National Aeronautics and Space Administration

X-PRESS

Volume 64 Number 3 March 2022

Exciting flights

X-57, X-59 in proposed 2023 NASA budget, coverage pages 6-7

AFRC2021-0076-09 NASA/Lauren Hughes

NASA Armstrong pilot Tim Williams (center), in a tan flight suit, watches as Lindsay Rodriguez (left), lead mechanic, provides cooling to the X-57 Mod II motors. Also pictured is Lyndel Lohberger (right), crew chief, in red.

Lockheed Martin

The illustration shows the X-59 aircraft beginning a flight.

X-59 visits Texas

Tests completed at Fort Worth facility

Jim Banke
Aeronautics Research
Mission Directorate

It appears the road to enabling a future that includes convenient commercial supersonic air travel over land demanded a substantial pit stop in Fort Worth, Texas.

Who knew?

Aeronautical innovators at NASA and Lockheed Martin did. They have long planned for this milestone in assembling and testing the X-59 airplane.

Although the X-59 is being built by Lockheed Martin at its Skunk Works facility in Palmdale, the airplane needed to be moved to another Lockheed facility in Texas for a series of important structural tests before returning it to the West Coast.

But let's back up a bit.

NASA's X-59 is a one-of-a-kind airplane designed to fly at supersonic speeds without making annoying, if not alarming, sonic booms below.

Lockheed Martin

NASA's X-59 airplane underwent structural stress tests at a Lockheed Martin facility in Fort Worth, Texas.

Instead, because of its unique shape, the X-59 is expected to produce quieter sonic "thumps" that can barely be heard on the ground – if at all.

Current rules prohibit aircraft from flying faster than the speed of sound over land. Those rules are based on speed, not noise. If the X-59 can publicly demonstrate that a plane can fly supersonic at an acceptable noise level, then those rules could be changed.

If that happens, NASA technology from the X-59 could be applied to new aircraft designs so commercial airlines might introduce faster-than-sound flights capable of speeding people coast-to-coast in half the time.

"That's what we're all working so hard to make possible," said Walter Silva, a senior research scientist at NASA's Langley Research Center in Virginia. He is also NASA's structures lead for the X-59, so he was directly involved in the airplane's Texas visit.

OK, so what happened in Texas?

Construction of the X-59 in California had made enough progress where all the major structural pieces – the wing, main body, tail, and nose – were assembled and power could be turned on to the vehicle for the first time.

The next major task was to make sure the airplane structure wouldn't break apart in flight when exposed to stresses small and extreme.

Mike Buonanno, a Lockheed Martin aerospace engineer who

X-59, page 3

Lockheed Martin

This panoramic side view of NASA's X-59 airplane shows the aircraft sitting on jacks at a Lockheed Martin test facility in Fort Worth, Texas.

X-59... from page 2

is the company's vehicle lead for the X-59, explained why wrapping up the X-59 and shipping it by truck to Texas in late December was the best way to prove that.

"Our Texas site has existing facilities to perform the kinds of tests needed. It would have been expensive and time consuming to design and build them from scratch in Palmdale. But in Fort Worth, they've got the perfect facility with a full control room and all the support equipment needed to do those tests very efficiently," Buonanno said.

The company's Fort Worth facility is where the F-16 Fighting Falcon was built for many years. Test equipment still available needed some modifications to handle the X-59's longer nose compared to the F-16, but those changes didn't get in the way.

"Our folks in Fort Worth were able to hit the ground running from the moment the airplane arrived from Palmdale," Buonanno said.

Feeling the Pressure

NASA had three goals for the X-59's stay in Texas in terms of the structural proof tests.

"The first goal was to make sure that the airplane can handle the anticipated loads during flight," Silva said.

Loads, in this case, mean anything that would put pressure or stress on the aircraft's structure. Typically, these kinds of stresses come when the airplane experiences rough air, makes quick turns, and during landing – among others.

Since the airplane isn't actually flying, tests are done with the aircraft sitting on hydraulic jacks that are connected directly with the structure. Arms that press down on areas of the airplane, such as the top of the wing, also are used.

Lockheed Martin

This illustration shows NASA's X-59 in flight.

How much stress is too much? Buonanno explained the loads applied to the X-59 are 25% greater than any load the airplane was designed to ever see in actual flight.

Because the X-59 isn't a prototype for a series of aircraft, none of the tests are designed to see how much stress a part could take before it breaks. This type of "test to destruct" is seen only in large production runs where one airplane can be pulled away and sacrificed.

"In any case, there are all sorts of safety features built into the testing so that if anything we don't want happening was detected everything shuts off and the whole thing goes into a safe position," Silva said.

The second goal was to calibrate the sensors built into the X-59 that are designed to tell the pilot how much stress is being measured at that point on the airplane. This is done by comparing what the sensors say with the known amount of stress being applied during a test.

"The third goal was to take the data and compare it with the computer models we used in designing the airplane in the first place and make sure what we thought was going to happen turned out to be accurate and the airplane is built as designed," Silva said.

Additional testing

Once all the structural tests were complete, the team – including NASA and Lockheed Martin representatives from Palmdale – turned its attention to performing fuel tank calibration tests.

The X-59's gas tanks were filled, and fuel-remaining sensors inside were checked, not only with the airplane sitting level but with it pitched and rolled.

Once that work was completed, the X-59 was returned to Palmdale, where the aircraft will see the rest of its major systems and subsystems installed – its GE engine, landing gear, cockpit displays, etc. – with the hope of having it ready for first flight late this year.

When that happens, the world's focus will be on the California high desert where once again aviation history will be made.

News at NASA

Hubble spots farthest star ever detected

NASA's Hubble Space Telescope has established an extraordinary new benchmark: detecting the light of a star that existed within the first billion years after the universe's birth in the big bang – the farthest individual star ever seen to date.

The find is a huge leap further back in time from the previous single-star record holder; detected by Hubble in 2018. That star existed when the universe was about 4 billion years old, or 30% of its current age, at a time that astronomers refer to as "redshift 1.5." Scientists use the word "redshift" because as the universe expands, light from distant objects is stretched or "shifted" to longer, redder wavelengths as it travels toward us.

The newly detected star is so far away that its light has taken 12.9 billion years to reach Earth, appearing to us as it did when the universe was only 7% of its current age, at redshift 6.2. The smallest objects previously seen at such a great distance are clusters of stars, embedded inside early galaxies.

Affirmative action helped me

Opportunities led to a great career and helped NASA

Guest column

Carol Reukauf
Former NASA Armstrong project manager

During my early years with NASA, I worked in a close-knit group at the Flight Research Center (now NASA Armstrong), in the Propulsion Branch. The tenor of camaraderie of the group set my expectations for my entire career.

I got my start at NASA as a cooperative education (co-op) student in January 1971, and there were few women or minorities in engineering, or in NASA. It was also a time when the United States government had decided to make a concerted effort to change the status quo in the workforce.

I was one of two female co-ops hired that January. The center wanted to do what they could to help us get a good start, so they arranged for an apartment for the two of us to share, and they sent an engineer to Los Angeles International Airport to pick me up and drive me to Lancaster when my plane arrived late in the evening. This set the tone for my experience and gave me confidence. Although there were two other women engineers already at the center, I was the first in my branch. Throughout my co-op time and my early career, I was guided and mentored in a way that made me feel an integral part of the organization.

Those were changing times in the United States. There were still a couple of professors at college and a few NASA employees, who questioned my motives and qualifications for my career choice, and they told me I was taking the job of someone who needed it to provide for their families. However, by far the majority of my colleagues were extremely helpful and inclusive. My NASA superiors welcomed and supported me; they made sure I knew of opportunities and encouraged me.

EC97-44274-008 **NASA**

Carol Reukauf, right, was the project manager for the Eclipse F-106 Flight Experiment in which the F-106 was towed and released by a C-141 to simulate and evaluate the towed launch of a space vehicle. To her left are Bob Keltner, the Kelly Space and Technology project manager, and Candi Mertes, the project's technical documentation specialist. Reukauf also served as one of several managers for the F-16XL Supersonic Laminar Flow Control project, the F-15 Advanced Control Technology for Integrated Vehicles project, and the Pegasus Hypersonic Experiment.

During that time the Federal government created programs to help strengthen women employees, such as the Federal Women's Program and the Equal Employment Opportunity (EEO) Program. My management encouraged me to participate, and I did. Outside of NASA I was active in helping minority groups in the community. I joined the Antelope Valley Human Relations Council, which concentrated on fair housing and employment, and I served as its president for a term. Within NASA, I served as an EEO counselor for many years.

The organization also worked to provide women with skills that helped me compete in a mostly male environment. For example, the center offered special seminars on communication skills for women, and I was also sent to a ten-week middle management program for women at Simmons College in Boston.

Within the technical arena, my supervisors and mentors always encouraged me to take classes offered by NASA and to earn a master's degree in mechanical engineering.

All of this support during my early career paid off for me and for NASA. By the mid-1980s, I was at the journeyman level and had begun to move around within the center into other jobs, exploring system and project engineering, team leadership, and management. I spent the next 25 years applying my training and experience within the organization, trying to give those who came after me as much opportunity and encouragement as I had been offered.

I am grateful to NASA and the center for giving me the many opportunities and so much help throughout

Carol Reukauf, page 8

Committed to safety

Desiree Heyliger
NASA Armstrong Public Affairs
Jay Levine
X-Press Editor

Safety is the foundation of everything in a flight organization like NASA Armstrong, especially during the pandemic.

Hernan Posada, research pilot and an aviation safety officer, received national recognition for his contributions to flight safety with the recently announced 2021 Federal Aviation Safety Professional Award for an Individual. He is the first from NASA Armstrong to win the honor that will be formally awarded in June.

Shawn Kern, NASA Armstrong's new aviation safety officer, was the force behind the nomination and said, "I was delighted to learn that Hernan Posada was recognized."

Posada was a catalyst for NASA Armstrong's safety excellence and mission success, as acting aviation safety officer during 2020 and 2021. Posada began his NASA Armstrong career in 2005, when he was selected as a pilot. His decades flying the remotely piloted Predator A and Predator B aircraft from a cockpit on the ground was put to use when the center acquired the Ikhana (Predator B) in 2006 until the aircraft's retirement in 2018. He has also flown many small, unmanned aircraft projects, and currently is assigned to fly the Global Hawk.

A new role

In December 2019 after the retirement of Barton Henwood, NASA Armstrong's veteran aviation safety officer of more than 15 years, Posada stepped up. He assumed all aviation safety responsibilities for NASA Armstrong's 111 aircrew members, 200 maintainers, and fleet of 22 unique research aircraft.

ed09-0242-75 **NASA**

Hernan Posada, pilot and an aviation safety officer, recently was named 2021 Federal Aviation Safety Professional Award for an Individual. He is the first from NASA Armstrong to win the honor. He is pictured with the Ikhana remotely piloted aircraft.

NASA/Kathy Barnsdorf

NASA pilot Hernan Posada signed many autographs at an Experimental Aircraft Association AirVenture air show in Oshkosh, Wisconsin.

He had a major role in establishing NASA Armstrong's PACE program - Pause, Assess, Communicate and Execute/Evaluate - an innovative program to identify and mitigate risks to operations most likely to occur when the currency and proficiency of the center's maintainers were at unprecedented lows. As a result, in 2020 and 2021, NASA Armstrong operated with zero Type A and B mishaps and injury and damage rates below pre-pandemic averages.

Posada looks to help where it is needed. For example, he acted as safety liaison to other center directorates, NASA Headquarters, the NASA Safety Center, and external agencies such as the National Transportation Safety Board. Posada was also central to the safe design and engineering of center's fleet of highly modified and prototype aircraft, signing flight releases for numerous research projects and serving on NASA Armstrong's airworthiness board.

He provided critical support to NASA's Ames Research Center in Silicon Valley, California, when there was an aviation safety officer vacancy. He has since been selected as the aviation safety officer for Ames.

Posada enabled NASA's mission success throughout 2020 and 2021, as NASA Armstrong sustained its capabilities in high-risk, high-consequence aerospace research, culminating in the center's recognition as a 2020

Safety award, page 8

2023 outlook

NASA rolls out proposed $26 billion budget

By Jay Levine
X-Press editor

The Biden administration's proposed $26 billion fiscal year 2023 NASA budget will support the agency's Moon and Mars Artemis missions, continue climate research, and advance the James Webb Space Telescope operations.

It also is intended to promote diversity, equality, inclusion, and accessibility, drive economic growth, and sustain U.S. leadership in aviation and aerospace innovation. Those were some of the key points in NASA Administrator Bill Nelson's State of NASA address from Kennedy Space Center in Florida on March 28.

He discussed highlights of the fiscal year 2023 budget, which is up 8% from the enacted 2022 budget. Full details of the proposed NASA budget are available at NASA.gov/budget.

The full-size all-electric X-57 Mod II airplane and the X-59 aircraft are included in the proposed NASA aeronautics budget of $971.5 million, which is up from $880.7 in the enacted 2022 budget. The aircraft are planned to fly at NASA Armstrong later this year. The experimental aircraft also were prominent in a pulse-pounding video reflecting the agency's new mission statement "Exploring the Secrets of the Universe for the Benefit of All," which proceeded Nelson's remarks.

NASA/Kim Shiflett

NASA Administrator Bill Nelson delivers the 2022 State of NASA address on March 28 from NASA's Kennedy Space Center in Florida. Nelson highlighted NASA's plans to explore the Moon and Mars, address climate change, promote racial and economic equality, and economic growth, while sustaining U.S. leadership in aviation and aerospace innovation.

In addition, in short segments from individual NASA centers, Matt Kamlet, NASA Armstrong public affairs specialist, introduced the X-57 Mod II. Test pilot Tim Williams, who will be flying the aircraft, gave viewers of the State of NASA presentation a look inside the cockpit.

Kamlet segued to Sarah Mann, NASA Armstrong public affairs specialist, who was at the X-57 Mod II simulator with Heather Maliska, X-57 Mod II project manager, and Ryan Wallace, simulation engineer.

"The X-57 project has made significant contributions to industry," Maliska said. "As a reference platform we are able to influence industry, standards, and the future of electric aviation."

Kamlet also introduced Sean Clark, X-57 Mod II principal investigator. Clark explained what the X-57 project has to offer industry.

"We are really excited to take all the engineering, lessons learned, and get it to flight test," he said. "What's really important is that we learn from the fabrication, engineering, development, and air worthiness process. We will share that with regulators and standards writers so that aircraft of the future can take advantage of the research NASA is doing here in the next generation of electric aircraft."

Budget highlights that NASA Armstrong has or could have a role include:

- The $289 million for Integrated Aviation Systems to develop Electrified Powertrain Flight Demonstrations and a Sustainable Flight Demonstrator will pave the way to reducing aviation emissions. This also supports the first flights of the X-59 and X-57.
- Proposed is $253 million for Advanced Air Vehicles to support advanced engine technology development, techniques for high-rate manufacturing of composite structures, advanced transonic truss-braced wing testing, Advanced Air Mobility vertical lift vehicle designs, and supersonic boom data validation.
- The $156 million for Airspace Operations and Safety to work with the Federal Aviation Administration to safely increase operational efficiency at the vehicle, fleet, and system-wide levels and reduce environmental impacts. Also includes the Advanced Air Mobility project (transferred from Integrated Aviation Systems) and initiates a new wildfire management project.
- Also included is $156 million for Transformative Aero Concepts to support

Budget, page 7

Budget includes flying X-57, X-59

By Jay Levine
X-Press editor

Flying two experimental aircraft, Flight Opportunities program work, NASA Earth Science airborne research, and continuing the Advanced Air Mobility missions to prove autonomous drone abilities are enabled in NASA Armstrong's proposed budget.

NASA Armstrong's funding for fiscal year 2023 is $312.1 million, which is $24.6 million less than the enacted 2022 budget. The decrease is the result of reduced funding for the Stratospheric Observatory for Infrared Astronomy (SOFIA), and the request to begin actions to conclude it.

NASA Armstrong Center Director David McBride emphasized that the SOFIA's missions are fully funded for fiscal year 2022, including a mission in September to observe an asteroid impact over the Indian Ocean. Congress and other factors are still possibilities to avoid cancellation, but a decadal science review suggestion to end the flying observatory is a signal that the program may be concluding.

Although the all-electric X-57 Mod II and X-59 aircraft are a part of the proposed budget, the move from the development phase to flight operations cost less and represents another area of decreased funding compared to the previous year. In all, the NASA aeronautics budget is $181,807 million, which is about $17 million less than the 2022 enacted budget.

NASA illustration

The Transonic Truss-Braced Wing is one concept that could be part of future aviation and the push for cleaner and more efficient aircraft.

NASA illustration

A hybrid wing body aircraft design could be part of the future of commercial airliners. NASA Armstrong researched the structural, aerodynamic, and operational advantages of the concept with a series of X-48 remotely piloted aircraft in different configurations in the mid 2000s and early 2010s.

In addition, NASA Armstrong will continue to work on the Sustainable Flight Demonstrator. The national partnership includes a NASA, industry, academia, and other government agencies for a full-scale demonstration. The test aircraft will integrate and test new technologies aligned with aviation's aggressive goal to reduce aviation carbon emissions in half by 2050 and net zero emissions by 2060.

The Electrified Powertrain Flight Demonstrator initiative is another major effort in which NASA Armstrong has a role. The idea here is to accelerate the development of electrified commercial aircraft, targeting a 1-megawatt class powertrain.

Here are a few other facts about the NASA Armstrong budget:

• Space Technology is $21.8 million, which is down from $23.6 million in the enacted 2022 budget. Funding is estimated to be consistent in the coming years.

• Space Operations is proposed at $92,000, which is up $2,000 from the enacted 2022 budget.

• The Office of Science, Technology, Engineering and Mathematics (STEM)

Funding, page 7

Budget... from page 6

revolutionary aviation concepts development with opportunities focused on zero-emissions aviation, new computational tools, and experimental capability advancement.

• The proposed budget includes $2.4 billion in Earth science and observations to make detailed climate data freely available to scientists and policymakers and more than $500 million to reduce the climate impact of aviation.

• In addition, $525 million is set aside for Technology Demonstration for ground and flight testing.

• NASA's Science, Technology, Engineering and Mathematics (STEM) engagement efforts are budgeted for $150 million to focus on broadening student participation, expanding K-12 student engagement in STEM pathways, and building partnerships and networks to magnify reach and impact.

Safety award... from page 5

Federal Aviation Safety Award recipient.

Problem solver

As acting aviation safety officer, Posada overhauled the center's bird strike prevention and response program. Posada initiated an outreach program, consisting of academic and hands-on training for full and part-time crewmembers. As a result, the accuracy of bird strike reports increased significantly, providing needed trend information to improve overall prevention. This lowered the number of strikes, which can cause damage to aircraft in flight, incurred by NASA Armstrong aircraft, and sharing information with the United States Air Force.

In another effort, Posada reviewed and updated the center's hazardous cargo procedures when the broader aviation industry was experiencing a rash of on-aircraft lithium-ion battery fires from cell phones that have since been discontinued. He canvassed a wide range of commercial and governmental operators for lessons learned and best practices and initiated discussion across the center's engineering, maintenance, and operations communities to assess and address hazardous cargo risks. This required balancing industry standards with the unique research requirements encountered at NASA Armstrong.

External audits found zero discrepancies with NASA Armstrong's hazardous cargo policies and procedures preserving AS9100 certification and ongoing compliance with the General Services Administration Gold Standard Certificate for Safety Management Systems. More importantly, the center has not experienced any cargo-related incidents or close calls during the past two years.

No matter where he was needed, Posada was there. This honor celebrates his efforts in complicated situations to deliver on one of NASA's core values – safety.

Carol Reukauf... from page 3

my career. I can see the faces and hear the voices of all the colleagues and supervisors who helped and guided me.

My career with NASA was long and rewarding. It was the product of my own efforts and with the benefit of affirmative action within the federal government. I encourage all of you to support and educate all of your colleagues whenever you can – because it makes a difference.

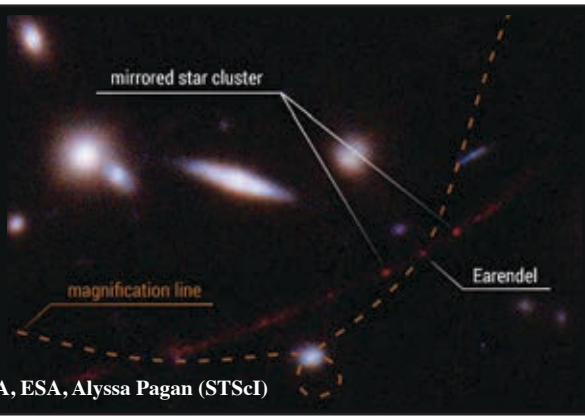
Funding... from page 7

Engagement funding remains flat at $11.5 million, as the agency continues to support STEM outreach.

• Safety, Security and Mission Services is $64.5 million, up from $60.9 million in the enacted 2022 budget.

• Science is $22 million, which is down from $31.9 million in the enacted 2022 budget, is due to the proposal in the budget to conclude the SOFIA program.

Want to keep up? Subscribe to the NASA Explore newsletter and NASA specialty publications at: https://go.nasa.gov/3r20wkl



This detailed view highlights the star Earendel's position along a ripple in space-time (dotted line) that magnifies it and makes it possible for the star to be detected over such a great distance – nearly 13 billion light-years. Also indicated is a cluster of stars that is mirrored on either side of the line of magnification.

Science: NASA, ESA, Brian Welch (JHU), Dan Coe (STScI); Image processing: NASA, ESA, Alyssa Pagan (STScI)

The X-Press is published the first Friday of 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
FAX: 661-276-3167**

**Editor: Jay Levine,
Logical Innovations, ext. 3459**

Managing Editor: Steve Lighthill, NASA

**Chief, Strategic Communications:
Kevin Rohrer, NASA**

National Aeronautics and Space Administration

NASA Armstrong Flight Research Center
P.O. Box 273
Edwards, California, 93523-0273

Official Business
Penalty for Private Use, $300