National Aeronautics and Space Administration

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DC-8 returns to flight

AFRC2021-0003-09 NASA/Carla Thomas

NASA's DC-8 lifts off from Air Force Plant 42 in Palmdale at sunset. The aircraft returned to flight following major maintenance. *See story, page 2.*

www.nasa.gov/

DC-8 engines overhauled

By Jessica Arreola
NASA Armstrong Public Affairs

NASA's DC-8 aircraft returned to the skies on Jan. 6 after more than a year of maintenance, which included an overhaul to all four engines.

NASA operates the highly-modified Douglas DC-8 as a flying science laboratory in support of the agency's Airborne Science program. On Monday, Jan. 18, the aircraft departed for San Antonio, Texas, where it will remain for planned periodic depot maintenance over several months.

Following its stay in Texas, the DC-8 will begin instrument upload in preparation for the Convective Processes Experiment – Aerosols & Winds campaign, or CPEX-AW. The CPEX-AW campaign, a joint effort between NASA and the European Space Agency, includes a 45-day deployment targeted for July.

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

AFRC2021-003-15 **NASA/Carla Thomas**

DC-8 returns to flight after major maintenance as it lifts off from Air Force Plant 42 in Palmdale at sunset.

Armstrong assists with supply logistics

By Jessica Arreola
NASA Armstrong Public Affairs

NASA has once again joined forces with the community in the continuing effort to fight COVID-19.

The agency provided specialized ground support on Jan. 11 for Samaritan's Purse, enabling the aid organization to land their DC-8 cargo jet at NASA Armstrong's Building 703 in Palmdale.

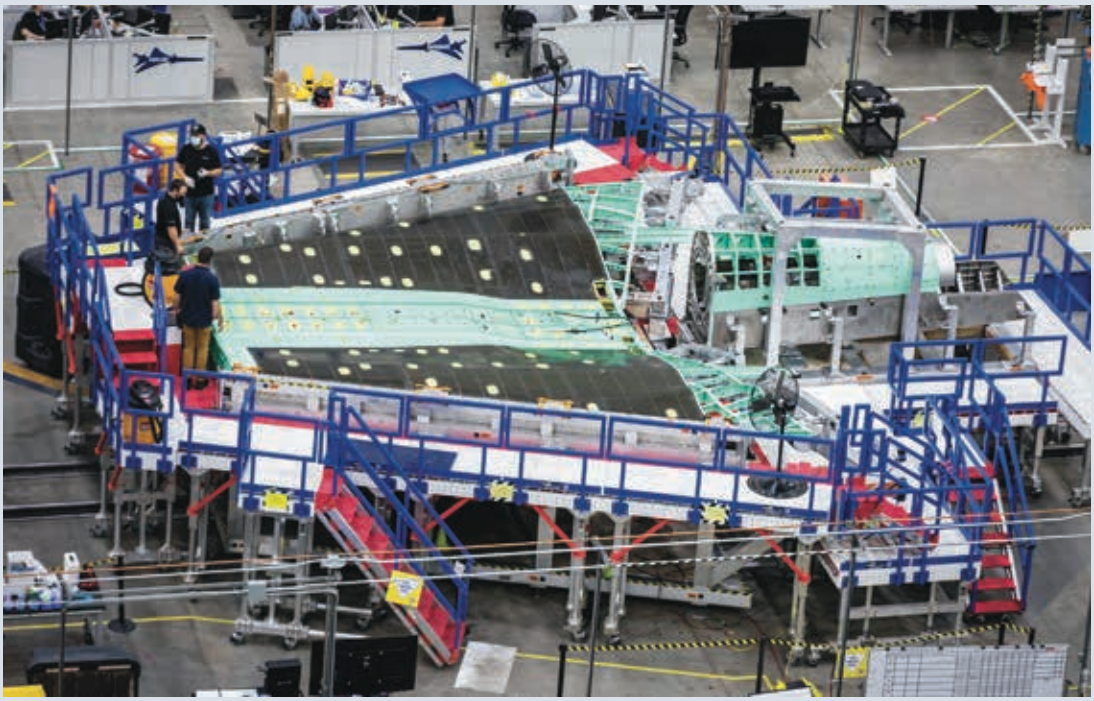
The Samaritan's Purse DC-8 arrived early with supplies to aid in Los Angeles County's Emergency Field Hospital that will expand capacity to care for COVID-19 patients at Antelope Valley Hospital. The aircraft

Supplies, page 8

AFRC2021-0004-13 **NASA/Lauren Hughes**

Samaritan Purse landed its DC-8 at Armstrong's Building 703 in Palmdale to deliver supplies needed to meet the demands of the COVID-19 pandemic. Armstrong personnel assisted in unloading the aircraft.

X-59 QueSST is half way there



Lockheed Martin

NASA is on a mission to revolutionize supersonic air travel for passengers across the globe. In this image, you'll see a halfway built, single-piloted X-59 Quiet SuperSonic Technology (QueSST) aircraft, which will be used to provide rule-makers the data needed to enable a new commercial market for faster-than-sound air travel over land. The aircraft's uniquely crafted parts help ensure it will reduce a disruptive sonic boom to a quiet sonic thump to people on the ground when flying. The X-59 team at Lockheed Martin in Palmdale, recently closed the structural backbone of the aircraft – the wing section – while simultaneously working on the plane's forebody and empennage. The forebody section of the aircraft will carry the pilot and the avionics needed to fly the aircraft. The empennage supports the engine and other flight systems. The team will soon merge all three sections together and gear up for final assembly in 2021. The X-59 will undergo numerous tests to ensure structural integrity of the aircraft and that its components work properly. First flight of the aircraft will be in 2022, and community testing to understand the public's perception of the X-59's sound will begin in 2024.

Rare flying DC-8s meet nose to nose

AFRC2021-0004-24 NASA/Lauren Hughes

NASA and Samaritan's Purse DC-8 aircraft met on the ramp in front of Armstrong's Building 703. Armstrong provided the Samaritan Purse DC-8 a place to land and help unloading supplies to assist with the COVID-19 pandemic.

News at NASA

Changing batteries

Changing batteries may sound like a menial task, but in space, it requires careful planning. Eight years of research and development and 14 spacewalks to replace aging batteries are part of an overall electrical system upgrade to help us continue research after 20 years of continuous human presence aboard the International Space Station.

As the International Space Station orbits Earth at about 17,500 miles per hour, it passes between sunlight and darkness every 45 minutes. During the 45 minutes that the space station is in sunlight, its solar arrays provide power to the station and gather power to be stored in the batteries on the station's truss structure. Once the station crosses the "terminator line," or the difference between day and night on Earth, the station's batteries provide stored power to be routed throughout the space station. This electricity powers everything from the station's life support systems to the vacuums the crew uses to keep the station clean – and everything in between.

Upgrades to the International Space Station are designed to maximize the capability of the orbiting laboratory to support scientific research and technology development. The station serves as a base to continue the development of a robust commercial economy in low-Earth orbit. In addition, the station helps prepare NASA for future long-duration missions to the Moon with Artemis, and eventually, to Mars.

NACA/NASA

Howard C. "Tick" Lilly was the first NACA engineering pilot assigned to the Muroc Flight Test Unit, now known as NASA Armstrong. He also was the first pilot who died on a research mission. Lilly is posing beside a P-63A airplane.

NASA

Joseph A. "Joe" Walker piloted such aircraft as the X-15. He died during a mission piloting the F-104.

Remembrance

The pilots who perished in NACA/NASA aircraft

By Christian Gelzer
NASA Armstrong Historian

NASA's Day of Remembrance recognizes astronauts who have perished in the efforts to advance the nation's reach into space. It's also a day to reflect on how to keep future astronauts safe and the need to remain vigilant on safety.

On the same solemn day, NASA Armstrong officials remember three pilots in its history who died at the stick of a NASA or National Advisory Committee for Aeronautics (NACA) aircraft.

Howard C. "Tick" Lilly was the first NACA engineering pilot assigned to the Muroc Flight Test Unit, now known as NASA Armstrong. Lilly trained as a Naval aviator and joined the NACA's Langley Memorial Aeronautical Laboratory in Virginia, now known as Langley Research Center in 1942. In 1943 he transferred to the NACA's Lewis Flight Propulsion Laboratory in Cleveland, Ohio, (today's Glenn Research Center) and then to Muroc in 1947.

NASA

Richard E. "Dick" Gray, seen above with the AD-1 oblique wing experimental aircraft, lost his life during a pilot proficiency flight.

At Muroc, he flew the Douglas D-558-1 transonic research aircraft and the Bell X-1. Lilly was the fourth person to exceed the speed of sound. He died May 3, 1948, when components of the D-558-1's engine compressor failed, severing control cables and the airplane crashed. He was the first NACA pilot to die in the line of duty.

It was 18 years later when the center lost another pilot. Joseph A. "Joe" Walker was a chief research pilot at the NASA Flight Research Center during the mid-1960s.

During World War II Walker flew P-38 aircraft for the Army Air Force in North Africa. He joined the NACA's Lewis Flight Propulsion Laboratory in Ohio in 1945 and transferred to the High-Speed Flight Research Station in 1951.

Walker made the first NASA-piloted X-15 flight March 25, 1960, and flew the aircraft 24

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SOFIA: Magnetic 'highway' channels material out of Cigar galaxy

By Alison Hawkes
Ames Research Center
and Elizabeth Landau
NASA Headquarters

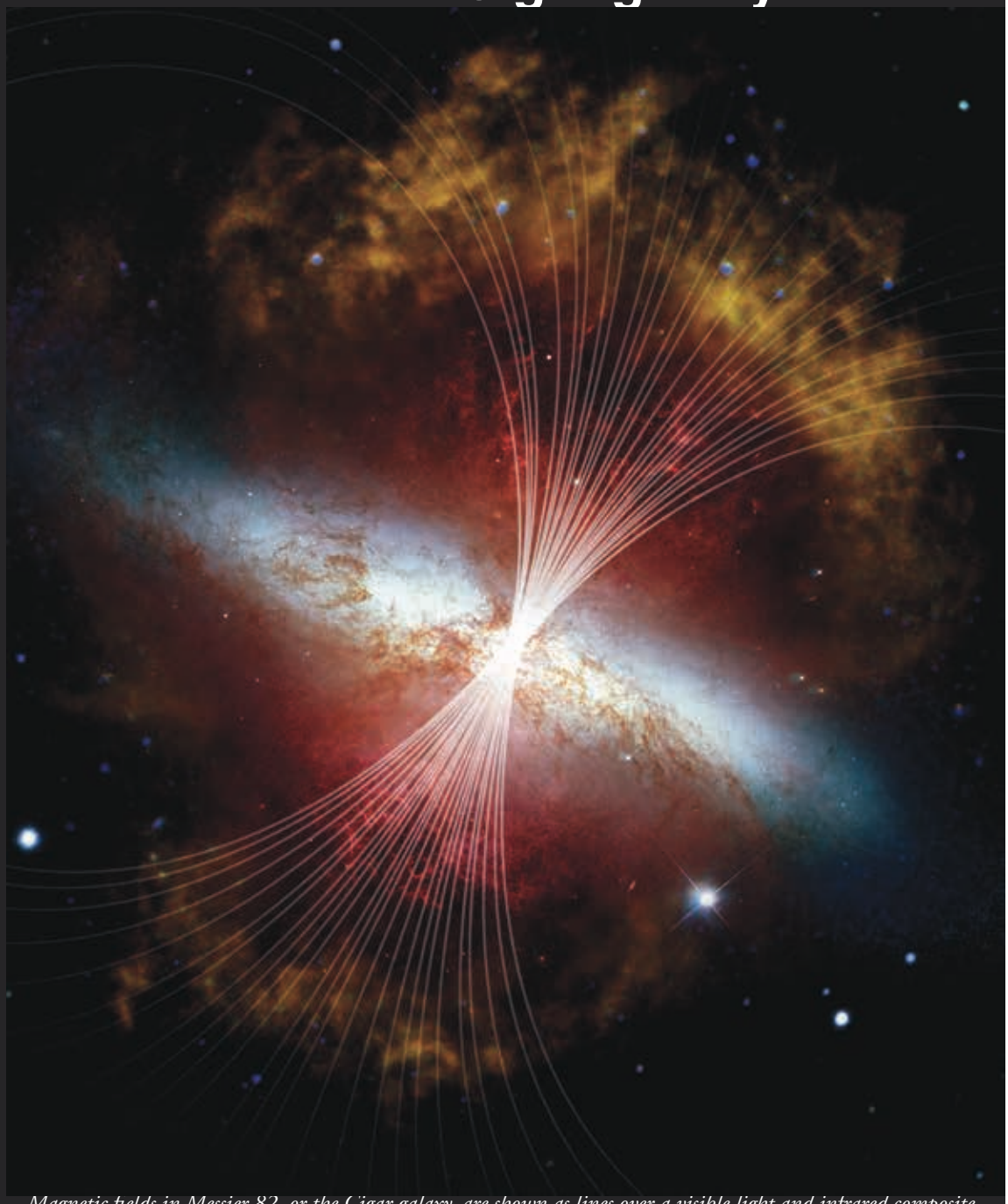
What's fueling the massive ejection of gas and dust out of the Cigar galaxy, otherwise known as Messier 82?

We know that thousands of stars bursting into existence are driving a powerful super-wind that's blowing matter into intergalactic space. New research shows that magnetic fields are also contributing to the expulsion of material from Messier 82, a well-known example of a starburst galaxy with a distinctive, elongated shape.

The findings from NASA's Stratospheric Observatory for Infrared Astronomy, or SOFIA, help explain how dust and gas can move from inside galaxies into intergalactic space, offering clues to how galaxies formed. This material is enriched with elements like carbon and oxygen that support life and are the building blocks for future galaxies and stars. The research was presented at the meeting of the American Astronomical Society.

SOFIA, a joint project of NASA and the German Aerospace Center, DLR, previously studied the direction of magnetic fields close to the core of Messier 82, as the Cigar galaxy is officially known. This time the team applied tools that have been used extensively to study the physics around the Sun, known as heliophysics, to understand the magnetic field's strength surrounding the galaxy at a distance 10 times larger than before.

SOFIA, page 6



Magnetic fields in Messier 82, or the Cigar galaxy, are shown as lines over a visible light and infrared composite image of the galaxy from the Hubble Space Telescope and the Spitzer Space Telescope. Stellar winds streaming from hot new stars form a galactic super wind that is blasting out plumes of hot gas (red) and a huge halo of smoky dust (yellow/orange) perpendicular to the narrow galaxy (white). Researchers used the Stratospheric Obser vatory for Infrared Astronomy magnetic field data and tools that have been used extensively to study the physics around the Sun to extrapolate the magnetic field's strength 20,000 lights-years around the galaxy. They appear to extend indefinitely into intergalactic space, like the Sun's solar wind, and may help explain how the gas and dust have traveled so far away from the galaxy.

Whirlpool galaxy

Magnetic chaos hidden within

By Alison Hawkes
Ames Research Center
and Elizabeth Landau
NASA Headquarters

Not all appears as it would seem in the Whirlpool galaxy. One of the best-studied spiral galaxies and a delight to amateur astronomers, Messier 51, as it's officially named, is influenced by powerful, invisible forces.

Located 31 million light-years away in the constellation Canes Venatici, the galaxy's arms are strikingly visible as they reach out along the central spine structure, displaying swirling clouds of gas and dust that are massive star-making factories. But new observations by NASA's Stratospheric Observatory for Infrared Astronomy, or SOFIA, presented at this week's 237th meeting of the American Astronomical Society, shows a more complicated picture.

Radio telescopes previously detected neatly-drawn magnetic fields throughout the length of the galaxy's massive arms. But under SOFIA's infrared gaze for the first time those lines give way to a chaotic scene in the outer spiral arms. Using a far-infrared camera and imaging polarimeter instrument called the High-Resolution Airborne Wideband Camera, or HAWC+, researchers found that the magnetic fields in the outskirts of the galaxy no longer follow the spiral structure and are instead distorted.

Whirlpool galaxy, page 7

NASA, the SOFIA science team, A. Borlaff; NASA, ESA, S. Beckwith (STScI) and the Hubble Heritage Team (STScI/AURA)

Magnetic field streamlines detected by SOFIA are shown over an image of the Whirlpool galaxy, M51, from NASA's Hubble Space Telescope. For the first time, SOFIA's infrared view shows that the magnetic fields in the outer arms do not follow the galaxy's spiral shape and are instead distorted. The intense star formation activity in these regions, shown in red, may be causing the chaos, along with the forces from the yellow neighboring galaxy, NGC 5195, tugging on one of the spiral arms.

SOFIA... from page 5

"This is old physics for studying the Sun, but new for galaxies," said Joan Schmelz, a director at the Universities Space Research Association based at NASA's Ames Research Center in Silicon Valley, and co-author of the upcoming paper about this research. "It's helping us understand how the space between stars and galaxies became so rich with matter for future cosmic generations."

Located 12 million light-years from Earth in the constellation Ursa Major, the Cigar galaxy is undergoing an exceptionally high rate of star formation called a starburst. The star formation is so intense that it creates a "super wind" that blows material out of the galaxy. As SOFIA previously found using the instrumented called the High-Resolution Airborne Wideband Camera, or HAWC+, the wind drags the magnetic field near the galaxy's core so that it's perpendicular to the plane of the galaxy across 2,000 light-years.

Researchers wanted to learn if the magnetic field lines would extend indefinitely into intergalactic space like the magnetic environment in the solar wind, or turn over to form structures similar coronal loops that are found in active regions of the Sun. They calculate that the galaxy's magnetic fields extend out like the solar wind, allowing the material blown by the super wind to escape into intergalactic space.

These extended magnetic fields may help explain how gas and dust spotted by space telescopes have traveled so far away from the galaxy. NASA's Spitzer Space Telescope detected dusty material 20,000 lightyears beyond the galaxy, but it was unclear why it had spread so far away from the stars in both directions instead of in a cone-shaped jet.

"The magnetic fields may be acting like a highway, creating lanes for galactic material to spread far and wide into intergalactic space," said Jordan Guerra Aguilera, a postdoctoral researcher at Villanova University in Pennsylvania and co-author on the upcoming paper.

With rare exceptions, the magnetic field in the solar corona cannot be measured directly. So, about 50 years ago, scientists developed methods to accurately extrapolate magnetic fields from the Sun's surface into interplanetary space, known in heliophysics as the potential field extrapolation. Using SOFIA's existing observations of central magnetic fields, the research team modified this method to estimate the magnetic field about 25,000 light-years around the Cigar galaxy.

"We can't easily measure the magnetic fields at scales this large, but we can extrapolate it with these tools from heliophysics," said Enrique Lopez-Rodriguez, a Universities Space Research Association scientist for SOFIA based at Ames and lead author on the study. "This new, interdisciplinary method gives us the larger perspective that we need to understand starburst galaxies."

SOFIA is a joint project of NASA and the German Aerospace Center. NASA Ames manages the SOFIA program, science, and mission operations in cooperation with the Universities Space Research Association, headquartered in Columbia, Maryland, and the German SOFIA Institute at the University of Stuttgart. The aircraft is maintained and operated by NASA Armstrong at Building 703 in Palmdale. The High-Resolution Airborne Wideband Camera instrument was developed and delivered to NASA by a multi-institution team led by NASA's Jet Propulsion Laboratory in Pasadena, California.

ED15-0187-236 NASA/Carla Thomas

This high-dynamic range (HDR) photo of the Stratospheric Observatory for Infrared Astronomy (SOFIA) was captured just before sunset at the Christchurch International Airport in Christchurch, New Zealand while aircraft crews were preparing for a nighttime observation flight.

Whirlpool galaxy... from page 6

What's causing all this magnetic pandemonium? The intense star formation in these areas creates chaos that can only be seen with infrared flight. A nearby, yellowish galaxy called NGC 5195 tugging at the outermost tip of one of the arms adds to the turmoil, possibly strengthening the magnetic fields. The research builds on SOFIA's previous findings that show magnetic fields are important in shaping spiral galaxies and helps unravel the complex role magnetic fields play in the evolution of galaxies.

Supplies... from page 3

is specially configured to carry up to 84,000 pounds of cargo and 32 passengers in support of international relief efforts.

NASA also operates a highly modified Douglas DC-8 as a flying science laboratory in support of the agency's Airborne Science program. NASA's DC-8, based at Armstrong, is flown to collect data for experiments in support of projects serving the world's scientific community.

While there are few operational DC-8s left in the world, the arrival resulted in a rare visual, as these two aircraft met on the same flight line.

AFRC2021-0004-16 NASA/Lauren Hughes

Marlon Espinoza uses a forklift at Armstrong's Building 703 in Palmdale to assist in Samaritan Purse's COVID-19 aid work. The supplies were unloaded from a DC-8 and loaded onto a truck.

Remembrance... from page 4

times, achieving its highest altitude (354,200 ft.) Aug. 22, 1963; he made the first flight in the Lunar Landing Research Vehicle in 1964 that led to the Lunar Landing Training Vehicle used in Houston to train astronauts to land on the moon. Walker perished June 8, 1966, when his F-104 was caught in the wingtip vortex of the North American XB-70.

In the 1980s, a pilot proficiency flight claimed the life of Richard E. "Dick" Gray.

Gray was an aerospace research pilot at NASA's Johnson Space Center in Houston, from 1978 until he transferred to Ames-Dryden Flight Research Center, now NASA Armstrong.

At JSC he was chief project pilot on the WB-57F high-altitude research aircraft and served as the prime chase pilot in the T-38 aircraft for video documentation of the landing portion of space shuttle orbital flight tests. A Naval aviator, he flew 48 combat missions in F-4s over Vietnam while assigned to squadron VF-111 aboard the USS Coral Sea in 1972.

Gray was fatally injured Nov. 8, 1982, in the crash of a Cessna T-37 aircraft while on a flight to hone his skills flying the airplane.

Carlos Meza, technician and inspector, dies at 43

Carlos Meza, a NASA Armstrong technician and inspector, died Jan. 1. He was 43.

"He was a great guy that made a number of contributions to AFRC that most people probably don't realize," said Gustavo Carreno IV, Avionics and Instrumentation Branch chief. "He was definitely an unsung hero."

Carreno said Meza's skills at work were amazing and he was a family man.

"He was always looking out for what was in NASA's best interests and for his wife and kids," he said. "He was my utility player – or the Leatherman in my tool belt. I knew I could give him an assignment and he would get it done quickly and that it would be right."

Meza started his career as a NASA Armstrong contractor and was selected as a civil servant in January 2017. During his career, he worked on the center's support aircraft fleet, supported the C-20 and G-III aircraft, moved between the DC-8, and ER-2, and helped with the instrumentation modifications on the F-15 aircraft No. 884.

"He was assigned to the X-59 program to use his expertise there," Carreno said. "He will definitely be missed by his peers and by me."

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

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