



THE ARMSTRONG X-59 EXPRESS

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X-59 advances



Lockheed Martin

The team at the Lockheed Martin Skunk Works in Palmdale merged the major sections of the X-59 Quiet SuperSonic Technology aircraft, which includes the wing, tail assembly, and fuselage or forward section. This marks the first time the X-59 resembles an actual aircraft. See story on page 2.

X-59 takes shape

By **Sasha Ellis and Evan Flatt**
NASA Langley Research Center

A heavy chorus of bolting and machinery filled the X-59 Quiet SuperSonic Technology, or QueSST, assembly building as engineers, system technicians, and aircraft fabricators worked to merge the major aircraft sections together, making it look like an actual aircraft for the first time since the initial cut of metal in 2018.

“We’ve now transitioned from being a bunch of separate parts sitting around on different parts of the production floor to an airplane,” said Jay Brandon, NASA chief engineer for the Low Boom Flight Demonstrator (Lbfd) project.

NASA’s X-59 QueSST is under construction at Lockheed Martin Skunk Works in Palmdale and is designed to fly at supersonic speeds – approximately 660 mph at sea level – without producing a startling sonic boom for people on the ground.

NASA will work with U.S. communities to understand their response to the aircraft’s sound and provide that data to regulators, which could change the rules that currently ban supersonic flight over land, cutting travel time in half for air travelers in the near future.

The Merger

With great precision and accuracy, the team used features on the structure to precisely self-locate the aircraft’s wing, tail assembly, and fuselage or forward section, then employed a series of laser projections to verify the precise fit.

“The extensive use of features and pre-drilled, full-size fastener holes has significantly reduced the time it takes to locate and



Lockheed Martin

This is an illustration of the X-59 Quiet SuperSonic Technology aircraft, which will soon take to the skies as NASA’s first purpose-built, supersonic experimental plane in decades.

fit parts, especially mating large assemblies like this,” said David Richardson, Lockheed Martin program director. “It is sort of like how Legos go together. We used the laser tracker to make sure it is all aligned per the engineering specs before we permanently bolted it all together.”

The mating of these major hardware components was a breath of fresh air for the team.

“A milestone like this – seeing the airplane coming together as a single unit – really reinvigorates and motivates the team,” said Dave Richwine, NASA’s Lbfd deputy project manager for technology.

Fuselage

The aircraft’s fuselage contains the cockpit and helps define the shape of the X-59. Eventually the 30-foot-long nose of the aircraft will be mounted to the fuselage.

Part of the cockpit is something you might see in an office. The pilot will see the sky ahead through a 4K computer monitor,

which will display complex computer-processed imagery from two cameras mounted above and below the X-59’s nose. NASA calls this forward-facing “window” the eXternal Vision System or XVS.

The XVS serves as an additional safety aid to help the pilot maneuver safely through the skies. This cutting-edge vision system is necessary because the desired shape and long nose of the X-59 won’t allow for a protruding cockpit canopy.

The X-59’s unique shape controls the way the air moves away from the plane, ultimately preventing a sonic boom from disturbing communities on the ground.

Wing

The most recognizable part of the airplane – the wing – was “the most complicated section and first section of the X-59 that was fabricated by Lockheed Martin,” explained Richwine. Housed within the 29.5-foot-wide wing are the aircraft’s fuel systems

and a large portion of its control systems.

The Lockheed Martin team used robotic machines with names that sound like pilot call signs – Mongoose and COBRA – to manufacture the wing before its mate to the tail assembly and fuselage.

Mongoose is a tool with the ability to weave together composite wing skins using ultraviolet light to bind the composite material. COBRA – Combined Operation: Bolting and Robotic AutoDrill – efficiently created holes that allowed the team to attach the wing skins to the wing frame.

Tail Assembly

The tail assembly contains the engine compartment. This section is built with heat resistant materials that protect the aircraft from the heat given off by the X-59’s GE F414 engine.

The engine is in the upper section of the X-59. Similar to the XVS, it is one of many purposeful design elements that ensure the aircraft is shaped as desired to produce a quieter noise to people below.

What’s the point of the X-59 – apart from it just being ‘plane’ cool?

The X-59 – the visual centerpiece of the mission – definitely brings in the cool factor, but the data part of NASA’s mission – the nerdy part – is what will revolutionize speedy commercial air travel over land.

NASA’s quiet supersonic mission involves building the X-59 (happening now) and conducting initial flight tests starting in 2022.

X-59 page 7



Divonte Williams, top right, was awarded the NASA Armstrong Exchange Council's 2021 Thomas W. Finch Scholarship. On a teams call, also were NASA Armstrong Center Director David McBride, top left. Bottom, from left are Tamika Williams and Jerald Herron and Damone Williams Sr.

Williams awarded scholarship

By Desiree Heyliger
NASA Armstrong

Divonte Williams combines his academic learning achievements with soccer, choir, and volunteer work. It is a winning combination for a scholarship.

Williams, a 2021 graduate of Quartz Hill High School, was awarded the NASA Armstrong Employee Exchange Council's 2021 Thomas W. Finch Memorial Scholarship. The scholarship is available to sons and daughters of Armstrong employees and offers \$2,000 per year for up to four years, contingent on full-time enrollment and a 3.0 GPA.

"The scholarship was extremely competitive," said Randy Thompson exchange council scholarship committee chairman. "Through a blind evaluation process Divonte Williams was the scholarship board's unanimous selectee. We are pleased to award the scholarship to such an incredibly dedicated student, and we wish him the best in his educational endeavors."

Williams is the son of Tameka Williams, who is an

accountant at the center, and Damone Williams Sr. Williams' stepparents are Jerald Herron and LaShondra Williams.

"I am proud of his determination and commitment to accomplishing what he sets his mind to, including academics and sports," Tameka Williams said. "He doesn't give up. He naturally has the drive and determination to accomplish his goals."

Williams said his motivation to go to college began with his parents instilling in him the value of education and knowledge. "Can't" was not part of his vocabulary.

His passion for the marvels of the Earth is what makes him interested in Geological Science. He believes that Geology is important since it not only looks at the Earth in its present state but how the structures, organisms and processes have changed over time and will continue to impact the Earth. Living in Southern California has also helped him become more aware and captivated by Earth's wonders.

As a kid, one of his hobbies was rock collecting. That interest grew into a career path, which he plans

to begin with studying geological sciences this fall at California State University, Northridge, in Southern California. He is looking forward to guidance from his older brother, Damone Williams Jr., who also attends the university.

"I plan to gain hands-on knowledge and experience throughout my college career by taking advantage of all training, opportunities and other programs that become available," he wrote in his essay. He states that he would love to land a job with an amazing employer like NASA, which would give him the opportunity to participate with geoscience research teams.

"I want to study theories and hypotheses about the Earth's crust and develop my own hypothesis about what happens in the deeper layers," he said.

He achieved a 3.14 GPA in his academic studies at Quartz Hill High School. Williams was captain of the varsity soccer team and was the goalkeeper. He also participated in the Quartz Hill High School Chamber Singers

Scholarship page 7

News at NASA

NASA seeks volunteers for Mars sim

NASA is seeking applicants for the first one-year simulation mission on Earth in a habitat to simulate life on a distant world, set to begin in Fall 2022.

In preparation for the real-life challenges of future missions to Mars, NASA will study how highly motivated individuals respond under the rigor of a long-duration, ground-based simulation.

The series of missions - known as Crew Health and Performance Exploration Analog - includes three one-year Mars surface simulations based at NASA's Johnson Space Center. The analogs will support research to develop methods and technologies to prevent and resolve potential problems on future human spaceflight missions to the Moon and Mars.

Each mission will consist of four crew members living and working in a 1,700-square-foot module 3D-printed by ICON, called Mars Dune Alpha. The habitat will simulate the challenges of a mission on Mars, including resource limitations, equipment failure, communication delays, and other environmental stressors. Crew tasks may include simulated spacewalks, scientific research, use of virtual reality and robotic controls, and exchanging communications.

NASA is looking for healthy, motivated U.S. citizens or permanent residents who are

Mars sim page 8

Air taxi flights

NASA begins air taxi flight tests with Joby Aviation

By Teresa Whiting

NASA Armstrong Public Affairs

NASA began flight testing Aug. 30 with Joby Aviation's all-electric vertical takeoff and landing (eVTOL) aircraft as part of the agency's Advanced Air Mobility (AAM) National Campaign.

The testing runs through Sept. 10, at Joby's Electric Flight Base located near Big Sur, California. This is the first time NASA has tested an eVTOL aircraft as part of the campaign. In the future, eVTOL aircraft could serve as air taxis for those in cities and surrounding areas around the country, adding another mode of transportation for moving people and goods.

NASA's goal is to collect vehicle performance and acoustic data for use in modeling and simulation of future airspace concepts. This test will help identify gaps in current Federal Aviation Administration regulations and policies to help incorporate AAM aircraft into the National Airspace System. This multi-event campaign to advance airspace mobility in the U.S. will take place at multiple locations over several years.

"The National Campaign Developmental Testing is an important strategic step in NASA's goals to accelerate the AAM industry timeline," said Davis Hackenberg, NASA AAM mission integration manager. "These testing scenarios will help inform gaps in current standards to benefit the industry's progress of integrating AAM vehicles into the airspace."

During this round of testing,



Joby Aviation

Joby's all-electric vertical takeoff and landing aircraft is pictured at the company's Electric Flight Base, located near Big Sur, California. NASA began flight testing with the aircraft Aug. 30 as part of the agency's Advanced Air Mobility National Campaign. This test runs through Sept. 10.

NASA will collect data from Joby's eVTOL aircraft, which is intended to serve as a commercial passenger service in the future. Analyzing that data readies the AAM National Campaign to execute the first set of campaign tests, known as NC-1, slated for 2022, with more complex flight scenarios and other industry vehicles.

As the Joby aircraft flies planned test scenarios, the NASA team will collect information about how the vehicle moves, how the vehicle sounds, and how the vehicle communicates with

controllers. Future partners will fly similar scenarios to evaluate their vehicle readiness.

The team will deploy the mobile acoustics facility and construct an array of more than 50 microphones to measure the acoustic profile of Joby's aircraft in different phases of flight.

"NASA's AAM National Campaign is critical to driving scientific understanding and public acceptance of eVTOL aircraft," said Joe Ben Bevirt, founder and CEO of Joby Aviation. "We're incredibly

proud to have worked closely with NASA on electric flight over the past 10 years and to be the first eVTOL company to fly as part of the campaign."

Another element of the testing includes making sure external ranges participating in NC-1 meet the protocols for future testing by establishing a baseline to participate. The team will also test NASA's flight safety and airworthiness processes to approve participants to fly in the campaign.

Air taxi page 7

X-57 completes high-voltage testing

By Sarah Mann

NASA Armstrong Public Affairs

NASA's all-electric X-57 Maxwell has completed another milestone toward first flight; the successful completion of high-voltage testing. High-voltage testing powers the aircraft from an auxiliary power supply to test the functionality of the integrated systems under full power. A highlight from high-voltage testing included the spinning of the propellers for the first time under electric power. Though the propellers had previously spun during the X-57's initial build phase conducted by the small business prime contractor Empirical Systems Aerospace, Inc. at Scaled Composites in Mojave, it is now up to NASA engineers to advance the system and use lessons learned from previous tests. The propellers are powered by electric cruise motors, which will also be used to power the X-57 in flight.

A principal goal of the X-57 project is to share the X-57 design and airworthiness process with regulators and standards organizations. Another goal is to establish the X-57 as a reference platform for integrated approaches of distributed electric propulsion technologies. Next up, X-57 will undergo verification and validation testing.



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NASA/Lauren Hughes

NASA's all-electric X-57 Maxwell concluded high-voltage ground testing at NASA Armstrong. The principal goals of the X-57 Project are to share the X-57 design and airworthiness process with regulators and standards organizations; and to establish the X-57 as a reference platform for integrated approaches of distributed electric propulsion technologies.

DC-8 deploys to the U.S. Virgin Islands

By Elena Johnson

NASA Armstrong Public Affairs

NASA's DC-8 aircraft deployed to St. Croix in the U.S. Virgin Islands on Aug. 17 after more than six months of preparation and instrument upload.

As part of the Convective Processes Experiment – Aerosols and Winds campaign, CPEX-AW, NASA Armstrong prepared the airborne science laboratory for the 45-day deployment to St. Croix, US Virgin Islands with a series of test flights earlier this month.

The campaign, which is a joint effort between NASA and the European Space Agency, aims to gather critical data about tropical convection processes. Instruments on NASA's DC-8 will measure winds, aerosols, precipitation, and other conditions that influence convection from the west to east coast of the Atlantic Ocean near the Equator.

NASA's DC-8, based at NASA Armstrong's Building 703 in Palmdale is flown to collect data for experiments in support of projects serving the world's scientific community.



AFRC2021-0106-06

NASA/Joshua Fisher

NASA's DC-8 takes off to St. Croix in support of the Convective Processes Experiment – Aerosols and Winds campaign (CPEX-AW) on Aug 17.

Making the dream work

Flexibility needed in times of a pandemic

Sarah Mann

NASA Armstrong Public Affairs

Imagine getting a dream internship at NASA. There is so much to look forward to from the exciting new discoveries, to meeting the brilliant engineers and scientists, and learning from mentors about potential careers.

Then the pandemic hits and most NASA employees are required to work from home – including students. For two interns at NASA Armstrong, the learning experience was complicated by working in a virtual environment.

Internships are an important part of NASA's STEM engagement and as part of National Intern Day, Juan Battaglia and Gracie Awalt described their experiences.

Many NASA internships are hands on in a lab and working completely remote made learning those new skills difficult, Battaglia said. His internship at NASA Armstrong focused on developing a climate control circuit for the micro Fiber Optic Sensing System (micro FOSS) unit. Battaglia was specifically tasked with designing a circuit that would heat and cool the device in extreme conditions.

Battaglia is a junior at the University of Central Florida, who is studying electrical engineering. Without the commute to work, he had time to not only complete his internship, but also his schoolwork. The remote internship had its challenges, but the NASA Armstrong team worked to include Battaglia as much virtually as he would have been in person.

"Daily meetings do a lot to make you feel more integrated and being able to call your co-workers at any time is great for when you get stuck on a problem," said Battaglia. "I would call at least one of my mentors individually about once a day, depending on what kind of problem I was dealing with. They were always very helpful and seemed genuinely interested in what I was doing, and how I was thinking about a problem."

Battaglia said he learned the skills needed to complete he assigned tasks.

"Being able to arrive at a solution after lots of brainstorming and research gave me a sense of accomplishment despite not being able to see it all come together in person," he said.

"The most important things that this internship gave me are the confidence in my skills as a professional and as an engineer, and perspective on what the engineering industry is really like," said Battaglia. "I was really



Courtesy of Juan Battaglia



Above, Juan Battaglia's virtual internship during 2020 took place at NASA Armstrong. His internship focused on developing a climate control circuit for the micro Fiber Optic Sensing System unit.

At left, Gracie Awalt provided support to the Office of Strategic Communications on the Low Boom Flight Demonstrator X-59 during her 2020 virtual internship at NASA Armstrong.

Sinek part of NASA event to envision the future

Best-selling author and speaker, Simon Sinek, will join NASA's Veronica Marshall for a conversation on how great leaders and organizations think, act, and communicate to imagine bold futures and make them a reality. The event, called The

Next Giant Leap: Envisioning the Future with Simon Sinek, is set for Sept. 17, beginning at 9 a.m. PST.

Topics will include lessons from NASA's pandemic experience; revisiting NASA's "why" with the evolving space industry;

challenges and successes in addressing diversity, equity and inclusion; remaining agile and resilient in a new age of digital transformation and hybrid work; and NASA's goals and missions and how to lead for success.

The conversation will be

followed by a NASA leadership roundtable. This event will be aired live to the NASA workforce via Town Hall. For more, visit the event webpage at <https://nasa.sharepoint.com/sites/Community/SitePages/One-Giant-Lea.aspx>

X-59... from page 2

In 2023, NASA will fly the X-59 over the test range at NASA Armstrong to prove it can produce a quieter sonic thump and is safe to operate in the National Airspace System. More than 175 ground recording systems will measure the sound coming from the X-59.

In 2024, NASA will fly the X-59 over several communities around the nation to gauge people's response to the sonic thump sound produced by the aircraft – if they hear anything at all. The data collected will be given to the

Federal Aviation Administration and the International Civil Aviation Organization for their consideration in changing the existing bans on supersonic flight over land.

That ban went into effect in 1973 and has plagued commercial supersonic ventures ever since, restricting faster-than-sound travel only to flights over the ocean. British Airways and Air France flying the Concorde were two airlines that offered such service between 1976 and 2003.

If rules change because of NASA's data, a new fleet of

commercial supersonic aircraft become viable, allowing passengers to hop on a plane and arrive from distant destinations in half the time. Though the single-piloted X-59 will never carry passengers, aircraft manufacturers may choose to incorporate its technology into their own designs.

The Future Awaits

With an eye to the future, the team is rigorously working on final assembly of the X-59, which will mark the end of manufacturing.

In late 2021, Lockheed Martin will ship the X-59 to a sister facility in Ft. Worth, Texas, where ground testing will be done to ensure the aircraft can withstand the loads and stresses that typically occur during flight. There, the team also will calibrate and test the fuel systems before the X-59 makes the journey back to California for more tests.

Though seemingly a long way away, community overflights, data collection and a possible new commercial market for supersonic flight over land is just around the corner.

Scholarship... from page 3

and the school's Acapella choir. In addition, his community service included volunteering with Skid Row Motorcycle Club Feed the Homeless in 2019 and 2020 and with the Popeye Toy Run from 2017-2019.

"My volunteer work taught me humility," Williams said. "I saw that not everyone is blessed with the same resources I had growing up. I also learned there are little ways I can make a

difference by helping."

Charles Gordon, his soccer coach at Quartz Hill and the California Elite Soccer Club wrote in a recommendation letter that Williams is capable, has leadership skills and is a well-rounded young man.

Annika Linde, the choral director at Quartz Hill High School observed that Williams is dedicated and makes personal sacrifices to be present for his teammates in all arenas.

Williams is a team player and that will bode well for him wherever he goes, Linde wrote in a recommendation letter.

Finch was a center engineer who specialized in stability and control and worked on aircraft such as the X-5, the X-F-91, and the legendary X-15 rocket-powered aircraft.

The Exchange Council scholarships are named for five former NASA Armstrong employees, with honorees

selected on a rotating basis. In addition to Finch, the other four people are Harold Walker, a former chief of the Aerodynamics Branch; Joseph Vensel, a former director of Flight Operations; Joseph Walker, a chief test pilot; and John Russell, who led the rocket propulsion group. Scholarship funds are raised from council activities.

Jay Levine contributed to this report.

Air taxi... from page 4

When fully integrated into the national airspace, AAM will provide an efficient and affordable system for passenger and cargo transportation, and other applications in the public

interest. This system could include aircraft like package delivery drones, air taxis and medical transport vehicles.

AAM is an aviation system that encompasses developing and

deploying aviation in innovative ways not typically seen today. The AAM National Campaign is managed by NASA's Advanced Air Mobility project, which plans to be a community catalyst

for developing and validating system-level concepts and solutions for AAM. The AAM project is a part of the agency's Aeronautics Research Mission Directorate.

Former NASA Armstrong branch chief dies

Lee Duke, a former NASA Armstrong chief of the Public Affairs, Commercialization and Education office (now Strategic Communications), died July 12. He was 76.

He graduated from University of California, Berkeley, despite never having finished high

school, and began his career at NASA Armstrong as an engineer. He worked on many projects during his more than two decades at the center including the Highly Maneuverable Aircraft Technology, or HiMAT. HiMAT was part of the Smithsonian Air and Space Museum's

"Computation to Flight" exhibit for more than 20 years.

Duke was also involved in the creation of the space shuttle simulation at the center. He published more than 70 technical papers, including four published by NASA.

Throughout his career and

into retirement, Duke always found time to be a mentor and an educator to upcoming engineers and mathematicians.

Duke has been described by people who knew him at NASA Armstrong as one-of-a kind, with a quick wit, irreverent humor, curiosity, and dedication.

Mars sim... from page 3

non-smokers, age 30 to 55 years old, and proficient in English for effective communication between crew and mission control. Crew selection will follow standard NASA criteria for astronaut candidate applicants.

A master's degree in a STEM field such as engineering, mathematics, or biological, physical or computer science from an accredited institution with at least two years of professional STEM experience or a minimum of one thousand

hours piloting an aircraft is required. Candidates who have completed two years of work toward a doctoral program in STEM, or completed a medical degree, or a test pilot program will also be considered. Additionally, with four years

of professional experience, applicants who have completed military officer training or a Bachelor of Science in a STEM field may be considered.

For more information go to <https://www.nasa.gov/chapea/> participate

Interns... from page 6

impressed by how much my mentors cared about what I was doing and what I was thinking. They trusted the interns to complete their projects, and that gave us a huge sense of responsibility".

For Awalt, it took some adjustment to get used to a remote internship, but once she did, she thrived.

She provided support to the Office of Strategic Communications, specifically working on the Low Boom

Flight Demonstrator X-59, during her virtual internship last year. One of the many positive aspects of her virtual internship was her ability to discipline herself and manage her internship tasks which gave her a new skillset to later manage her final year of college remotely.

"I think I learned new skills working remotely, and I handled it well after I got used to it," said Awalt.

She planned out her day by checking a spreadsheet she

created that listed her daily tasks, as well as major project tasks she was working on over time.

"It gave me perspective on what I needed to accomplish in the future, and what I'd already achieved," shared Awalt.

Many internships for college students were cancelled during the pandemic, however, NASA adapted and made them happen remotely. Just like the NASA workforce was adapting to working from home, so were interns.

On learning of her acceptance for her NASA internship, Awalt shared, "I felt amazing, it felt like fate. I was not mad that it was happening during the pandemic, because I was grateful to be doing anything at all, let alone something that literally contributed to something as impactful and inspiring as NASA missions."

Internships at NASA's Armstrong continue to thrive and are again taking place this year in the virtual environment.

The X-Press is published the first Friday of each month for civil servants, contractors and retirees of the NASA Armstrong Flight Research Center.

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