B200 King Air research aircraft used to fly the instrument is managed and operated from Armstrong.



AFRC2018-0038-35

NASA/Carla Thomas

*Radar operator Alexander Wineteer monitors incoming wind data from the Doppler-Scatt radar instrument during a science flight off the California Coast on March 5.*



AFRC2018-0025-42

NASA/Ken Ulbrich

*Engineers Raquel Rodriguez Monje and Fabien Nicaise discuss placement of the DopplerScatt radar instrument before its final installation onto the B200's fuselage.*

## World Tour... from page 2

over the ocean based on the measured suite of ingredient gases was higher than the models predicted.

"This implies that the remote Pacific is a larger source of tropospheric ozone than we previously understood," said ATom's deputy project scientist Michael Prather at the University of California, Irvine. "It's a preliminary

result, and we have yet to analyze whether this produced ozone is natural or related to pollution, but it does mean we'll need to rethink what we believe about how much ozone is produced over the remote oceans, and what that means for the climate and our efforts to reduce ozone pollution on land."

ATom's final deployment will

take place this spring. With the atmospheric data they've collected during flights from each season of the year, the science team will continue to analyze the data and improve the atmospheric models that help us understand our home planet.

ATom is funded by NASA's Earth Venture program and managed by

the Earth Science Project Office at NASA's Ames Research Center in Silicon Valley. Armstrong manages the DC-8 research aircraft at Building 703 in Palmdale. A team of over 100 people – scientists, engineers, flight crew and staff – across government agencies and universities support the mission in the air and from the ground.

## QSF18... from page 1

community that is not accustomed to hearing the sounds of supersonic flight.

The data from this flight series will provide direct insight into the community response element for future LBFD flights, which will fly over numerous communities in the United States to collect a large database that fully represents community response to quiet supersonic flight.

The research in Galveston will be conducted by flying the F/A-18 in an oval flight pattern offshore, where

it will dive from approximately 49,000 feet and briefly go supersonic before recovering to level flight at approximately 30,000 feet. This type of dive produces a sonic boom in such a way that the sound is perceived in a specific area as a quieter “thump” similar to the predicted sound signature of LBFD. NASA also will operate audio sensors in the area to measure the acoustic levels of this sound.

“We’ve performed similar research flights in the past to prove that our flights are safe and that

the sounds we plan to create are not dangerous or damaging,” said Coen.

QSF18 also marks a unique collaboration between NASA’s aeronautics and human spaceflight programs. Part of the decision to engage the city of Galveston for this research was its proximity to the Johnson Space Center, located approximately 30 miles north of the island, which is best known as the home of NASA’s astronauts and several mission control centers.

“This is a great opportunity

for us to participate in another exciting area of NASA research,” said Melanie Saunders, Johnson’s acting deputy center director. “The agency’s Aeronautics Research Mission Directorate is doing work that could help air travelers everywhere in the future, and we’re looking forward to be part of it.”

QSF18 is an element of NASA’s Commercial Supersonic Technology project, one of the many Aeronautics Research Mission Directorate efforts that supports the motto “NASA is with you when you fly!”

## Safety... from page 6

protective gear.

U.S. Air Force Lt. Col. Dan Montez experienced shimmy in the front wheel of his motorcycle that made the vehicle impossible to control. His full-face helmet saved his chin, but he received numerous injuries and was immobilized on his right side. Montez said he usually wears more protection than he had worn on that day. If he had the extra protection his injuries would have been less severe. His shoulder mobility isn’t the same and he now has titanium in his right arm. “Even if it is a little warmer and less comfortable, it is worth it to wear protective gear,” he added.

In a separate talk Alejandro Osorio recalled a motorcycle accident captured by his dashcam. His crash resulted in a 30-foot fall off a cliff. He fractured both shoulder blades, four ribs and vertebrae and received other

injuries that left him temporarily disabled for two months. Motorcycle accidents result in 25 times more fatal accidents than do passenger cars, he added. Helmets reduce death in motorcycle crashes by 37 percent, but a motorcycle offers no crumple zones, air bags or seat belts.

Health and awareness are critical to safety, said Dr. Dwight Peake, chief medical and flight surgeon. Good cardiovascular condition assists in the fight against depression and anxiety and can reduce the chance for heart related illness as well as lower blood pressure, treat diabetes, lower risk for cancer and strengthen mood.

There is a price to pay for ill health. For example, the U.S. currently spends \$555 billion each year on heart disease, \$245 billion on diabetes and \$225.8 billion on cancer. Benefits of good health

can be felt by employees and employers. Johnson & Johnson saved \$250 million a year by instituting a wellness program. Moderate exercise (150 minutes a week) has positive results for thinking, attention and memory, which are all critical for safety.

Art Tomassetti, a retired Marine Corps colonel who flew all three variants of the X-35 as the lead government pilot, explained that there isn’t always a red alert like in the science fiction classic “Star Trek” when danger is eminent.

“Fatigue is a factor,” he said. “Sometimes you are up late, haven’t slept well and you are less than 100 percent of your capability. If there are signs of fatigue, that is not the time to take on the most critical tasks.”

Complacency, unawareness and level of satisfaction can also lead to

mishaps. Teamwork requires trust to work together efficiently and safely.

“A ‘no’ vote is important, but rarely easy to do, but a ‘no’ vote can save us,” Tomassetti said.

Safety Day also included activities and exhibits offered by the NASA Safety Center, the NASA Safety Reporting System, the Government – Industry Data Exchange Program, the Employee Assistance Program, the Armstrong Ombudsman Program and the NASA Inspector General.

Featured were the Automated External Defibrillator exhibit, an evacuation chair demonstration, hand safety, hearing conservation, zone aid station tours and demonstrations, the Community Response Team Program, the California Highway Patrol, a distracted driving simulator and live fire extinguisher training.

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