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In Today's Edition

"If you do not tell the truth about yourself you cannot tell it about other people."

— Virginia Woolf

SLAC’s premier facilities and record-setting datasets fuel DOE Genesis Mission

June 16, 2026 SLAC’s premier facilities and record-setting datasets fuel DOE Genesis Mission The lab’s contributions to the national AI initiative are bolstered by its breakthrough scientific tools, unprecedented data and unique partnerships that help illuminate nature from the expansion of the universe to the motions of electrons. By Angela Anderson Subscribe to SLAC Breaking News Key takeaways: Expertise and strong partnerships in many areas of science and technology at SLAC are now helping advance the Genesis Mission goal of transforming the way America does science and engineering to double productivity and impact within a decade. SLAC hosts two of the biggest scientific data producers on the planet – AI solutions for those unique data sets can be leveraged for future technologies. Joining other national laboratories, universities and industry leaders across the country, SLAC researchers are innovating AI tools to address the entire discovery pipeline, turning data into insights by connecting the instruments to computing across the national lab complex. When the U.S. Department of Energy (DOE) announced the Genesis Mission last fall, researchers at the DOE’s SLAC National Accelerator Laboratory were poised to jump on board the national effort to accelerate scientific and technological discovery through artificial intelligence. They had already been building AI into the lab’s programs for a decade:

Source: SLAC National Accelerator Laboratory

streamlining operations at the linear particle accelerator; identifying new materials for batteries and catalysis; and developing tools to analyze vast datasets coming from SLAC's state-of-the-art facilities. The Genesis Mission goal of building a singular discovery platform to enable faster breakthroughs and solve problems at a national scale opened new visions and ambitions. Joining other national laboratories, universities and industry leaders across the country, SLAC researchers are now innovating AI tools to address the entire discovery pipeline, turning data into insights by connecting scientific instruments to computing across the national lab complex. Genesis Mission projects at SLAC represent the broad scope of the lab's mission – to explore how the universe works at the biggest, smallest and fastest scales – and the pioneering tools SLAC has developed in partnership with collaborators around the world to do that. "SLAC hosts two of the biggest scientific data producers on Earth," Chris Tassone, SLAC associate lab director of Energy Sciences, said. "The Linac Coherent Light Source [LCLS] and the NSF-DOE Vera C. Rubin Observatory will collect data at speeds and volumes that humans cannot process in real time." During the Legacy Survey of Space and Time (LSST), Rubin Observatory will generate about 7 million science alerts per night. Over the 10-year survey, Rubin data will add up to 30 petabytes – more than any other optical astronomical survey to date – helping scientists obtain new observations of billions of stars and galaxies, and providing insights into the nature of dark matter, dark energy and the origins of the universe. Ultrafast X-ray experiments at SLAC's LCLS generate unprecedented

Source: SLAC National Accelerator Laboratory

views of electrons, atoms and molecules in motion, driving scientific discovery in materials, chemistry and biology. X-ray pulses arriving at up to a million times per second will generate up to 40 terabytes of data in as much time. Left unprocessed, this will add up to zettabytes (1 billion terabytes) of data each year. To put that in perspective, the world's 30 billion smart devices connected to the cloud today produce 100 zettabytes. In this era of rapid and expansive data collection, AI will necessarily augment the way science is done – the same way the microscope or the telescope has accelerated breakthroughs, Tassone said. "The need to grapple with such enormous and varied datasets and the instruments that produce them will feed the AI revolution and lead to future technologies with broad societal benefits," said Lisa Bonetti, associate lab director for Technology Innovation and head of SLAC's Integrated Scientific and Data-Intensive Computing (ISDCI) Initiative. Expertise and strong partnerships in many areas of science and technology at SLAC are now helping advance the Genesis Mission goal of transforming the way America does science and engineering to double productivity and impact within a decade. Genesis Mission projects are pulling together teams across national labs, academic institutions and industry. SLAC's close relationship with Stanford and other universities, and its ties to the national lab complex and Silicon Valley are fueling its progress as a Genesis Mission partner. Here are some of the ways SLAC is contributing. Building the platform One of the most ambitious goals of the Genesis Mission is to build an integrated platform that connects supercomputers,

Source: SLAC National Accelerator Laboratory

experimental facilities, AI tools and datasets across the country. The SLAC Shared Science Data Facility (S3DF) – a hub for scientific data from more than two dozen DOE Office of Science projects and home of Rubin Observatory's U.S. Data Facility – is a key partner in the American Science Cloud (AmSC). AmSC is the infrastructure – hardware and software – for the platform on which partners can make data AI-ready, train AI models, search for and use previously developed AI models, and analyze data. S3DF also supports the SLAC Sandbox for Streaming AI (S3AI) interface to AmSC and the broader DOE ecosystem. S3AI allows scientists and engineers across the DOE complex and in collaboration with private sector partners to evaluate and benchmark unique combinations of hardware and trained AI models to continuously process data at ultrahigh rates in real or near-real time. Teams at SLAC are also partnering on efforts to ensure AmSC can meet the needs of applications that involve real-time streaming prediction and control for facilities – essential for particle accelerators, which must continuously adapt to changes while operating. SLAC researchers are working on agentic AI and digital twin workflows for accelerators and light and neutron sources to enable improved operation of accelerator-based scientific facilities and analysis of light source experiment data. "The American Science Cloud gives us a unified platform where AI models can run at scale, in real time, across all computing resources, locally or at other national labs. This platform will enable scientific discoveries to get published much faster," Pamela Schleissner, SLAC research associate at LCLS, said. "What used to take

Source: SLAC National Accelerator Laboratory

days or weeks can now happen in real time – turning measurements into insight while the experiment is still running.” Close How SLAC and LCLS Are Using the American Science Cloud SLAC’s Pamela Schleissner explains how the American Science Cloud enables real-time AI-driven data processing at the Linac Coherent Light Source (LCLS), where up to a million X-ray pulses per second capture snapshots of proteins in action. By running AI models at scale across distributed computing resources, scientists can now turn measurements into discoveries while experiments are still running, accelerating the path from data to publication. Olivier Bonin/SLAC National Accelerator Laboratory Number of Slides Designing new materials for energy & manufacturing Key to project names ISAAC Integrated Scientific Agentic AI for Catalysis SLAC’s advanced X-ray and ultrafast science tools are part of the DOE network of facilities that allow energy sciences researchers to peer deep into atomic and molecular dynamics of materials and chemistry. Genesis Mission projects at SLAC are now using agentic AI to accelerate discovery in this field that underpins American manufacturing. SLAC is leading a project (ISAAC) that connects complementary data from light sources and neutron facilities across the country with theory and scientific literature to advance catalysts, which are essential to modern manufacturing. “With ISAAC, we can now reason across the entire body of evidence at once, accelerating catalysis discovery in addressing the grand challenges of selectivity, efficiency and durability,” said Dimosthenis Sokaras, SLAC senior scientist. Key to project names SYNAPS-I America’s AI revolution

Source: SLAC National Accelerator Laboratory

transforms scientific discovery at the speed of light The lab is also partnering on a project (SYNAPS-I) that allows scientists to rapidly identify anomalies in materials and biological samples that can lead to flaws – like a crack in a semiconductor device or a misfolded protein – that impact performance. These anomalies can be hidden in massive collections of scientific images, making them hard to detect. SLAC's synchrotron facility is designing "one-click" 3D images of materials, such as battery cathodes, with AI models right at the X-ray experiment. "This will speed up the data processing and analysis of imaging data from months to minutes using AI on DOE computing facilities," Johanna Nelson Weker, SLAC lead scientist at the Stanford Synchrotron Radiation Lightsource (SSRL) said. "It will allow users to leave the beamline with publication-ready results." Quantum technologies Key to project names MAIQMag Multimodal AI for 2D Quantum Magnets SLAC is also partnering on a project (MAIQMag) related to materials for future quantum technologies, specifically those whose magnetic properties are determined by quantum mechanics. Because existing databases and models of these materials haven't fully captured the complexity of their magnetic structures, a team including SLAC researchers is creating a database for 2D quantum magnets that will provide more reliable calculations and train or fine-tune models. The project also aims to significantly reduce the time it takes to model quantum systems, providing a scalable and transferable platform for detailed understanding of quantum materials. "The effort positions AI as a transformative tool in condensed matter physics,

Source: SLAC National Accelerator Laboratory

integrating theory, simulation and experiment within a unified platform that will answer questions in real time," Matthias Kling, professor of photon science and director of the Stanford PULSE Institute at SLAC, said. Fusion energy SLAC researchers are also contributing to American Science Cloud projects that are building AI models to enable autonomous stabilization of magnetic confinement fusion energy and laser and target control and optimization for inertial fusion energy . The team recently demonstrated how AI models can predict when a tokamak fusion reactor was becoming unstable to pull the plasma automatically back into stabilization. "AI models can push the speed of predictions and decisions much further than has traditionally been viewed as feasible," Ryan Coffee, SLAC senior scientist said. "When autonomous decisions occur significantly faster than the plasma fluctuations, the impossible becomes possible." Close Rethinking AI for the edge At SLAC, we are rethinking AI/ML analysis and control workflows to run in real time, at the "edge" within detector, instrument, and control architectures. This video explores the cutting edge technologies, such as embedded FPGAs, analog computing in ASICs, and quantum algorithms in hardware, that push the boundaries of real-time intelligence in data acquisition. Olivier Bonin/SLAC National Accelerator Laboratory Number of Slides Biotechnology Key to project names AIMS-LEAF AI-driven Multimodal Science for Linking fEnotype to Phenotype One of the grand challenges in modern biology is understanding how genetic information influences the physical expression of genes – the link between genotype and phenotype. It's a question that is

Source: SLAC National Accelerator Laboratory

foundational for advancing bioenergy and biotechnology solutions. A SLAC-led Genesis Mission project (AIMS-LEAF) aims to employ AI tools to integrate data collected with various techniques across multiple spatial scales, building models that connect genetic modifications in plants to their phenotypic expressions. “The long-range goal is to enable AI frameworks for predictive modeling of plant processes under a range of environmental conditions, which could aid future research in resilient agriculture and biosystems design,” said Sam Webb, SLAC lead scientist. Key to project names LAMBDA Lakehouse-Enabled AI Ready Multi-Modal Bioimaging Data Architecture By unifying structural biology data across the nation’s scientific facilities, another project (LAMBDA) will transform how researchers discover, integrate and analyze datasets from different methods of study. “Structural biology experiments at DOE facilities are conducted using photons, neutrons or electrons – providing complementary information,” said Aina Cohen, SLAC senior scientist. “The challenge is integrating the datasets, which currently exist in silos. That integration will accelerate discoveries in biology, bioenergy and critical minerals.” Accelerators for discovery Key to project names MOAT Multi-office Particle Accelerator Team Particle accelerators power advances in research, industry and medicine. These incredibly complex machines have many components and information systems that must be managed simultaneously. SLAC is a key partner in a project (MOAT) aimed at improving the way accelerators are operated and designed across the DOE. SLAC will help build tools to make it easier to develop and

Source: SLAC National Accelerator Laboratory

deploy adaptive digital twins to monitor and predict accelerator performance – as well as agentic AI-driven tools for interfacing with many resources commonly used during operations, such as electronic logbooks, machine schedules, tech reports, and optimization or control algorithms. “Digital twins and agentic workflows are important avenues to enable future capabilities in particle beam production and automated accelerator operation,” said Auralee Edelen, SLAC lead scientist. The project will also use similar tools to change the way future accelerators are designed. “This project brings together participants from across the DOE to develop methods and tools that can be used at different accelerators and leverage insights across them,” Edelen said. Close How SLAC Is Using AI to Improve Particle Accelerator Operations Particle accelerators are the backbone of SLAC's X-ray and ultrafast facilities, but tuning and troubleshooting them is complex work. SLAC is using machine learning to help operators tune electron beams faster, diagnose faults across hundreds of subsystems, and make more informed decisions in real time. These AI tools, developed by SLAC and collaborators, are now in use at accelerators around the world, from the largest research facilities to industrial and medical devices. Olivier Bonin/SLAC National Accelerator Laboratory Number of Slides Critical minerals and materials Key to project names CM2U Critical Minerals and Materials to Unlock Supply Critical minerals and materials (CMMs) are an important resource for magnets in motors, turbines, generators, batteries, semiconductors, microelectronics and nuclear reactors, among other things. SLAC is a

Source: SLAC National Accelerator Laboratory

partner in a Genesis Mission project (CM 2 US) that aims to model the critical minerals and materials supply chain from geologic sources to applications to support real-time decision making, secure U.S. technological leadership and build a self-sufficient future. “This project will revolutionize how we discover, develop and produce CMMs,” Steve Eglash, director of Applied Energy at SLAC, said. In addition, the project seeks to discover alternatives to rare-earth materials for magnets, batteries and other applications. Quarks to cosmos Key to project names Q2C Quarks to Cosmos Exploration of fundamental particles and forces of nature has led to countless discoveries that are foundational to human knowledge and technological advances. SLAC is collaborating on Genesis Mission projects that will use AI to shed light on some of the biggest mysteries of physics, including the nature of dark matter, the invisible matter that makes up most of our universe. One project (Q2C) will use AI to expose hidden connections across disparate large-scale data sets, enabling new types of discoveries in fundamental physics. “We are working on using agentic AI to bridge currently disconnected efforts to study dark matter, from experiments carried out at particle colliders to surveys of the Milky Way and the greater universe, eventually including data from DOE cosmological surveys like DESI [Dark Energy Spectroscopic Instrument] and LSST,” Ben Nachman, Stanford associate professor of particle physics and astrophysics, said. Key to project names TREASURE Tokenized Representations for Energy-frontier AI Searches via Understanding and Reasoning SLAC researchers are also co-leading a

Source: SLAC National Accelerator Laboratory

Genesis Mission effort (AI Universe) to transform and combine data from Rubin, DESI, and other cosmology experiments to enable astrophysicists to train the next generation of large-scale, data-driven AI models of the Universe. Others are collaborating on a project (TREASURE) that will similarly develop AI-ready data to enable training large-scale AI models for high energy physics research at particle colliders. These foundational models have the potential to assist researchers in making precision measurements and identifying patterns in vast datasets relating to some of the smallest and largest structures in nature. Another project (Knowledge Extraction) will use AI agents to resurrect data and documentation of legacy experiments to enable new discoveries with AI and modern insights. Microelectronics Key AXESS Specs-to-Silicon Microelectronics in Extreme environments for Transformative Science One Genesis Mission collaboration (AXESS) aims to accelerate the design of micro-electronics for extreme environments – such as cryogenic temperatures, high radiation levels and ultra-fast operating conditions – by leveraging AI and machine learning across the entire process of chip design, according to Ryan Herbst, SLAC chief engineer. “SLAC is working with many other national labs and industry partners to build a unified ecosystem of foundational models, agentic design tools, and curated datasets to dramatically speed up the path from material properties to working silicon.” Genesis Mission work underway at SLAC today is leveraging the energy and enthusiasm spurred by the DOE initiative to break new ground and turn ideas into solutions, according to SLAC Deputy Director of

Source: SLAC National Accelerator Laboratory

Science and Technology Alberto Salleo. “It will no doubt evolve as quickly as the landscape of AI for science, fueled by the ambition of fast-paced discoveries, solutions to pressing problems and partnerships that make it all possible,” he said. The Genesis Mission is a U.S. Department of Energy initiative. Genesis Mission projects at SLAC are supported by the DOE Office of Science. LCLS and SSRL are DOE Office of Science user facilities. Read more about SLAC and the Genesis Mission at the ISDCI website . For media inquiries, please contact media@slac.stanford.edu . For other questions or comments, contact SLAC Strategic Communications & External Affairs at communications@slac.stanford.edu . About SLAC SLAC National Accelerator Laboratory explores how the universe works at the biggest, smallest and fastest scales and invents powerful tools used by researchers around the globe. As world leaders in ultrafast science and bold explorers of the physics of the universe, we forge new ground in understanding our origins and building a healthier and more sustainable future. Our discovery and innovation help develop new materials and chemical processes and open unprecedented views of the cosmos and life’s most delicate machinery. Building on more than 60 years of visionary research, we help shape the future by advancing areas such as quantum technology, scientific computing and the development of next-generation accelerators. SLAC is operated by Stanford University for the U.S. Department of Energy’s Office of Science . The Office of Science is the single largest supporter of basic research in the physical sciences in the United States and is working to address some of

Source: SLAC National Accelerator Laboratory

the most pressing challenges of our time. Related topics Accelerators Accelerator engineering Energy sciences Fundamental physics Rubin Observatory/LSSTCam Partnerships DOE partnerships Industry partnerships SLAC+Stanford Science news AI and machine learning Astrophysics and cosmology Biological sciences Chemistry and catalysis Computer science Energy science Extremely large datasets Inertial fusion energy Materials science Particle physics Plasma physics and fusion energy science Quantum information science (QIS) Ultrafast science X-ray science Technology innovation X-ray light sources and electron imaging Linac Coherent Light Source (LCLS) Stanford Synchrotron Radiation Lightsource (SSRL) Dig Deeper Related stories News Brief VIA Fermilab Fermilab completes its part in upgrading world's most powerful X-ray laser The lab sent its final contribution to SLAC for the high-energy upgrade of the superconducting accelerator of the LCLS X-ray laser. May 5, 2026 News Brief New detector triples the speed of SLAC's electron camera, enabling higher sensitivity Researchers reengineered an ePix10k detector for use in ultrafast electron diffraction, empowering studies of chemical processes that were previously out of reach. April 3, 2026 · 4 min read Feature Creating the perfect X-ray pulse After five years, SLAC scientists are ready to prototype a new X-ray laser concept. March 3, 2026 · 5 min read News Brief VIA Fermilab Fermilab completes its part in upgrading world's most powerful X-ray laser The lab sent its final contribution to SLAC for the high-energy upgrade of the superconducting accelerator of the LCLS X-ray laser. May 5, 2026 News Brief New

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NASA Webb, Hubble Reveal History of Relic of Milky Way's Formation

Explore Webb Science James Webb Space Telescope (JWST) NASA Webb, Hubble Reveal… Webb News Latest News Latest Images Webb's Blog Awards X (offsite – login reqd) Instagram (offsite – login reqd) Facebook (offsite- login reqd) Youtube (offsite) Overview About Who is James Webb? Fact Sheet Impacts+Benefits FAQ Webb Timeline Science Overview and Goals Early Universe Galaxies Over Time Star Lifecycle Other Worlds Science/Engineering Explainers Observatory Overview Launch Deployment Orbit Mirrors Sunshield Instruments & ISIM Module Instrument: NIRCam Instrument: MIRI Instrument: NIRSpec Instrument: FGS/NIRISS Optical Telescope Element Backplane Spacecraft Bus Webb vs Hubble -> Multimedia About Webb Images Images Videos What is Webb Observing? 3d Webb in 3d Solar System Podcasts Webb Image Sonifications Webb's First Images Team International Team People Of Webb More For the Media For Scientists For Educators For Fun/Learning 7 Min Read NASA Webb, Hubble Reveal History of Relic of Milky Way's Formation New observations from Webb combined with multiple observations from Hubble prove that Terzan 5 is a self-contained, self-enriching stellar system that contains up to four distinct star populations. It orbits within our Milky Way galaxy's central bulge. Credits: Image: NASA, ESA, CSA, STScI, Giorgia Zullo (University of Bologna), Francesco Ferraro (Univer-

Source: NASA

sity of Bologna); Image Processing: Alyssa Pagan (STScI) Researchers using two of humanity's most powerful observatories — NASA's James Webb and Hubble Space Telescopes — have definitively shown that Terzan 5 is not a globular star cluster as it was once classified, offering new insight into how galaxies like our own form and evolve over time. A globular star cluster typically has only one ancient star population. New data not only confirms the existence of two distinct populations of stars in Terzan 5, but also provides evidence for two more recent rounds of star formation. Although located within the crowded bulge of our Milky Way, our galaxy's central, spherical region of older stars, Terzan 5 was massive enough to maintain its separate identity while lighter weight systems spread out and mixed to form the bulge billions of years ago. It's like a lump in an otherwise well-mixed cake batter. "Webb's new near-infrared observations, cross-referenced with Hubble's archival observations, have given us a much clearer picture of the history of Terzan 5," said Giorgia Zullo, who led the research and is a PhD student at the University of Bologna in Italy. These results were presented at a press conference Tuesday at the 248th meeting of the American Astronomical Society in Pasadena, and were published in Astronomy & Astrophysics. Image: Bulge Fossil Fragment Terzan 5 (Webb and Hubble Image) New observations from Webb combined with multiple observations from Hubble prove that Terzan 5 is a self-contained, self-enriching stellar system that contains up to four distinct star populations. It orbits within our Milky Way galaxy's central bulge. Image: NASA, ESA, CSA, STScI, Giorgia Zullo

Source: NASA

(University of Bologna), Francesco Ferraro (University of Bologna); Image Processing: Alyssa Pagan (STScI) Four generations of stars Discovered in 1968 by astronomer Azop Terzan, Terzan 5 resembles a globular cluster in many ways. However, in 2009 this system was discovered to harbor two distinct populations of stars. In 2016 Hubble provided the first estimate of their ages, showing that one formed roughly 12 billion years ago — as the Milky Way itself was assembling — and the other about 5 billion years ago, just before Earth started forming. This pointed to a more complex history than a typical globular cluster. Studying Terzan 5 is complicated by its location in a region of our galaxy crowded with stars and heavily obscured by dust. This is where Webb stepped in. Its infrared view allowed the research team to peer through the dust and catalog many more stars, and fainter stars, than previous work. By measuring star colors and brightnesses, astronomers can classify them into populations of different ages and chemistries. Webb was able to measure these key properties for every star within the field of view in the sky — both stars within Terzan 5 and unrelated foreground stars. To isolate the stars of Terzan 5, the team relied on the power and longevity of Hubble. The 12-year separation allowed the team to measure very small movements of individual stars, known as proper motions , to determine which stars belong to Terzan 5 and which are part of the Milky Way bulge. By combining data from both Webb and Hubble, the researchers found strong evidence for two more stellar populations, one that formed 3.8 billion years ago and another only 2.5 billion years ago. They also were able to

Source: NASA

determine the ages of the previously known stellar populations with unprecedented precision, finding that they formed 12.5 billion and 4.7 billion years ago. With the previously known two generations of stars, astronomers could not rule out the possibility that Terzan 5 interacted with another object, like a globular cluster or a giant molecular cloud, becoming enriched with new gas and dust that set off a second round of star formation. With four stellar generations, those explanations are ruled out. Measurements of the stellar composition of Terzan 5 populations made at the W. M. Keck Observatory and European Southern Observatory's Very Large Telescope also point toward very distinct populations. "Along with the ages of these populations, the cluster preserves a fossil record of progressive enrichment of heavy elements by supernovae," said co-author R. Michael Rich, a research astronomer at the University of California, Los Angeles. Terzan 5 formed multiple generations of stars because it was able to retain the necessary raw materials. There is evidence of powerful supernova explosions in Terzan 5 that forged heavier elements that were swept up by subsequent generations of stars. In lighter weight systems, the force of the explosions themselves could have ejected the resulting elements as well as sweeping out leftover gas and dust. The progenitor of Terzan 5 had enough mass to retain those stars' ejections, allowing new generations of stars to form over billions of years. 'Bulge fossil fragment' The results show that Terzan 5 is most likely the remnant of a much more massive stellar system that initially formed 12.5 billion years ago. Terzan 5 is extraordinary because it survived — and never

Source: NASA

merged or fully “mixed in” with the Milky Way’s bulge. “For some reason, this peculiar clump of stars formed separately from the bulge and was not destroyed as the bulge itself formed,” said Francesco R. Ferraro, a professor at the University of Bologna and principal investigator of the Webb observations. “Terzan 5 is what we now call a bulge fossil fragment because it resembles the primordial clumps that contributed to the formation of the bulge.” To date, there’s one other known cosmic object like Terzan 5. Liller 1 was the second to be reclassified from a globular star cluster to a bulge fossil fragment. It also contains multiple generations of stars. There may be more objects like it. Between 40 to 50 additional globular clusters that orbit within the bulge will be examined by Ferraro’s team to determine if their stellar populations are all the same, like globular clusters, or have several generations, like bulge fossil fragments. Video: Zoom to See Terzan 5 Near Our Milky Way Galaxy’s Bulge To view this video please enable JavaScript, and consider upgrading to a web browser that supports HTML5 video Zoom in to Terzan 5, a star cluster that lies within the crowded central region of our Milky Way galaxy known as the bulge. The scene starts with a ground-based image of our Milky Way bulge and zooms in on and circles Terzan 5, ending with the composite image of the star system from the James Webb and Hubble Space Telescopes. Video: NASA, ESA, CSA, Alyssa Pagan (STScI); Acknowledgment: ESO, Pan-STARRS, DSS2, Akira Fujii Potential parallels for galaxy formation near, far Ultimately, this research may improve what we know about how the central bulges of galaxies form over hundreds of millions of

Source: NASA

years. “Based on observations and in-depth simulations, we think that galaxies in the early universe had huge disks of gas that fragmented into clumps and formed stars. These clumps migrated to the center of the galaxies, and many merged to form their bulges,” said Barbara Lanzoni, a co-author and associate professor at the University of Bologna. For example, Webb has turned up several examples of “clumpy” galaxies that were actively forming when the universe was only a few hundred million years old, like the clumps in the Firefly Sparkle galaxy . “Terzan 5 may provide direct evidence that can help explain how bulges formed in galaxies throughout the universe,” Lanzoni said. The James Webb Space Telescope is the world’s premier space science observatory. Webb is solving mysteries in our solar system, looking beyond to distant worlds around other stars, and probing the mysterious structures and origins of our universe and our place in it. Webb is an international program led by NASA with its partners, ESA (European Space Agency) and CSA (Canadian Space Agency). The Hubble Space Telescope has been operating for over three decades and continues to make ground-breaking discoveries that shape our fundamental understanding of the universe. Hubble is a project of international cooperation between NASA and ESA (European Space Agency). NASA’s Goddard Space Flight Center in Greenbelt, Maryland, manages the telescope and mission operations. Lockheed Martin Space, based in Denver, also supports mission operations at Goddard. The Space Telescope Science Institute in Baltimore, which is operated by the Association of Universities for Research in Astronomy,

Source: NASA

conducts Hubble science operations for NASA. To learn more about Webb, visit: https://science.nasa.gov/webb To learn more about Hubble, visit: https://science.nasa.gov/hubble Downloads & Related Information The following sections contain links to download this article's images and videos in all available resolutions followed by related information links, media contacts, and if available, research paper and Spanish translation links. Related Images & Videos Bulge Fossil Fragment Terzan 5 (Webb and Hubble Image) New observations from Webb combined with multiple observations from Hubble prove that Terzan 5 is a self-contained, self-enriching stellar system that contains up to four distinct star populations. It orbits within our Milky Way galaxy's central bulge. Terzan 5 (Webb and Hubble Compass Image) This image of bulge fossil fragment Terzan 5 was captured by the James Webb and Hubble space telescopes. Webb's data are from its NIRCam (Near-Infrared Camera) and Hubble's from its Advanced Camera for Surveys (ACS). The image shows a scale bar, compass arrows, and co… Zoom to See Terzan 5 Near Our Milky Way Galaxy's Bulge Zoom in to Terzan 5, a star cluster that lies within the crowded central region of our Milky Way galaxy known as the bulge. The scene starts with a ground-based image of our Milky Way bulge and zooms in on and circles Terzan 5, ending with the composite image of the star system f… Related Links Read more: Hubble's star clusters Explore more: ViewSpace | Forms of light: the Cluster Omega Centauri Watch: Globular Clusters, Stellar Pockets Watch: Sorting the Stars in Omega Centauri Webb : News | Images | Science | Home Page Hubble : News | Images |

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Source: NASA

Flags Find Rainbow Factory That Also Raises Razorbacks and Bonytails

Below Hoover Dam, Willow Beach National Fish Hatchery Stocks Rainbow Trout for Angling and Endangered Native Fish for Recovery Jun 16, 2026 Written By Image Matt Trott Image Details As part of the Flags Across America initiative for America’s 250th anniversary, the U.S. Fish and Wildlife Service is sharing stories from the places where our commemorative flags have traveled. From historic hatcheries to vibrant refuges, each stop celebrates conservation as an enduring American value. Join us as we highlight the lands, waters, and wildlife that connect our nation’s past, present, and future. Rainbow trout rank among the top sport fish in North America, and stocking them is one of the missions of Willow Beach National Fish Hatchery , where the flags visited in February 2026. Image Details The hatchery in Arizona serves tribal partners and the public by annually raising a minimum of 100,000 rainbow trout — each 10 to 12 inches long — and stocking waters of the Lower Colorado River Basin on tribal lands and spots below the Hoover and Davis dams. Anglers can then test their skill against the fish. Rainbow trout and Hoover Dam had a hand in the hatchery’s establishment in 1959. After construction, the dam released water ideal for the cold-water rainbow trout, and the hatchery was built for rainbow trout production because of that colder water. We’re always proud to support fishing opportunities. Across the

Source: U.S. Fish & Wildlife Service

United States, 71 national fish hatcheries raise millions of fish yearly , and one goal is to enhance state and tribally managed fisheries. Along with hunters, anglers are often called the first conservationists. Conservation helps ensure the future of outdoor pursuits, including fishing. Plus, money from their license and fishing equipment purchases funds the management and research of 200 fish species and supports 321 state fish hatcheries that stock over 1 billion fish annually. According to the 2022 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation , the nearly 40 million U.S. residents 16 and older who fished that year spent almost $100 billion on fishing expenditures. Image Details As the hatchery provides fish for angling, it takes care to ensure that its stocked rainbows do not hurt an area's native fish populations. All the hatchery's rainbow trout are sterile, which prevents the species from overwhelming native fish, like other kinds of trout, for instance. While rainbow trout are popular and present in most parts of the country today, they are native to only a handful of states in the West and have just been introduced to much of the rest of the country. In fact, introductions have put rainbows on every continent except Antarctica. Image Details From Cold to Warm Rainbow trout production is just part of the work at the hatchery. Since 1995, it has also raised native endangered razorback sucker and bonytail chub to help the warm-water fish recover. The Bureau of Reclamation and Service have an agreement through the Lower Colorado River Multi-Species Conservation Program to stock up to 660,000 razorback suckers and 620,000 bonytail chubs in the Lower Colorado River through 2044. To date,

Source: U.S. Fish & Wildlife Service

Willow Beach has stocked 153,368 razorback suckers and 8,363 bonytail. The razorback sucker is one of the largest sucker species in North America, growing up to 3 feet in length. We and many partners work together to restore self-sustaining populations through propagation and stocking. Image Details The bonytail chub is the rarest of the endangered native fish of the Colorado River. It is thought to have evolved around 3 million to 5 million years ago. Image Details By raising and stocking rainbow trout Willow Beach National Fish Hatchery benefits the community with everything fishing brings. By doing the same for endangered native fish, the hatchery ensures a future for the Colorado River’s native fish. Next up, we follow the flags to Pelican Island National Wildlife Refuge in Florida, the first national wildlife refuge national wildlife refuge A national wildlife refuge is typically a contiguous area of land and water managed by the U.S. Fish and Wildlife Service for the conservation and, where appropriate, restoration of fish, wildlife and plant resources and their habitats for the benefit of present and future generations of Americans. Learn more about national wildlife refuge . Stay tuned for the next chapter on this historic tour! Read more flag stories. Story Tags A250 Fish hatcheries Fishing Sport fishing Recreational Activities Fishing Written By Image Matt Trott Published Jun 16, 2026 History and Culture Facilities Willow Beach National Fish Hatchery Latest Stories Wildlife Wonders Our nation's nature Jun 15, 2026 Get Involved Alaska Invasive Species Awareness Week Jun 15, 2026 Wildlife Wonders How are pollinators connected to the American flag? Jun 14, 2026

Source: U.S. Fish & Wildlife Service

Updates from Partners on Engaging the Recreational Fishing Community to Restore Habitat through the National Fish Habitat Partnership

Through the National Fish Habitat Partnership , NOAA Fisheries supports projects that restore habitat in collaboration with recreational anglers. Partners are reporting progress on several ongoing projects that actively engage local communities and recreational anglers to conserve fish habitat. Engaging Anglers in Oyster Reef Monitoring Sponsoring Partnership: Atlantic Coastal Fish Habitat Partnership Restoring the habitat provided by oyster reefs has long been a focus of NOAA Fisheries. In the Chesapeake Bay, this has led to restoration of roughly 3 square miles of healthy reef habitat . NOAA scientists help plan, implement, and monitor oyster reef restoration . Engaging local communities in restoration of oyster reefs is key to project success, so our partners at the Chesapeake Bay Foundation (CBF) recruited local recreational anglers to participate in fishing surveys to track how fish use restored reefs in the South River in Maryland. CBF is also using other data collection methods such as video, water quality, and fishing surveys to monitor this oyster reef restoration progress. In addition to fishing surveys, CBF has been working to plan the 7th Annual Rod and Reef Slam catch-and-release fishing tournament to showcase the importance of healthy habitat. By awarding anglers for a high diversity of catches, rather than the largest catch by size, this

Source: NOAA Fisheries

tournament heavily depends on healthy oyster reefs to support diverse fish populations. This project is sponsored by the Atlantic Coastal Fish Habitat Partnership and is made possible by an agreement with the Atlantic States Marine Fisheries Commission . Removing and Controlling the Spread of Invasive Species in Alaska Sponsoring Partnerships: Matanuska-Susitna Salmon Habitat Partnership and Kenai Peninsula Fish Habitat Partnership Trout Unlimited (TU) is removing Elodea , an aquatic invasive plant from Alaska waters. Elodea is Alaska's first known freshwater submerged invasive plant and it forms dense mats that grow quickly, block light, slow water flow, and deplete oxygen from important salmon habitat. The presence of Elodea in salmon streams and lakes can reduce the quality of spawning and rearing habitat important for the salmon life cycle. A single, two-inch stem is enough to establish a new infestation in another lake or river so it is very easily spread in popular fishing areas. TU is hosting an Elodea expert speaker at events in Alaska to educate local communities about how Elodea spreads across water bodies and what anglers can do to prevent the spread. Building on these events, TU is developing outreach materials to educate anglers about how fishing equipment, boats, and float planes can transfer Elodea from infected waters to other parts of Alaska. Materials will also demonstrate best practices for mitigating the spread. By increasing awareness about the impacts of Elodea and ways to prevent its spread, local anglers are empowered to fish and recreate safely while supporting healthy salmon habitat across Alaska. TU is also leading efforts to address invasive Northern pike that prey upon juvenile salmon in these

Source: NOAA Fisheries

critical habitats. This project is sponsored by two Fish Habitat Partnerships: the Matanuska-Susitna Salmon Habitat and Kenai Peninsula . It is made possible by an agreement with the Pacific States Marine Fisheries Commission . Engaging Anglers to Remove Invasive Red Mangroves in Hawai'i Sponsoring Partnership: Hawai'i Fish Habitat Partnership Buck and Bones is leading events to remove invasive red mangroves along Moloka'i's southern shores because they are degrading habitats that support recreationally and culturally important fisheries for bonefish, mullet, and surgeonfish. These invasive mangroves reduce water flow and oxygen levels and increase sedimentation in the salt flats which are critical fishing grounds for the local community. While mangroves are valued in most tropical regions for their function as ecosystem engineers, in Hawai'i, they create habitats that are vastly different from the naturally occurring sandy shorelines and salt flats. Volunteers at several angler- and community-led work days will remove these invasive plants. Nonprofit organizations, anglers, guides, community elders, and federal resource agencies will help identify sites for removal. Site selection is critically important since the red mangroves have a high tolerance for extreme conditions, grow rapidly, and disperse seeds via ocean currents. Removal of invasive red mangroves will strengthen community-led conservation on Moloka'i and restore habitat for recreationally and culturally important fish species. This project is sponsored by the Hawai'i Fish Habitat Partnership and made possible by an agreement with the Pacific States Marine Fisheries Commission .

Source: NOAA Fisheries

Celebrating America’s 250th Grant Spotlight: Borderlands Theater

Celebrating America’s 250th Grant Spotlight: Borderlands Theater Date Tue, 06/16/2026 - 12:00 Carolyn Coons Tue, 06/16/2026 - 08:41 Author Carolyn Coons barriostoirespuppets.jpg State Arizona Body A Barrios Stories Project puppet show. Photo by Haldun Morgan When Borderlands Theater launched the first Barrio Stories Project in 2016, its blend of oral history, community engagement, and site-specific performance defied conventional definitions of theater—so much so that the Arizona Daily Star created a new distinction for its annual theater awards: Best Theater Production in Its Own Category. The Barrio Stories Project preserves and celebrates the history of Tucson’s neighborhoods by collecting oral histories from longtime residents and transforming them into original theatrical vignettes performed in streets, parks, gardens, and other community spaces. Through these performances, the project highlights local traditions, strengthens neighborhood connections, and helps preserve community-rooted cultural traditions in the face of economic and demographic change. This year marks the 10th anniversary of the original project and coincides with the 250th anniversary of the signing of the Declaration of Independence. Supported by a $40,000 grant from the National Endowment for the Arts, the latest iteration of the Barrio Stories Project is using this convergence of milestones to explore Tucson’s place in the American story, emphasizing how residents’ experiences have

Source: National Endowment for the Arts

shaped both their communities and the nation. Over the past decade, Borderlands Theater has spotlighted three neighborhoods in Tucson and one in nearby Nogales, Arizona. The first project focused on Barrio Viejo, one of Tucson’s oldest neighborhoods, much of which was demolished to make way for the Tucson Convention Center. Borderlands Theater Producing Artistic Director Marc Pinate and his team collected stories from residents about life before and after the redevelopment. The organization also partnered with Pima Community College to offer an oral history course for high school students, who helped conduct interviews while learning about the history of their city. A Barrios Stories Project elder talk. Photo by Kathleen Dreier Using these interviews, theatrical vignettes are then designed based on what the narrative is most suited to, whether it’s with live actors or shadow puppets. When designing the overall performance experience, Pinate drew inspiration from an unlikely source: amusement parks. “I was really inspired by an amusement park, like Disneyland, or somewhere you get a map and there are all these attractions and the rides go constantly,” he said. “The [Barrio Project] little plays are on a loop—they're playing all day—and you get a map. That way of presenting theater was a first.” The innovative format—which incorporated live performances, recorded interviews, puppet shows, dance, conversations, and other interactive activities—resonated with audiences and helped establish the project as a signature Borderlands Theater program. In 2018, Borderlands Theater turned its attention to Barrio Anita. Pinate said the project had a tangible impact on the neighborhood, helping energize

Source: National Endowment for the Arts

efforts to revive a dormant neighborhood association. “I just think there's certainly something to be said for seeing yourself or your neighbor on a 12-foot high screen or 15-foot high screen, and talking about all the things that you see every day or that you maybe remember from your childhood,” he said. “Being seen and a sense of belonging were really activated in all these festivals that we do.” Within weeks of the festival, residents reestablished the neighborhood association after nearly a decade of inactivity, underscoring to the project's ability not only to preserve community stories, but also to strengthen civic engagement and neighborhood pride. The project also helped bridge generations by creating opportunities for younger residents to engage with family and community history in a dynamic, participatory setting. By bringing neighborhood history to life through theater, elders had the opportunity to share personal memories with younger family members in a way that felt immediate and engaging. “[Seeing theater] sparks the attention and imagination of a young person, and then the grandparent says, that was me, that was my life. That's how we did things,” he said. “And so it's such a great tool to bring to life memories of the past for young people with their family members.” Developed as part of the America250 commemoration, the latest iteration of the Barrio Stories Project will feature new theatrical vignettes highlighting the experiences of service members and veterans from every conflict since the Civil War. Pinate said military service has long served as a pathway to opportunity and upward mobility for many Tucson residents, making it an important part of the region's history.

Source: National Endowment for the Arts

Photographs, medals, and other memorabilia from Barrio Anita residents. Photo by Kate Gross “When we think of 250 years of the country, it's easy to think of the presidents and the big names and all that,” he said. “But for us, there is a lot of local history and local individuals that really had a big effect on the Tucson that we live in today.” Much of what Pinate and Borderlands Theater hoped to accomplish through the Barrio Stories Project was to preserve stories and histories that might not always appear in textbooks. Many of those stories reveal the ways cultures have blended in Tucson over generations. One example Pinate described is a local food tradition known as "Chinese chorizo," which emerged when Chinese-owned neighborhood markets repurposed leftover bologna and hot dogs, seasoning them with Mexican spices. This is just one detail in a much larger story of Tucson, a place that is uniquely American in the way cultures and traditions have not only coexisted but merged to create something new. “This 10-year anniversary is really allowing us to put forward what is the American story of all these different people from different places coming together to make Tucson what it is today.” Theater America250 Teaser Text Borderland Theater's interactive, place-based Barrio Stories Project highlights local history and resident oral histories as part of the larger American story. Celebrating America's 250th Grant Spotlight: Montgomery Symphony Orchestra Celebrating America's 250th Grant Spotlight: People's Light & Theatre Company

Source: National Endowment for the Arts

Activity Time - Word Search

Find the words below in the puzzle. Words go across or down only.

Words to Find:

C	P	H	E	Y	N	X	B	C	J	H
D	T	C	T	W	T	P	J	K	Z	W
M	J	L	V	Y	S	J	I	R	H	R
L	O	U	N	F	I	E	I	E	L	S
Z	G	P	F	Y	U	O	P	G	D	U
I	C	Y	O	L	W	D	K	T	D	I
S	K	A	T	W	Q	M	O	Q	N	P
R	G	U	E	B	C	T	N	I	L	K
A	F	S	K	U	W	W	Q	E	N	U
X	T	B	Z	U	N	D	F	O	V	W
G	U	U	E	H	B	A	Z	P	C	P