

# ENGINEERING FACELIFT

By Nestor Vences

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—**MEGAN LIN**  
Program Manager  
Chandra

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Caption ...

Illustration courtesy of  
NASA/CXC and James Vaughan

**A**fter 25 years in orbit, the Chandra X-ray Observatory is defying expectations, thanks to a major mission refresh by its dedicated team.

Two decades of exposure to radiation, cosmic dust and the harsh environment of space had taken its toll. Chandra's propulsion team was monitoring a common issue with aging spacecraft: rising operating temperatures.

"As its reflective materials get darker with each passing year, things get hotter on board, and that makes it harder to get the data," Megan Lin said, Chandra's program manager.

Megan leads a team of Northrop Grumman employees that oversee the day-to-day planning and execution of science observations at the Chandra X-ray Center.

"Astronomers come up with these amazing ideas of things that they want to observe in space, and we get to help make those a reality," Megan said. "Keeping all of the subsystems nice and cool is critical to taking these observations."

So, the team embarked on a quest to rejuvenate the world's most powerful X-ray observatory.

## A Quarter Century Strong

Chandra was built at Northrop Grumman's Space Park campus in Redondo Beach, California, and its mission was initially intended to last five years.

On July 23, 1999, it launched aboard NASA's Columbia shuttle, marking a historic moment. Not only was Chandra the largest payload ever carried on a space shuttle, but the

mission was also piloted by Eileen M. Collins, the first female shuttle commander.

Designed to observe X-rays using a groundbreaking barrel-shaped set of mirrors, Chandra has spent decades collecting emissions from supernovas, colliding galaxies and black holes.

These observations have helped answer fundamental questions about the origin and evolution of the universe. Far exceeding its original five-year design life, the spacecraft celebrated its 25th anniversary in the summer of 2024.

## Turn Things Around

To preserve — and possibly extend — Chandra's capabilities, Northrop Grumman's propulsion team partnered with the Smithsonian

Astrophysical Observatory and NASA. Their focus: the spacecraft's thrusters, the engines responsible for maintaining its position as it sling-shots around Earth.

"We have thrusters on board that get quite hot when we have to fire them, which was becoming difficult to plan around," Megan said. "It's kind of like solving a giant puzzle."

The team found a clue buried in a 1949 research paper, setting the stage for a groundbreaking solution.

"That was just the beginning," Megan said. "It was the start of several major projects."

The study revealed critical insights about Chandra's fuel type and how hot the thrusters could safely operate.

"After some discussion, we figured that a significant increase in thruster performance could be achieved with new thruster management software," said Paul Viens, a member of Chandra's spacecraft engineering team.

The team wrote new code and prepared a series of flight and ground software updates to make thrusters more efficient in the high-heat conditions.

Then came the hard part. To ensure the spacecraft's safety, they ran an analysis and modeling on Earth before implementing the updates in space. On April 15, 2024, the team beamed up the latest in the series of software updates to Chandra.

What came next, exceeded all expectations.

## New Life for Chandra

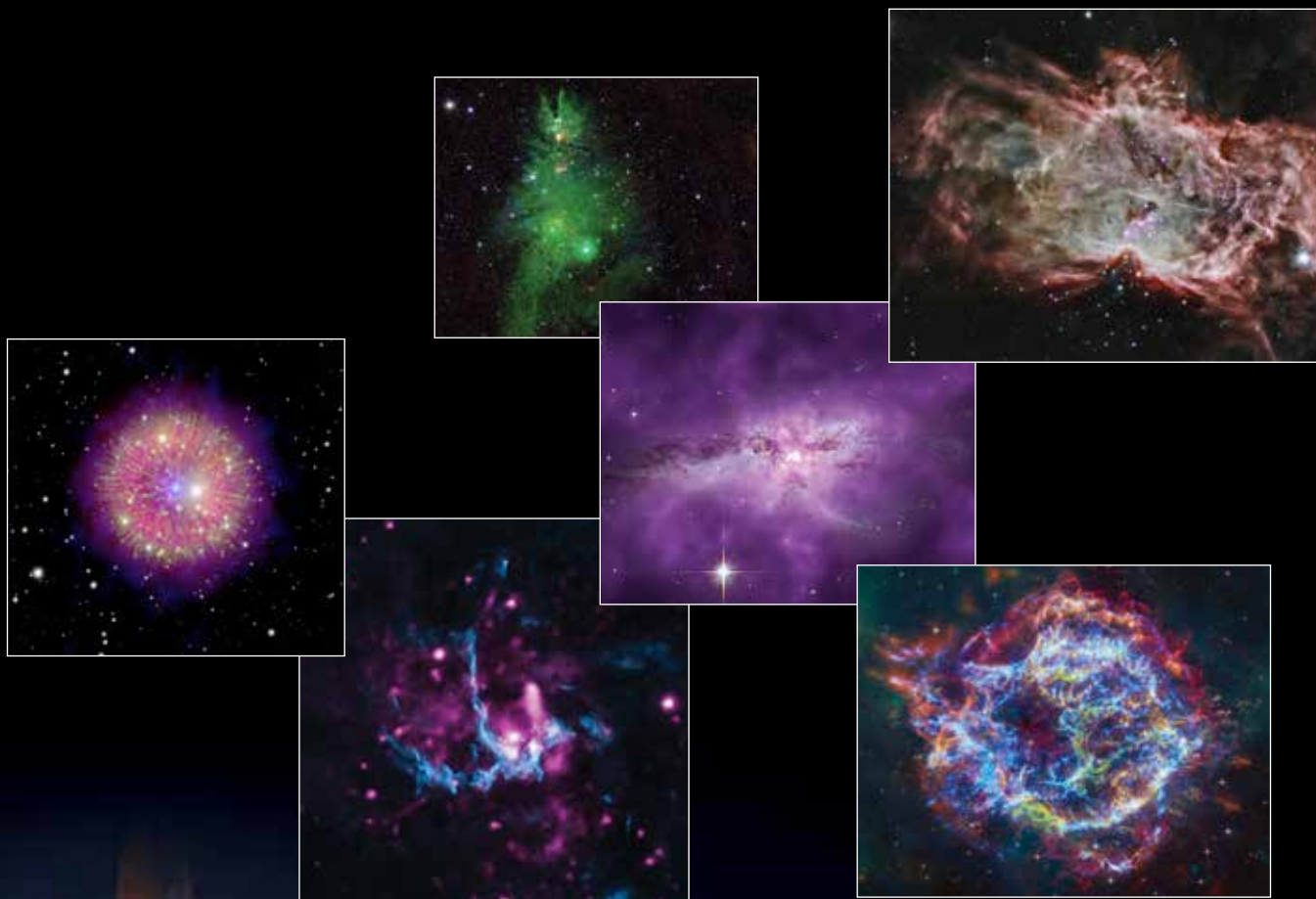
"We got so much new capability on board! Chandra can now spend two times as long doing a single observation, which has just increased our mission efficiency and is giving us such great science return," Megan said.

By conservative estimates, Chandra regained five years of life and is operating at levels not seen since 2020.

"It feels like we've regained several years of flexibility and scientific capability," added John Scott, Chandra's mission planning lead.

Thanks to innovative thinking and teamwork, Chandra's future looks as bright as its storied past. **n**

continued on page 30



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INTO THE MISSION HAS TRULY BEEN  
A REMARKABLE TEAM ACHIEVEMENT."

—**PAUL VIENS**   
Spacecraft Engineer Team Lead  
Chandra



Caption ...

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