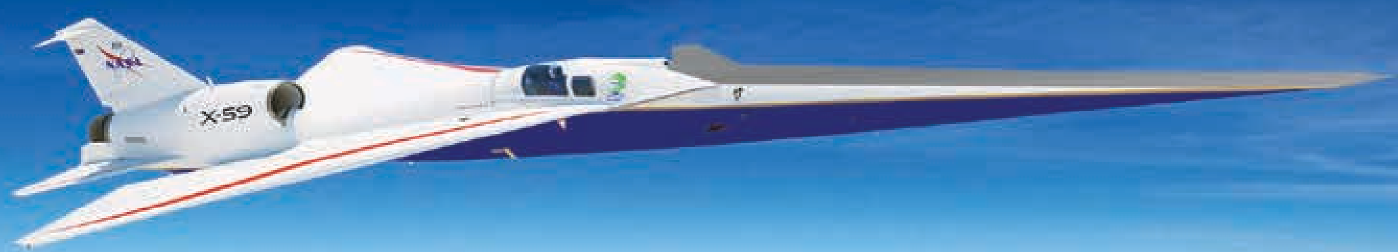
National Aeronautics and Space Administration

X-PRESS

ARMSTRONG FLIGHT RESEARCH CENTER

Volume 65 Number 4 April 2023



Quesst:

Mission could lead to the end of the overland civilian supersonic flight ban

Lockheed Martin

NASA's X-59, seen in this illustration, is designed to fly faster than sound but generate quieter sonic "thumps" rather than booms. To test the public's perception of this noise, part of the Quesst mission includes flying the X-59 over several communities to survey how people react. See page 4 and for more about the prohibition, and page 5 for the latest about the X-59.

Model wing tested

Larger scale efficient wing work next

By Jay Levine
X-Press editor

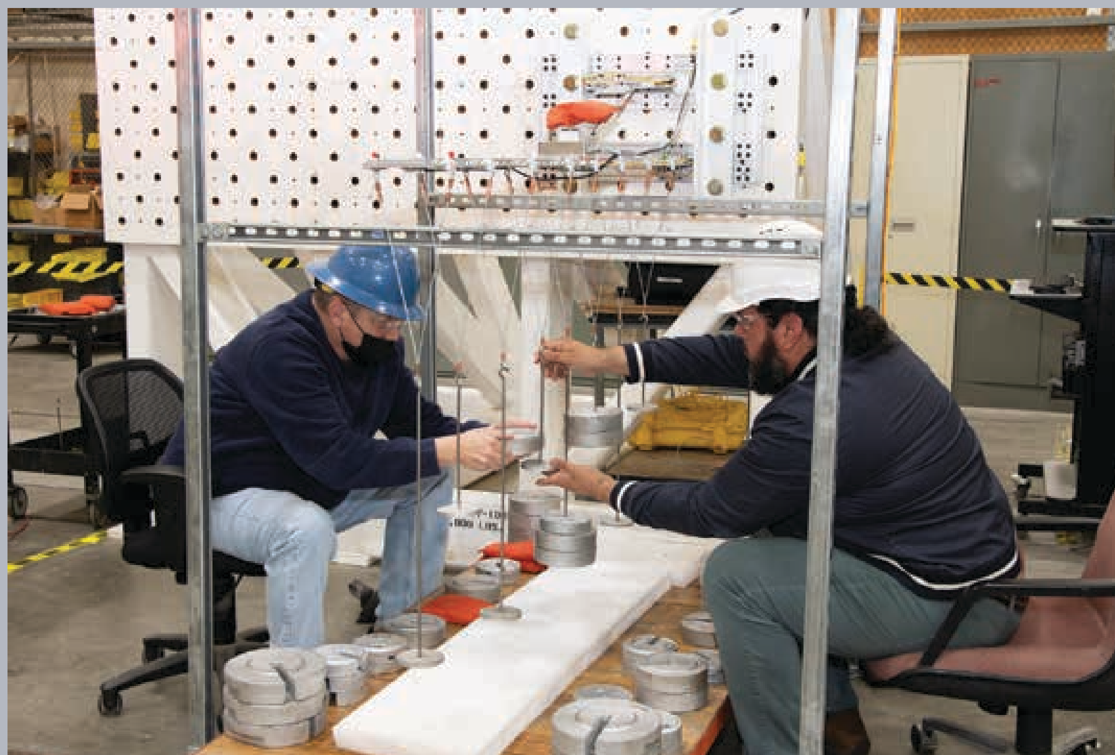
NASA researchers have completed testing on a scale model of a unique aircraft wing, gaining data that will help build larger versions of the design with the goal of improving fuel efficiency.

The model tested at NASA's Armstrong Flight Research Center in Edwards, California, is a 6-foot version of the Transonic Truss-Braced Wing (TTBW). This concept involves a wing braced on an aircraft using diagonal struts that also add lift and could result in significantly improved aerodynamics.

During load testing, researchers observed the interaction of the model strut and wing, as well as the forces affecting each, said Frank Pena, mock wing test director at the NASA Armstrong Flight Loads Laboratory. Until now, researchers had no calculations to estimate how forces transferred from the main wing to the strut. Information the team gathered from the model will enable them to calculate what will happen when NASA builds a larger wing.

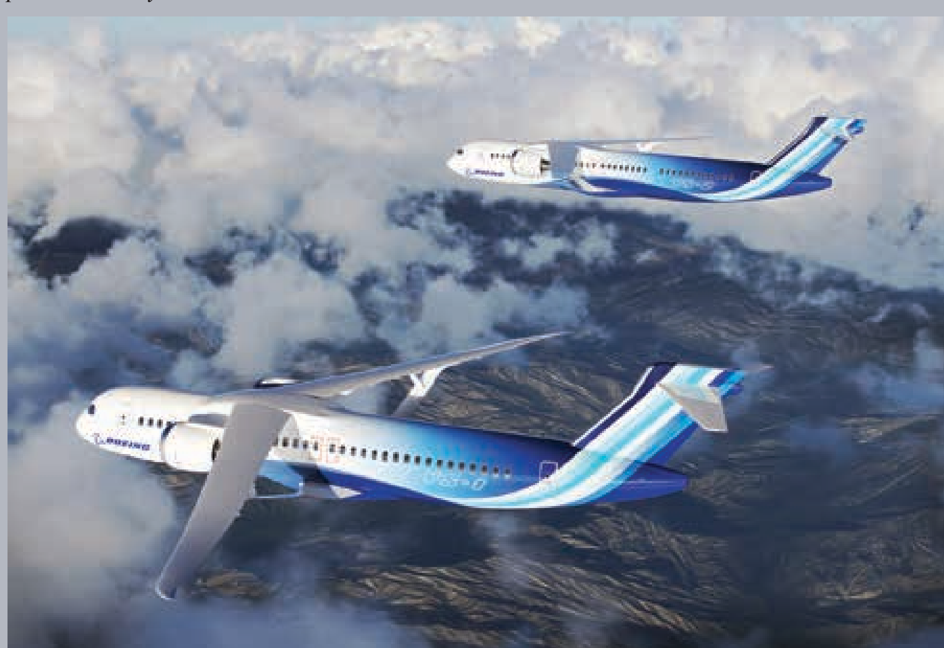
"We identified early that we needed to learn more about how these structures with the strut respond to load and to see what additional information we may need for a calibration of a bigger structure," Pena said. "We decided to use the load cell between the strut and the main wing to help us track down some of this missing

Wing tests, page 12



AFRC2022-0153-12 NASA/Carla Thomas

Aaron Rumsey and Beto Hinojos carefully add weight to a 6-foot model of the Transonic Truss-Braced Wing at NASA's Armstrong Flight Research Center in Edwards, California. The aircraft concept involves a wing braced on an aircraft using diagonal struts that also add lift and could result in significantly improved aerodynamics.



Artist concept shows commercial aircraft families with a Transonic Truss-Braced Wing configuration from the Sustainable Flight Demonstrator project.

Boeing

AFRC2022-0060-02 NASA/Ganero Vavuris

From left, NASA Administrator Bill Nelson, Armstrong Deputy Center Director Laurie Grindle, Deputy Administrator Pam Melroy, Associate Administrator Bob Cabana, and additional members from the Moon to Mars team speak to NASA Armstrong employees during a town hall on April 12.

NASA leadership details Moon to Mars strategy

By Teresa Whiting
NASA Armstrong Public Affairs

NASA Administrator Bill Nelson, Deputy Administrator Pam Melroy, Associate Administrator Bob Cabana, and team visited NASA's Armstrong Flight Research Center in Edwards, California, on April 12.

The team shared updates about NASA's plan to go back to the Moon and then to Mars with the Artemis Mission. Nelson and team also met with several groups around the center for one-on-one discussions.

"We return to the Moon to stay," said Administrator Nelson. "To learn and to live and to create. To do incredible science we can do nowhere else. To continue to build our Nation's capabilities in space, creating positive effects on our economy, our security, and our daily lives. And we go on to inspire the Artemis Generation to extend human presence and exploration throughout the solar system – and beyond."

California has more Artemis suppliers than any other U.S. state with 335 companies manufacturing pieces for upcoming space missions. NASA Armstrong continues to support space exploration in Southern California.

For more than a decade, NASA Armstrong has supported development and testing efforts for the Orion spacecraft and other key elements of NASA's Artemis missions.

Recently, researchers at the center invented a space-rated Fiber Optic Sensing System, or FOSS, which uses fiber optics to collect temperature and strain information critical to space flight safety. This system flew on the Low-Earth Orbit Flight Test of an Inflatable Decelerator, or LOFTID, mission.

News at NASA

Oxygen extracted from soil

As NASA works toward sending astronauts to the Moon through Artemis missions, one of the agency's primary goals is to establish a long-term presence on the lunar surface. Resources like oxygen are crucial building blocks for making that vision a reality. In addition to using oxygen for breathing, it can also be used as a propellant for transportation, helping lunar visitors stay longer and venture farther.

During a recent test, scientists at NASA's Johnson Space Center in Houston successfully extracted oxygen from simulated lunar soil. Lunar soil refers to the fine-grained material covering the Moon's surface. This was the first time that this extraction has been done in a vacuum environment, paving the way for astronauts to one day extract and use resources in a lunar environment, called in-situ resource utilization.

NASA's Carbothermal Reduction Demonstration team conducted the test in conditions similar to those found on the Moon by using a special spherical chamber with a 15-foot diameter called the Dirty Thermal Vacuum Chamber.

The team used a high-powered laser to simulate heat from a solar energy concentrator and melted the lunar soil simulant within a carbothermal reactor.

See the full story here.

Supersonic ban origins

Novelty turned into a nuisance as flights multiplied

By Jim Banke
Aeronautics Research Mission Directorate

Fifty years ago, the federal government banned all civilian supersonic flights over land.

The rule prohibits non-military aircraft from flying faster than sound so their resulting sonic booms won't startle the public below or concern them about potential property damage.

Officially put into effect on April 27, 1973, the ban's introduction was strongly influenced by public opinion surveys in cities where supersonic military jets were flown overhead, and many folks said they didn't like what they heard or the way their windows rattled because of the sonic booms.

Although some research suggested ways to soften the impact of sonic booms, aeronautical technology during the 1960s and early 1970s wasn't sophisticated enough to fully solve the problem in time to prevent the rule from being enacted.

But today, NASA is working on a solution.

"It's a rule that many people today aren't aware of, yet it's at the heart of what our Quesst mission with its quiet supersonic X-59 airplane is all about," said Peter Coen, NASA's Quesst mission integration manager.

NASA's X-59 is designed to fly faster than sound, but with drastically reduced noise – people below would hear sonic "thumps" rather than booms, if they hear anything at all. To test the public's perception of this noise, part of the Quesst plan includes flying the X-59 over several communities to survey how people react.

NASA will deliver the results to U.S. and international regulators, who will consider new rules that would lift the ban that has been in place for so long. The goal is for a regulatory shift that focuses on the sound an aircraft creates, instead of a speed limit.

"We're definitely ready to write a new chapter in the history of supersonic flight, making air travel over land twice as fast, but in a way that is safe, sustainable, and so much quieter than before," Coen said.

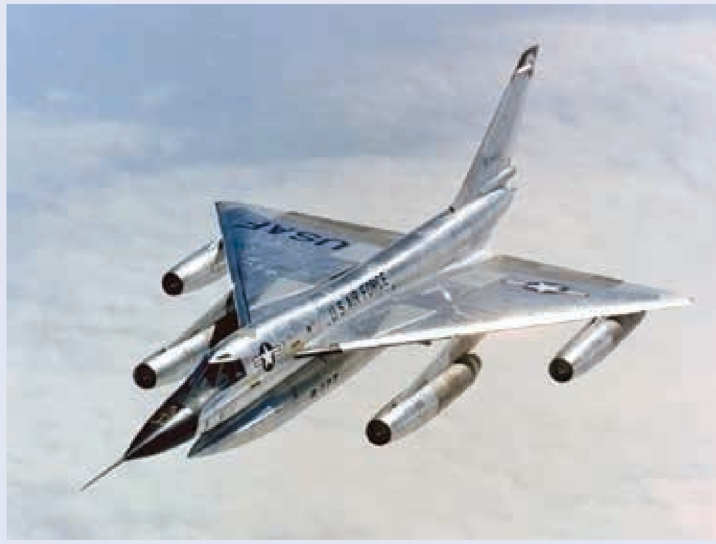
Boom Boom

The origins of the federal ban on supersonic flight go back to 1947, the first time the rocket-powered XS-1 airplane broke the sound barrier and initiated the heroic era of faster-than-sound research.

At first, it was all about learning to fly X-planes faster and higher. No one gave the sonic booms a second thought, mostly because few people lived where the research was taking place.

Despite early interest in what was then a mysterious phenomenon created as an airplane flies faster than the speed of sound and generate atmospheric shock waves we hear as sonic booms, there were few tools and only limited data available to help understand what was happening.

But as the Air Force and Navy began to deploy large numbers of supersonic jets at bases around the nation, interest in sonic booms quickly grew as more of the public became exposed to the often-alarming noise.



U.S. Air Force

An Air Force B-58 Hustler supersonic bomber like this one was one of many military jets used during the 1960s to generate sonic booms over U.S. cities to see how the public would react to the sound. The research helped lead to a ban on civilian faster-than-sound flight over land beginning in 1973.

Beginning in 1956 and continuing well into the 1960s, the Air Force, Navy, NASA, and the Federal Aviation Administration (FAA) employed resources to study how sonic booms formed under various conditions, what their effects might be on buildings, and how the public would react in different locations.

Through those years, using many types of supersonic jets, residents of Atlanta, Chicago, Dallas, Denver, Los Angeles, and Minneapolis, among others, all were exposed to sonic booms from military fighter jets and bombers flying overhead at high altitude.

Two concentrated studies – one over St. Louis in 1961 and the other over Oklahoma City in 1964 (dubbed Bongo and Bongo II, respectively) – left no doubt the public was not fully supportive of routine sonic booms coming down from above.

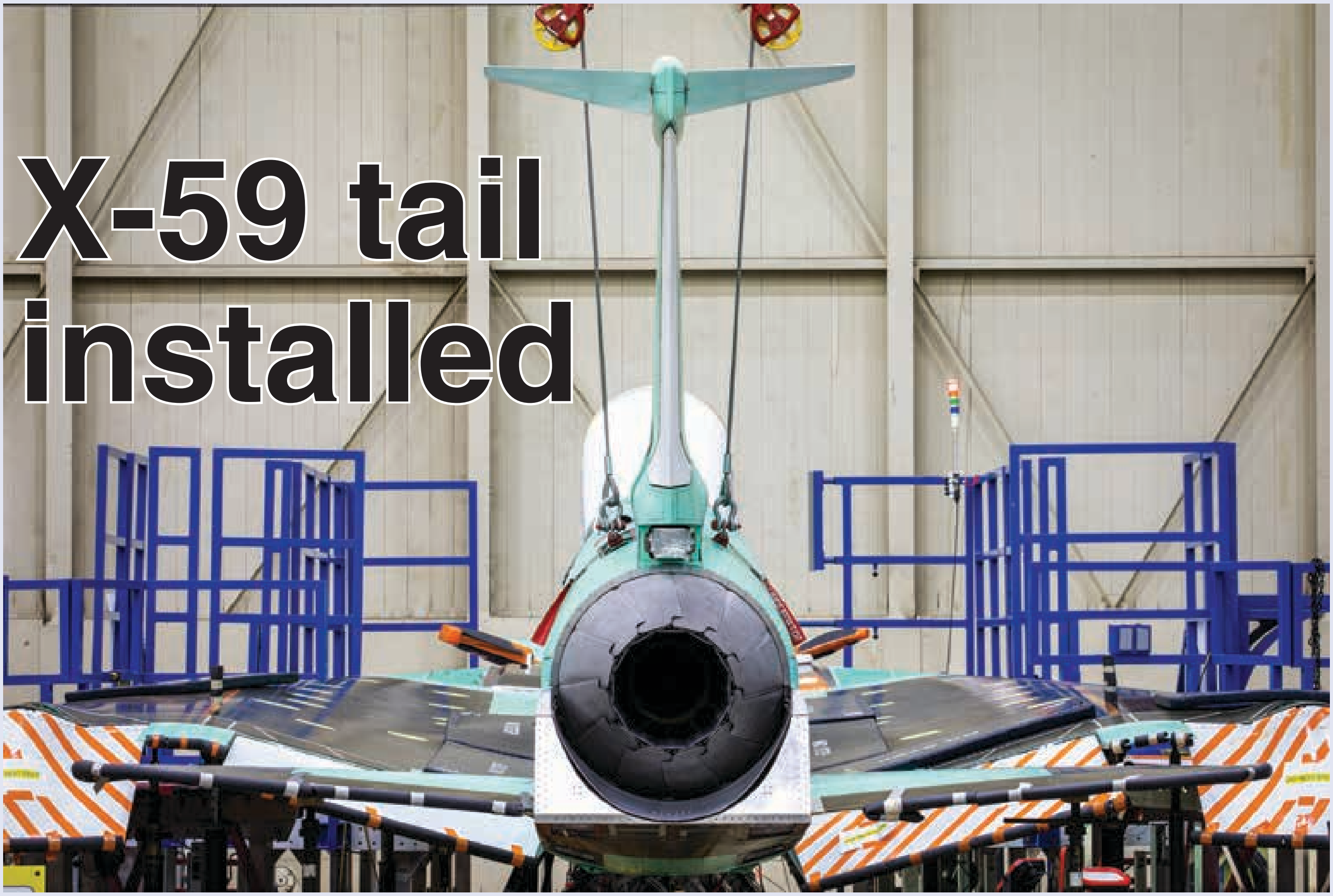
The tests generated national news and fueled strongly negative sentiment about supersonic flight.

The Supersonic Transport

As this work to better understand and predict sonic boom formation continued and gave rise to the first notions of how to minimize a sonic boom by changing an airplane's shape, the U.S. government began to work with industry in an attempt to develop

Supersonic ban, page 11

X-59 tail installed



Lockheed Martin

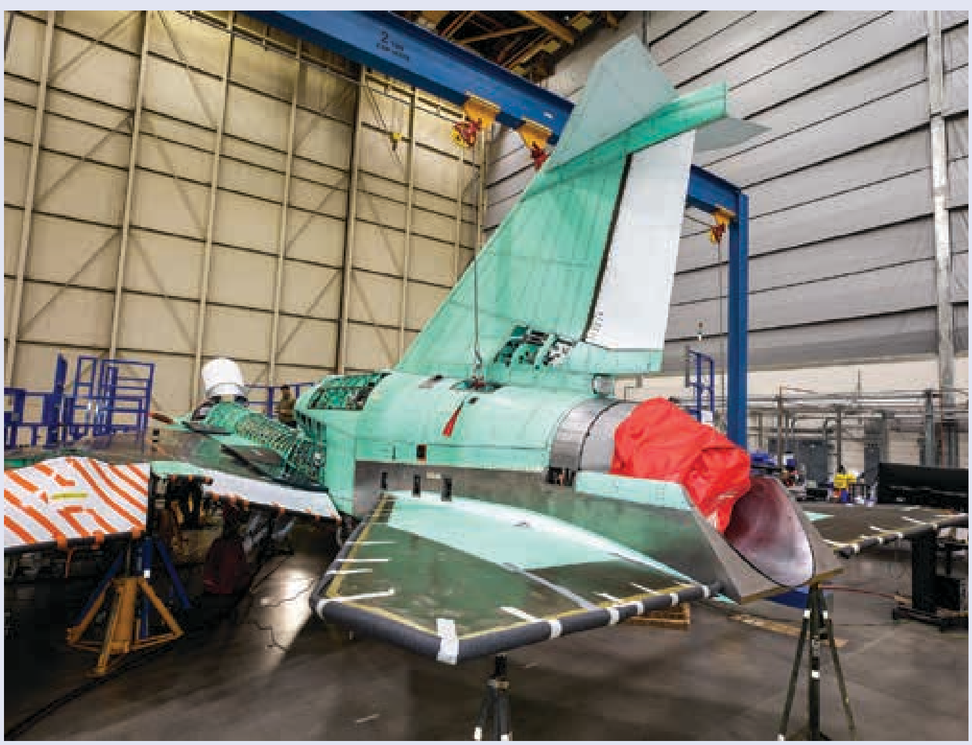
A perfectly framed rearview shot of NASA's X-59 tail after its recent installation of the lower empennage, or tail section, in late March at Lockheed Martin Skunk Works in Palmdale, California.

By Kristen Hatfield
NASA Langley Public Affairs

NASA's X-59 has undergone final installation of its lower empennage, better known as the tail assembly. This series of images was taken at Lockheed Martin Skunk Works in Palmdale, California.

This installation allows the team to continue final wiring and system checkouts on the aircraft as it prepares for integrated ground testing, which will include engine runs and taxi tests.

Once complete, the X-59 aircraft is designed to demonstrate the ability to fly supersonic while reducing the loud sonic boom to a quiet sonic thump. This aircraft is the centerpiece of NASA's Quesst mission.



NASA's X-59 sits in support framing while undergoing the installation of its lower empennage, or tail section, at Lockheed Martin Skunk Works in Palmdale, California.

Lockheed Martin

Focus on Safety

Prepare for the Unexpected and Expect to be Unprepared

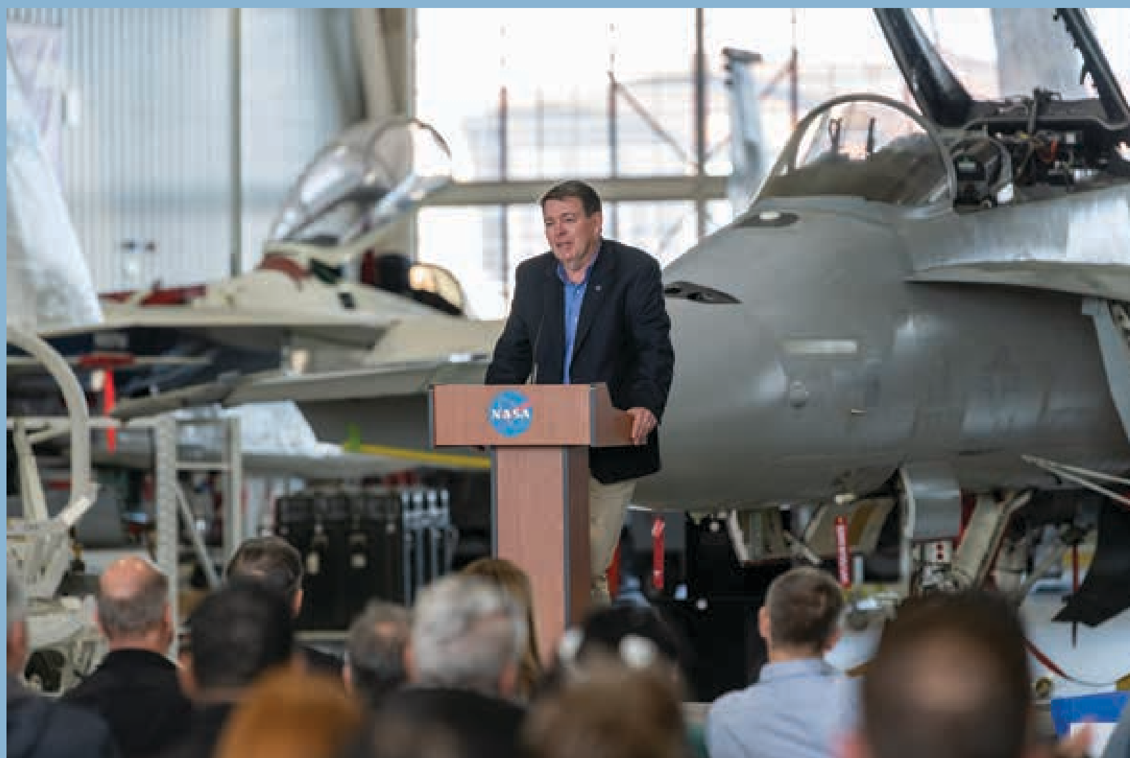
By Jay Levine
X-Press editor

A very busy fiscal year 2023 at MASA's Armstrong Flight Research Center in Edwards, California, includes 71 active projects, 722 flight hours, teaming with dozens of companies, other NASA aero centers and other federal agencies. The safety record is solid, and the first quarter of 2023 is the best in five years.

In addition, the 394 sorties at the halfway point of this fiscal year are just a single flight less than the 395 sorties at this time last year.

"If you compare the number of safety incidents across the agency, only NASA's Ames Research Center has fewer incidents than we do," said Glenn Graham, Safety and Mission Assurance director.

Graham's statistics began Safety Day 2023, which had the theme, "Prepare for the Unexpected and Expect to be Unprepared." That is a theme for life, he said, adding why Safety Day is valuable: "This pause from the daily grind gives us a chance to listen to cool stories, talk to co-workers in a different setting, hear new points of view, and most importantly to think about how we can do things better, and not hurt people or break things."



AFRC2023-0054-46 NASA/Steve Freeman

NASA's Armstrong Flight Research Center, Edwards, California Center Director Brad Flick said, "The knowledge and skill of the workforce allows us to make risk-informed decisions to completethe mission and do it safely."

NASA Armstrong Center Director Brad Flick said the center was the first to adopt a day each year to pause all operations and activities to talk about workplace safety.

"We are in a business where we have to take risks," Flick explained. "If not taking risks, we probably are not doing our business very well. We need to take risks right up to the point, but before it becomes unsafe. We walk that tightrope every single day. The knowledge and skill of the workforce allows us to make risk-informed decisions to complete the mission and do it safely."

Flick welcomed ideas on how to improve safety in all areas of the center and asked the workforce to "Keep us safe and successful."

Safety Day featured many speakers. Here is a brief encapsulation:

• Kody Carr, NASA Armstrong senior institutional safety specialist and Fall Protection Program administrator, gave an overview of the Safety Culture program. He said NASA's Safety Culture DNA includes just reporting, flexibility, learning, and engaged culture, which is interwoven into every agency task.

Many new employees are unaware of the past, Carr said, including the loss of Apollo 1 astronauts (1967), and space shuttle orbiter crews from Challenger (1986) and Columbia (2003).

A visit to the Forever Remembered exhibit at NASA's Kennedy Space Center gave Carr new perspective. The exhibit memorializes the 14 shuttle astronauts who perished. Also included is Challenger wreckage with an American flag emblem, and the Columbia cockpit window frame. The Columbia Preservation Room contains mangled front nose landing gear still leaking hydraulic fluid, damaged foam, and the last video transmission from the shuttle including this phrase: "That was not Columbia's last mission, Columbia still has a mission, to teach us not to repeat our past."

• Gareth Lock, a diving safety and human factors specialist, detailed a complex dive rescue in a cave. Divers didn't have any good options when a passage

Safety Day, page 10

Hollywood, NASA value flight safety

By Jay Levine
X-Press editor

If you've seen movie or television scenes with fighter jets zooming through tight canyon terrain, a helicopter flying under a bridge, or astonishing drone stunts, it's likely you are seeing Kevin LaRosa II's pulse-pounding footage.

LaRosa II, an aerial coordinator and stunt pilot, said his work in coordinating and documenting seemingly impossible visuals has similarities to research flights at a recent presentation at NASA's Armstrong Flight Research Center in Edwards, California.

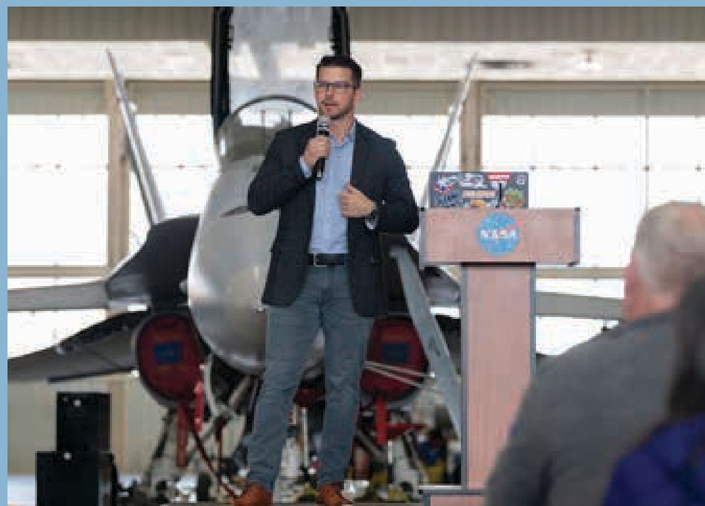
He has a long list of film credits including "Ironman"; "Avengers"; "Transformer 5"; "Top Gun: Maverick"; and "Devotion".

Working safely to deliver results is a common goal, said LaRosa II, a third-generation pilot. Also similar is that both organizations have specialized mission teams, detailed flight planning and safety plans, aircraft crews, and schedulers.

LaRosa II has two other links to the center. He knew former NASA Armstrong pilot Tom McMurtry, who he worked with and learned about military flying from earlier in his career. He also knows NASA Armstrong pilot Hernan Posada, who he first met when Posada flew aircraft for his father Kevin LaRosa's business. Posada invited him to speak at Safety Day.

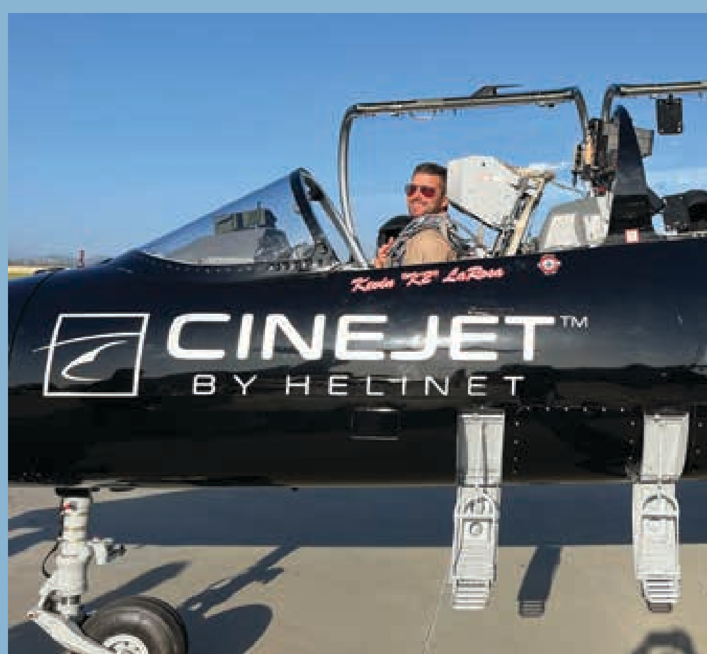
Landing on moving cars, or boats looks cool on screen, but the process for setting it up is methodical. "It is so far from stunt," he said. In fact, LaRosa II often works with the Federal Aviation Administration to ensure his work complies with established rules.

Another similarity between LaRosa II's work and NASA Armstrong's is that just as NASA employees are expected to identify when they think something is unsafe, he said he must do the same.



AFRC2023-0054-17 **NASA/Steve Freeman**

During a presentation at NASA's Armstrong Flight Research Center in Edwards, California, aerial coordinator and stunt pilot Kevin LaRosa II describes what it takes to safely plan and document breathtaking footage of aircraft.



Courtesy of Kevin LaRosa II

Aerial coordinator and stunt pilot Kevin LaRosa sits in the Cinejet, which is an L-39 jet with a customized camera gimbal system that is the first of its kind. The system is maneuverable, stable, and permits the aircraft to be in the right position at the right time for some of the hard-to-get footage.

Sometimes preparation reveals a proposed sequence is not worth the risk. LaRosa II explained to "Top Gun: Maverick" star Tom Cruise, who is an accomplished aviator, that a planned scene could not unfold as planned.

"Tom flew his own P-51 Mustang to the set," LaRosa II said. "Wing mounted cameras were to be used to film a closing sequence of Cruise and Jennifer Connelly. The aerodynamics disturbance on the aircraft's wing developed poor handling qualities Multiple test flights were performed by a highly experienced P-51 maintenance test pilot and he reported that the aircraft would not be safe in that configuration."

In other words, it wasn't safe and how to shoot the scene needed a new plan.

"I called Tom and reported the results and advised him that the aircraft couldn't be flown with the cameras for safety," LaRosa II recalled.

"Tom's response is what you would expect from a professional pilot. He said, 'No problem, how do you propose we move forward?' I proposed that we could shoot this sequence using close formation with the camera jet to accomplish the tight shots of the actors."

The CineJet, which is an L-39 jet with a customized camera gimbal system that is the first of its kind, was used to capture the scene with Cruise and Connelly. The system is maneuverable, stable and permits the aircraft to be in the right position at the right time for some of the hard-to-get footage of the F-18s and P-51 in action, LaRosa II explained.

Pilot training was another key to making the film look authentic. LaRosa II created, under the direction of Cruise, a pilot curriculum of intense training. Included were multitudes of high energy,

Kevin LaRosa II, page 12

NASA selects Grindle, Zavala for center leadership positions

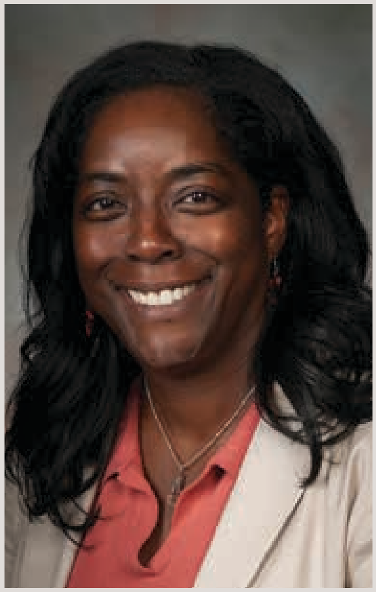
The agency selected two long-time managers at NASA's Armstrong Flight Research Center in Edwards, California, to fill key openings on the center's leadership team.

Laurie Grindle, who has been NASA Armstrong director for Programs and Projects since December 2020, will now serve as the center's deputy director. Eddie Zavala, who was acting deputy director, is the new director of Programs and Projects.

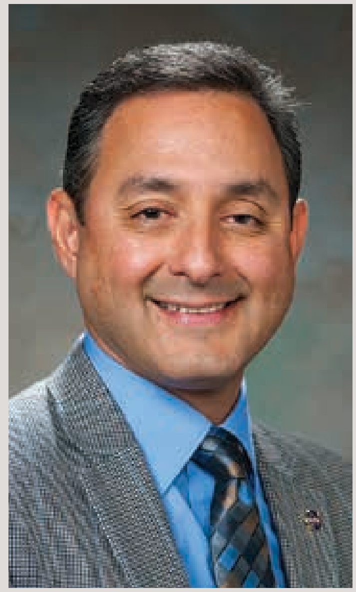
Prior to Grindle's selection as director of Programs and Projects, she was deputy director for the same organization from February 2017 until her promotion to director.

Grindle began her career with NASA Armstrong during a 1992 internship in the center's Aerodynamics Branch, which she followed up in 1993 with a full-time position in the same branch. Grindle was a principal investigator on the Advanced L-Probe Air Data Integration experiment flown on the F/A-18 Systems Research Aircraft, on which air pressure was used to determine angles of attack and sideslip and traditional air-data measurements. She was an aerospace researcher on the F-16XL Ship 2 Supersonic Laminar Flow Control project and was involved in analysis of space shuttle maneuvers that resulted in expansion of the shuttle's aeronautical database.

Grindle became chief engineer for the X-43A Hypersonic Research Vehicle project in 2004 after serving as the X-43A deputy chief engineer starting in 2001. The X-43A was a 12-foot-long, autonomous aircraft that, when flying at test conditions, demonstrated an "air-breathing" engine called a scramjet.



Laurie Grindle



Eddie Zavala

In 2005, Grindle became chief engineer of the Dryden Unmanned Air Vehicle (UAV) Business Unit. While in that role, she monitored technical aspects of NASA UAV projects, including X-48B Blended Wing Body low-speed vehicle and Global Hawk projects. From 2007 to 2011, Grindle was the NASA project manager for the Orion Multi-Purpose Crew Vehicle abort test booster project.

From 2011 to 2013, Grindle was the associate mission director for Aeronautics at Dryden (now NASA Armstrong), which is comparable to a deputy branch chief position. In that job she assisted in the management and technical direction of the center's aeronautics activities for manned and unmanned flight research programs.

Prior to serving as deputy director for Projects and Programs, Grindle was the project manager for the NASA Unmanned Aircraft System Integration in the National Airspace System project from 2013 to 2017.

Grindle is the recipient of a 2018 NASA Outstanding Leadership Medal, a 2013 NASA Exceptional Achievement Medal, and a 2005 NASA Exceptional Service Medal, among others. Also in 2013, Grindle was selected as a Women@NASA honoree.

Zavala was director of Center Operations at NASA's Ames Research Center in Silicon Valley, California, from 2020 to 2022. He was acting director of Safety and Mission Assurance at Ames from 2019 to 2020, including responsibility for the centers' initial response to the COVID pandemic.

From 2012 to 2019, Zavala was program manager of the Stratospheric Observatory for Infrared Astronomy (SOFIA), the world's largest airborne observatory, based at NASA Armstrong's Building 703 in Palmdale, California. The aircraft was retired in September 2022. Under his leadership, the program – a cooperative effort between NASA (Ames and Armstrong) and the German Aerospace Center – completed the development phase, implemented an improved cross-center organizational construct, became fully operational in May 2014, and completed the five-year prime mission. He oversaw the overall observatory operations (science and aircraft) at both NASA centers. Zavala joined NASA Ames in October 2015.

Zavala first came to NASA in 1989 as a cooperative education student at NASA Armstrong. In 1991, he began his professional career as a flight systems research engineer. As a member of the F/A-18 Systems Research Aircraft project, he developed technical expertise in fly-by-light (fiber optics) technology and electrical actuation control systems.

He transferred to NASA's Johnson Space Center in 1998. As a space shuttle flight controller, he supported several shuttle missions and participated in shuttle avionics upgrade projects. He returned to NASA Armstrong in 2000, where he was manager on the F-15B Intelligent Flight Control System, Flight and Systems Demonstrations, and Subsonic Fixed Wing projects. He also served as mission director, responsible for the center's full portfolio of aeronautics projects. In November 2007, Zavala transitioned to the SOFIA program as the deputy program manager.

Zavala is a recipient of the 2011 and 2016 NASA Exceptional Achievement medal and the 2014 NASA Outstanding Leadership medal.

More than weather

New tool aids data collection challenges

By Jim Skeen
NASA Armstrong Public Affairs

Researchers at NASA's Armstrong Flight Research Center in Edwards, California, developed an innovative atmospheric sensor suite, which can monitor air quality, help uncrewed aircraft avoid dangerous wind shears, and aid noise studies.

The idea for the sensor suite, called SonicSonde (pronounced Sonic S-ON-D), evolved from NASA Armstrong's research into noise from non-engine aircraft components during airplane landings. Because weather conditions impact how sound travels, the team wanted data on conditions such as temperature, moisture, and wind speed, but no one instrument could provide all the data to the resolution required by advanced research projects.

"Ultimately, the SonicSonde project came about because we saw that there was that gap in technology," said Senior Meteorologist Kimberly Bestul, the principal investigator for SonicSonde.

The team worked with an external weather instrumentation company to build a custom, lightweight sonic anemometer and then worked with NASA Armstrong's model shop to develop a frame that allowed the instrument to spin into the direction of the wind.

A sonic anemometer, which uses ultrasonic sound waves to calculate wind velocity, is not new to the weather world, Bestul said. Sonic anemometers are typically fixed on a tripod or a structure at the surface, whereas SonicSonde is exposed to constant motion while tethered and ascending.

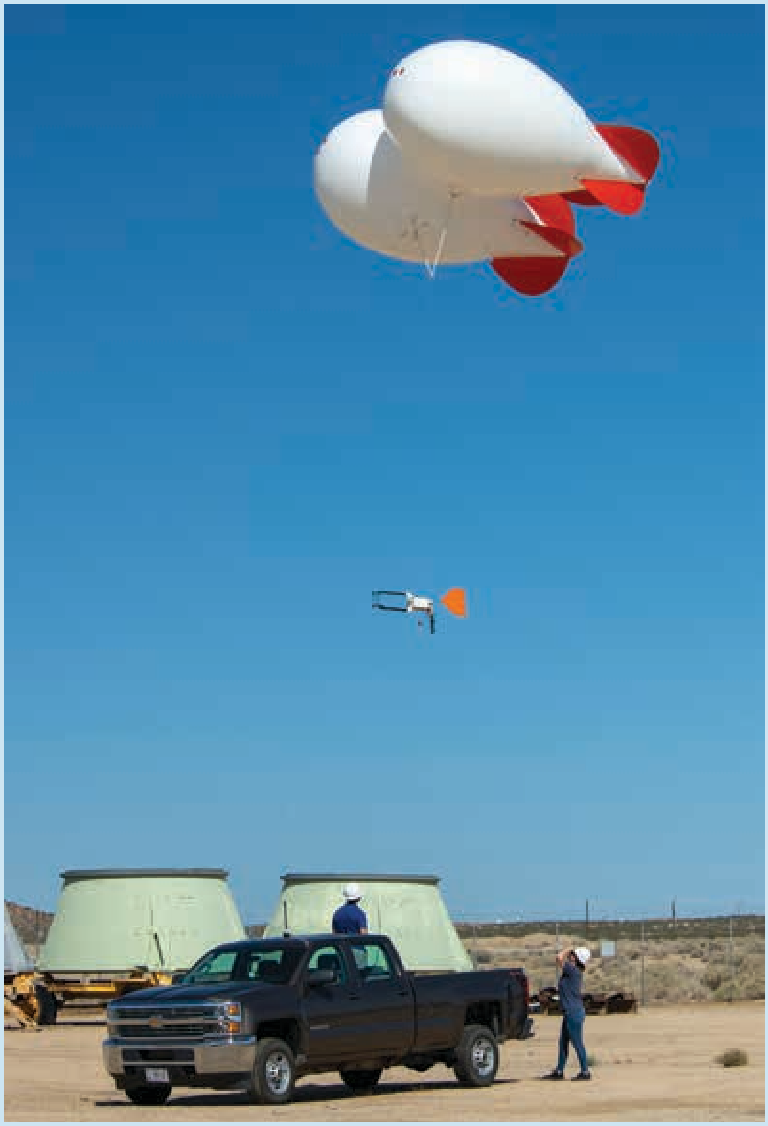
"A key aspect of this development was figuring out the math to allow us to get rid of the motion effect on the sensor so that we report true wind measurements as it's going up and down that column of air," Bestul said. "In addition, we have a temperature sensor, relative humidity sensor, pressure sensor, and an air quality sensor onboard. We can get all the variable data and have it wirelessly fed down to a ground station computer in near real time to give us a snapshot of the atmosphere at that time."

The project was paid for through NASA Armstrong's Center Innovation Fund, a program aimed at encouraging creativity and innovation while addressing NASA's technology needs.

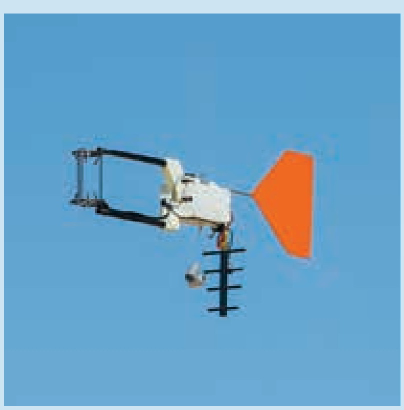
With the CIF funding, the SonicSonde project team custom-built a sensor platform that features a specialty, lightweight sonic anemometer, an instrument to measure atmospheric pressure, temperature, relative humidity, air quality, and wind velocities. Attached to two balloons tethered to a truck-mounted winch, SonicSonde provides measurements along a column of air up to 5,000 feet above ground.

"We chose a maximum altitude of 5,000 feet because the lowest layer of the atmosphere, specifically nearest the surface, is the most dynamically

SonicSonde, page 10



AFRC2022-0098-15 NASA/Lauren Hughes



AFRC2023-0098-16 NASA/Lauren Hughes

***Above**, SonicSonde begins a test mission. During flight tests, SonicSonde was attached to two balloons raised and lowered by a truck-mounted winch.*

***At left** is the SonicSonde during one of its flight tests. NASA's Armstrong Flight Research Center, Edwards, California, Model Shop developed a frame that allowed the instrument to spin into the direction of the wind.*

Safety Day ... from page 6

collapsed, and they had to rely on their best guess based on observations as they entered to escape.

Lock explained situational awareness is rarely complete or accurate, don't let your organization have holes, debrief thoroughly for lessons learned, and understand that there are always tensions in everything we do like safety and workload. In addition, self-perceptions are usually incorrect, plans are useless, but planning is essential, and knowledge without context is meaningless.

• Matt Graham, a long-time center senior operations engineer, learned people must never succumb to organizational silence through his experience in an Army flight test program. He equated the program to a piece of Swiss cheese, because there were a lot of holes in the testing of the C-23 Sherpa aircraft that resulted in the flight crew perishing.

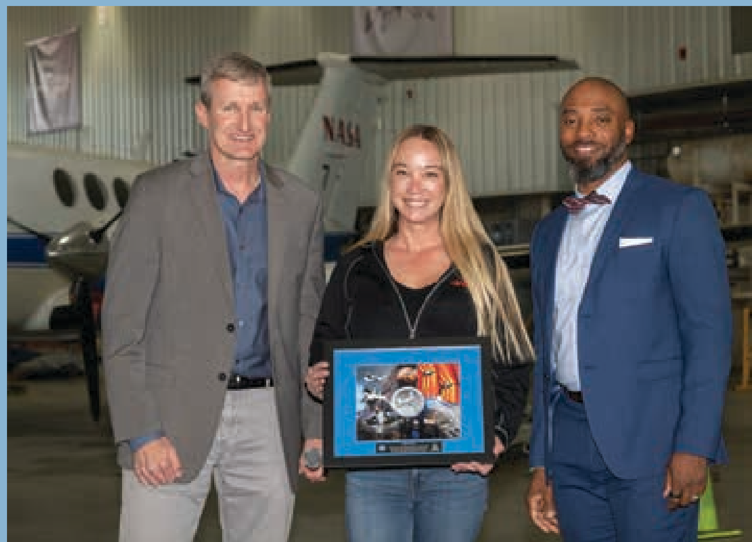
Organizational silence was a contributing factor, as was adversarial, overconfident and dismissive leadership, and failure to listen to calls for more modern flight test methods that had proved to be better. Other factors included crew members wanting to get home toward the end of a difficult flight series, failure to consider existing information, and not taking advantage of all available resources.

• Col. Art "Turbo" Tomassetti told Safety Day attendees that failure is always an option. Tomassetti was the lead U.S. government pilot for the X-35 Joint Strike Fighter test team, and the only U.S. government pilot to fly all three variants. He also spoke at the 2008 Safety Day and is focused on improving aviation safety.

Success and failure are the only options he explained as he detailed early non-rigid airships, or blimps, that were essentially giant bags of gas. The first ships were successful, but what wasn't learned in success, was learned through failures that later cost lives with other airships, including the commercial, passenger-carrying Hindenburg, which crashed due to a fire and was destroyed. Failure wants to happen, he said, and it takes effort to avoid it. He suggested to learn lessons from success as well as failure, and to keep an eye on schedule pressures.

• Officer Aaron Maurer, a public information officer for the California Highway Patrol Mojave Substation, said annually 9,000 traffic violation tickets are written, 800 traffic collisions happen, and 150 stolen vehicles are recovered.

With the long commute for many NASA Armstrong employees, he suggested they look for road hazards, put their phones away, observe what is happening 10 cars ahead, keep vehicle maintenance current, and wear a seatbelt. He also advised to drive responsibly and respectfully, avoid distractions, be patient, observe bad weather, and avoid driving impaired.



AFRC2023-0054-93 NASA/Steve Freeman

Glenn Graham, Safety and Mission Assurance director, at left, and Roosevelt "R.J." Jones, Quality Assurance branch chief and Safety Day master of ceremonies, present a certificate of appreciation to Andrea Muir, who was the Safety Day 2023 chairperson. The speakers also received certificates of appreciation for contributing to the event.

SonicSonde ... from page 9

changing," Bestul said. "To be able to frequently sample, at a high resolution, various atmospheric parameters is beneficial because it allows us to see the changes that occur in short time spans."

Ground testing included attaching the instrument suite to a line to simulate swaying motion. That allowed the team to determine the proper math to correct for motion once the instrument was aloft.

"We started to do some ascent tests where we'd hold the instrument suite at a specific altitude and compare it to a fixed sensor at the same altitude," Bestul said. "We let it drift like it normally would on the blimp and then compared the SonicSonde data to other sensor data to make sure that the math was still holding. From there, we did incremental altitude ascents to test how well the instrument suite was collecting data as it was constantly ascending."

The researchers developed customizable computer software to support and display real-time data streaming and they did ascent testing over six days, wrapping up late last summer. The team continues to analyze test results.

"By the time we were on the last test, we were live streaming all the data as it was going up," Bestul said.

The work resulted in a tethered sonic anemometer with the capability to capture a comprehensive snapshot of a vertical column of the atmosphere to a degree and resolution previously not obtainable in tethered instrumentation. SonicSonde offers flexibility to tailor data output and displays to specific research objectives.

"Everything that we set out to do, we accomplished," Bestul said. A patent is pending for SonicSonde and it already has interest from manufacturers looking to commercialize the technology.

Supersonic ban ... from page 4

the Supersonic Transport, or SST.

The announcement of the SST by President John F. Kennedy in June 1963 raised interest in studying and mitigating sonic booms from a technical standpoint, turning the research into a top priority.

The SST project aimed to produce the prototype for a new commercial supersonic airliner, capable of carrying as many as 300 passengers anywhere in the world at speeds as great as three times the speed of sound.

(Note that the speed of sound varies depending on things like temperature and altitude. At sea level and 68 degrees Fahrenheit it is 768 mph)

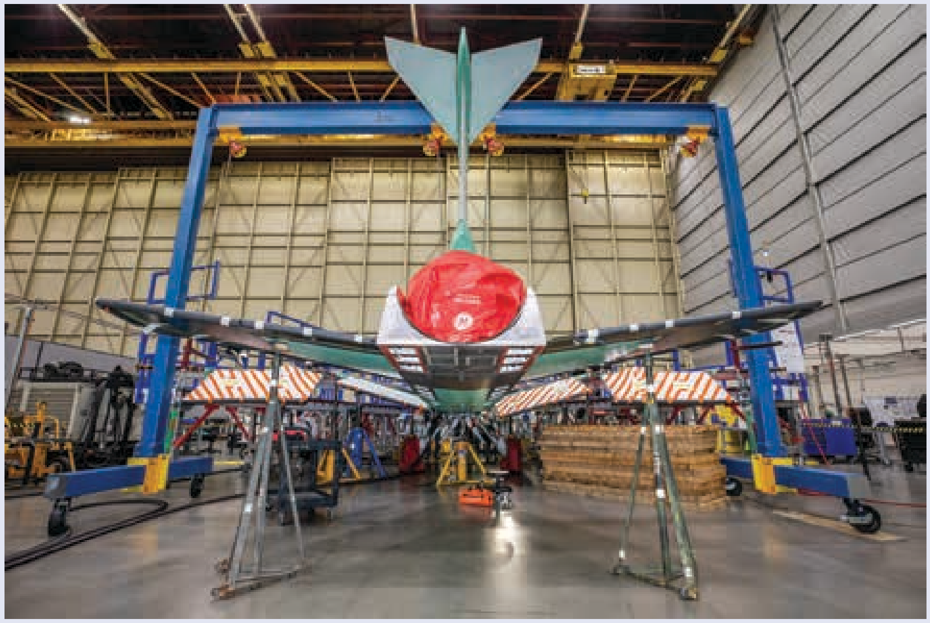
The aviation community was racing to develop its understanding of supersonic shockwaves to reduce the SST's potential sonic boom noise levels. But those researchers couldn't outpace the speed at which environmental concerns and policy discussions were cropping up, threatening to ground the aircraft before it was even built.

Three events during the summer of 1968 demonstrated this:

• On May 31, during a ceremony at the Air Force Academy in Colorado, an F-105 Thunderchief fighter jet broke the sound barrier flying 50 feet over the school grounds. The sonic boom blew out 200 windows on the side of the iconic Air Force Chapel and injured a dozen people.

• A week later, on June 8, the New York Times published an editorial using the incident in Colorado to underscore the danger sonic booms presented to the nation's peace and well-being, claiming many are "scared to death of it."

• This was followed on July 21 with Congress directing the FAA to develop standards for the "Control and Abatement of Aircraft Noise and Sonic Boom."



NASA's X-59 sits in support framing while undergoing the installation of its lower empennage, or tail section, at Lockheed Martin Skunk Works in Palmdale, California.

Lockheed Martin

Within a couple of years, the FAA formally proposed a rule that would restrict operation of civil aircraft at speeds greater than Mach 1. Then in May of 1971 Congress cancelled the SST program and the rule banning civil supersonic flights over land went into effect two years later.

During this same time, Great Britain and France were developing and test flying the Concorde, which went on to provide commercial supersonic air travel between 1976 and 2003. There were many reasons for its demise, including a deadly crash in 2000, but economic and environmental issues top the list. Restrictions against flying faster than sound over land due to the ban in the U.S. and elsewhere greatly limited its revenue-generating options.

Speed vs. Sound

Moving ahead, to lift the ban and enable a viable market for supersonic air travel over land, the idea is that regulators would base new rules on a different standard than before.

The speed limit created in 1973 didn't consider the possibility that an airplane could fly supersonic yet did not create sonic booms that could affect anyone below. It was a fair assessment at the time because the technology required to make that happen didn't exist yet.

"And now it does," Coen said. "So, instead of a rule based solely on speed, we are proposing the rule be based on sound. If the sound of a supersonic flight isn't loud enough to bother anyone below, there's no reason why the airplane can't be flying supersonic."

During the past half-century, NASA's aeronautical innovators methodically worked through the challenge of quieting the boom. Quesst's X-59 is on the path to proving that technology, with community overflights and the all-important public surveys to follow soon after.

Still, public acceptance of supersonic aircraft flying overhead today goes far beyond sonic boom noise. Airport noise, emissions, and climate impact are all factors that still need to be addressed.

With its government, industry, and academic partners, NASA is working to solve those challenges as well. But none of that will matter until the first step – lifting the half-century-old ban on supersonic flight over land – is accomplished.

"We are very excited to be making this big step forward, but we recognize that more needs to be done," Coen said.

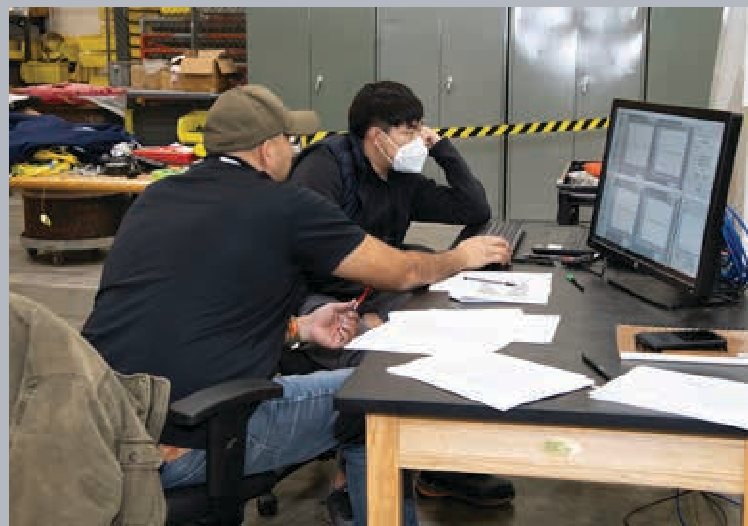
Much of this article is based on the work of Lawrence Benson, who wrote the official NASA history book "Quieting the Boom: The Shaped Sonic Boom Demonstrator and the Quest for Quiet Supersonic Flight." Read it here.

Wing tests ... from page 2

information that otherwise could not be obtained."

The Armstrong team will use the 6-foot model data to guide the design of a 10-foot version, in coordination with NASA's Langley Research Center, in Hampton, Virginia, which has worked on the TTBW concept for decades. The 10-foot wing will have a swept-back angle closer to the TTBW concept developed at Langley. It differs from the smaller wing version, which focused on testing instrumentation and methods. The larger wing will also have more representative connections between the fuselage and the strut and wing.

In addition to NASA's current TTBW research, which began more than a year ago, the agency also made an award in January for a TTBW proposal submitted by The Boeing Company for the Sustainable Flight Demonstrator project. Boeing will work with NASA to build, test, and fly a full-scale demonstrator aircraft and validate technologies aimed at dramatically reducing fuel burn and carbon emissions. The project's goal is to inform a new generation of single-aisle aircraft that will help the U.S. achieve its goal of net-zero greenhouse gas emissions by 2050.



AFRC2022-0153-27 NASA/Carla Thomas

Frank Pena and Benjamin Park watch as data streams in from tests on a 6-foot model of the Transonic Truss-Braced Wing at NASA's Armstrong Flight Research Center in Edwards, California. The aircraft concept involves a wing braced on an aircraft using diagonal struts that also add lift and could result in significantly improved aerodynamics.

While much of the hardware for the 6-foot mock wing was readily available to Flight Loads Laboratory staff, some parts required the sheet metal capabilities of NASA Armstrong's Experimental Fabrication Branch, Pena said. For example, the root of the truss sweep angle and the angle between the wings of the aircraft – known as a dihedral – required custom components, along with the adaptor plate for the three-axis load cell interface.

Success in testing the 6-foot and 10-foot wings could provide additional information for deciding if researchers will use the NASA Armstrong-developed Fiber Optic Sensing System (FOSS) to gather data for the future full-scale Sustainable Flight Demonstrator aircraft. The sensing system can take thousands of strain measurements along an optical fiber about the thickness of a human hair, which could resolve some of the challenges in gathering data along the extra-long, thin wings. The team used it successfully with the 6-foot model.

"FOSS generated 125 gigabytes of data," Pena said. "The testing was really smooth, and we finished it in one afternoon."

The 10-foot wing design is expected to be complete this year, with testing at NASA Armstrong set for later this year or 2024.

The TTBW models, part of NASA's Advanced Air Transport Technology project, are aimed at learning more about the concept and will indirectly benefit the Sustainable Flight Demonstrator. NASA Armstrong will also play other, more direct roles with the Sustainable Flight Demonstrator. These will include piloted simulation work, structural testing, technical expertise, flight testing, and the development of potential instrumentation and sensors. Armstrong will also provide facilities and equipment such as control rooms, radars, video tracking, hangars, and chase aircraft.

Kevin LaRosa II ... from page 7

high-g flying to simulate gravitational forces a pilot endures and flying an F/A-18 from an aircraft carrier.

"We knew exactly what we were going to do before we went to fly it," he said.

That statement can be appreciated by people in LaRosa II's world and in the flight research environment. Risk is not entirely avoidable, but finding out what those risks are and mitigating them to increase safety is paramount to mission success.

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

Address: P.O. Box 273,
Building 4800, MS 1422
Edwards, California, 93523-0273
Phone: 661-276-3449

Editor: Jay Levine,
Logical Innovations, ext. 3459

Managing Editor: Megan Person, NASA

Chief, NASA Armstrong Office of Communications:
Kevin Rohrer, NASA