

# HUBBLE

## Space Telescope

Aim of Nasa's service mission is to make Hubble more powerful, more robust and extend the star-gazer's life until at least 2014.

The 7 Nasa astronauts will carry out 5 space walks to replace the telescope's gyroscopes and batteries, and upgrade its optical instruments.

By Seth Borenstein

**WASHINGTON:** Using the power of pictures, the Hubble Space Telescope has snapped away at the mystery of the universe.

For 19 years, Hubble has shown the epic violence of crashing galaxies, spied on the birth and death of stars, taught cosmic lessons, and even provided comic relief.

In Hubble's photos, believers witness the hand of God, non-believers see astronomy in action, and artists discover galaxies worthy of galleries.

Two US astronauts from the *Atlantis* ventured into open space for a third time yesterday to continue repairs on the ailing Hubble Space Telescope and equip the 19-year-old observatory with a new key instrument.

Astronauts John Grunsfeld and Drew Feustel equipped Hubble with a second new science instrument, the Cosmic Origins Spectrograph, and repair another, the Advanced Camera for Surveys.

In five painstaking spacewalks, astronauts will repair and replace broken instruments, add a new long-gazing camera, and then say goodbye forever to Hubble.

If it all works, Hubble will get another five to seven years of life,

this flight should enable astronomers to look an extra 200 million light-years farther back, said Hubble chief scientist David Leckrone.

He said if everything goes well with the repair mission, Hubble will be at its sharpest ever.

It was a Hubble image in 1995 that forever restored the telescope's tarnished early reputation. The picture was Eagle Nebula.

It was stunning, with beautiful colours and dramatic clouds where stars formed. Nasa called it "the pillars of creation."

And the public, which once snickered at Hubble, now was smitten.

Hubble has snapped 570,000 pictures, and while some catch the birth of stars and planets, others capture the other end of life — death and violence on a cosmic scale.

"We have 20 gorgeous images of stars like our sun dying," said Hubble astronomer Frank Summers. "They are

Aperture door protects Hubble's optics.

Communications antennae send images back to Earth.

Solar panels power the telescope.



before it is remote-control steered into a watery grave.

Hubble doesn't just illustrate the story of the universe. It has its own story, complete with failure and redemption.

Senior Hubble scientist Mario Livio rhapsodised about the drama of Hubble's own story, "turning something that could have been the biggest scientific fiasco to the biggest scientific success."

After its launch into space in 1990, the Hubble Space Telescope was stuck with blurry vision because its mirror wasn't quite right.

It was the butt of jokes by late night comics; an editorial cartoon said its designer was Mr Magoo, a nearsighted cartoon character. It seemed like a massively overbudget screw-up.

But once it was fixed three-and-a-half years later with a new set of glasses, Hubble shed its myopic reputation. It began producing far-sighted images of space that seemed more art than astronomy.

Hubble helped pinpoint the age of the universe at 13.7 billion years, explain what's in it, and show where it is going.

Its photos hinted that as a planet, Earth may not be alone. Just one picture of warped distant galaxies provided visual proof of Einstein's general relativity theory.

"Hubble actually allows our human minds and spirits to travel light-years, even billions of light-years," said Nasa sciences chief Ed Weiler.

The photo "Hubble Ultra Deep Field" views a time when the universe was about 700 million years old, so the stars in it are 13 billion light-years away. One light-year is 5.9 trillion miles.

A new camera to be installed in

# From cosmic joke to cherished eye in space

just amazing. It boggles the mind to think that stars that are so similar can die in such different ways."

When age finally caught up with Hubble — it was designed to last 10 to 15 years — Nasa first decided the telescope would just have to slowly die.

An astronaut repair mission was deemed too risky during the time period shortly after the 2003 Columbia shuttle disaster, which claimed seven astronauts.

But ultimately, public opinion and politicians persuaded Nasa to change its mind. Sentiment and the promise of more stunning images beat out calculations of risk and cost.

"It has truly become an icon of American life," said Weiler, the public face of Hubble since its launch.

While the public loves Hubble from afar, those who know it up close find it has a personality.

"It's almost impossible not to start feeling like Hubble is a living being," said astronaut John Grunsfeld who has repaired the telescope twice already and is slated to get under Hubble's hood a third time.

"It's just another satellite, but once you've worked in the programme and are smitten with it, it is very easy to start adding personality to Hubble.

"I do feel like... I'm going to visit an old friend that I haven't seen in a long

time that will be a little bit weathered, a little bit older," Grunsfeld said in a news conference last fall.

Nasa hasn't visited Hubble for seven years and is expecting many signs of wear and tear, including holes from space junk.

The telescope has been anything but cheap. Nasa thought it could build Hubble for \$300 million (RM1.1 billion), but it actually cost more than five times that.

With all the fixes and upgrades and decades of use, the total cost will be close to US\$10 billion by the time it dies, but no one is complaining about that price tag, Weiler said.

Astronomer Livio said certain pictures remind him of abstract paintings. The colours — added in once they reach the ground because the cameras only shoot black-and-white — can be garish. But then so is the universe.

"This is art on a grand scale," astronomer Summers said. — **AP**

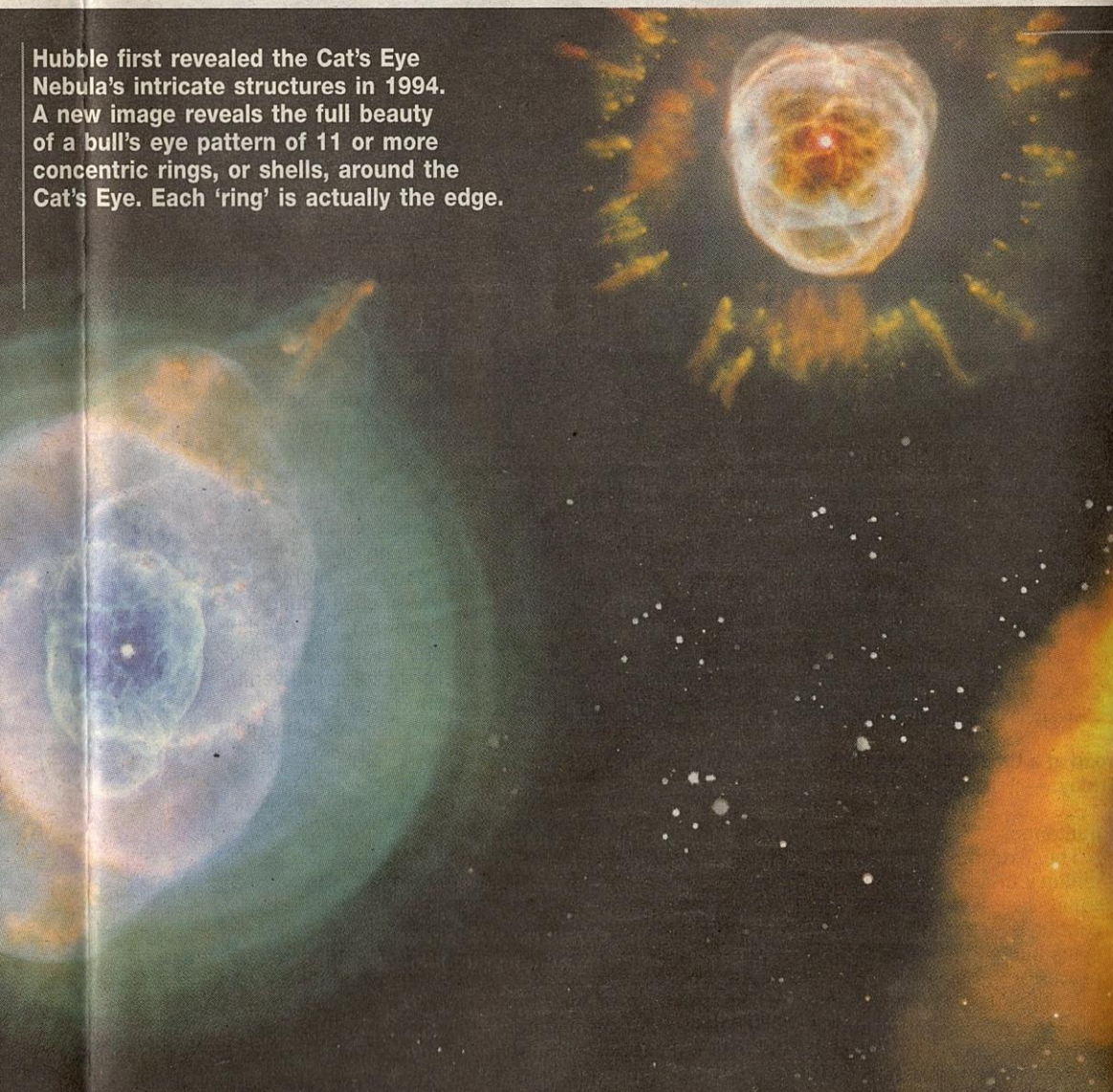
■ On the Net: The Hubble Space Telescope site:  
<http://hubblesite.org>

- Placed in orbit at an altitude of 600km in April 1990
  - Operational since 1993
  - Length: 13.3m
  - Weight: 11 tonnes
  - Hubble has transmitted more than 750,000 spectacular images and streams of data from the far reaches of the universe
- Source: Nasa

The Crab Nebula carries the chemical legacy of the star that exploded in 1054 AD. Almost all the elements in the universe other than hydrogen and helium were formed inside of stars, then thrown into space.

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Hubble first revealed the Cat's Eye Nebula's intricate structures in 1994. A new image reveals the full beauty of a bull's eye pattern of 11 or more concentric rings, or shells, around the Cat's Eye. Each 'ring' is actually the edge of a shell.



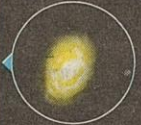
From space, the nebula displays gas clouds so complex they are not fully understood. The Eskimo Nebula is clearly a planetary nebula, and the gas seen above composed the outer layers of a Sun-like star only 10,000 years ago.

In one of the largest and most detailed celestial images ever, the coil-shaped Helix Nebula is displayed.

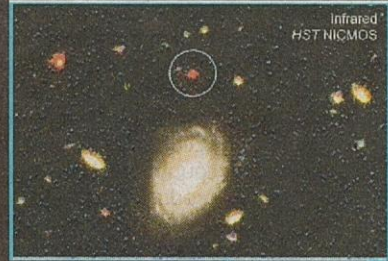


The Hubble space telescope has captured this dramatic moment when a searing pulse of light from an exploding star races across the vast interstellar void of deep space. Hubble has made more than 880,000 observations and snapped hundreds of thousands of images of 29,000 celestial objects over the past 19 years.

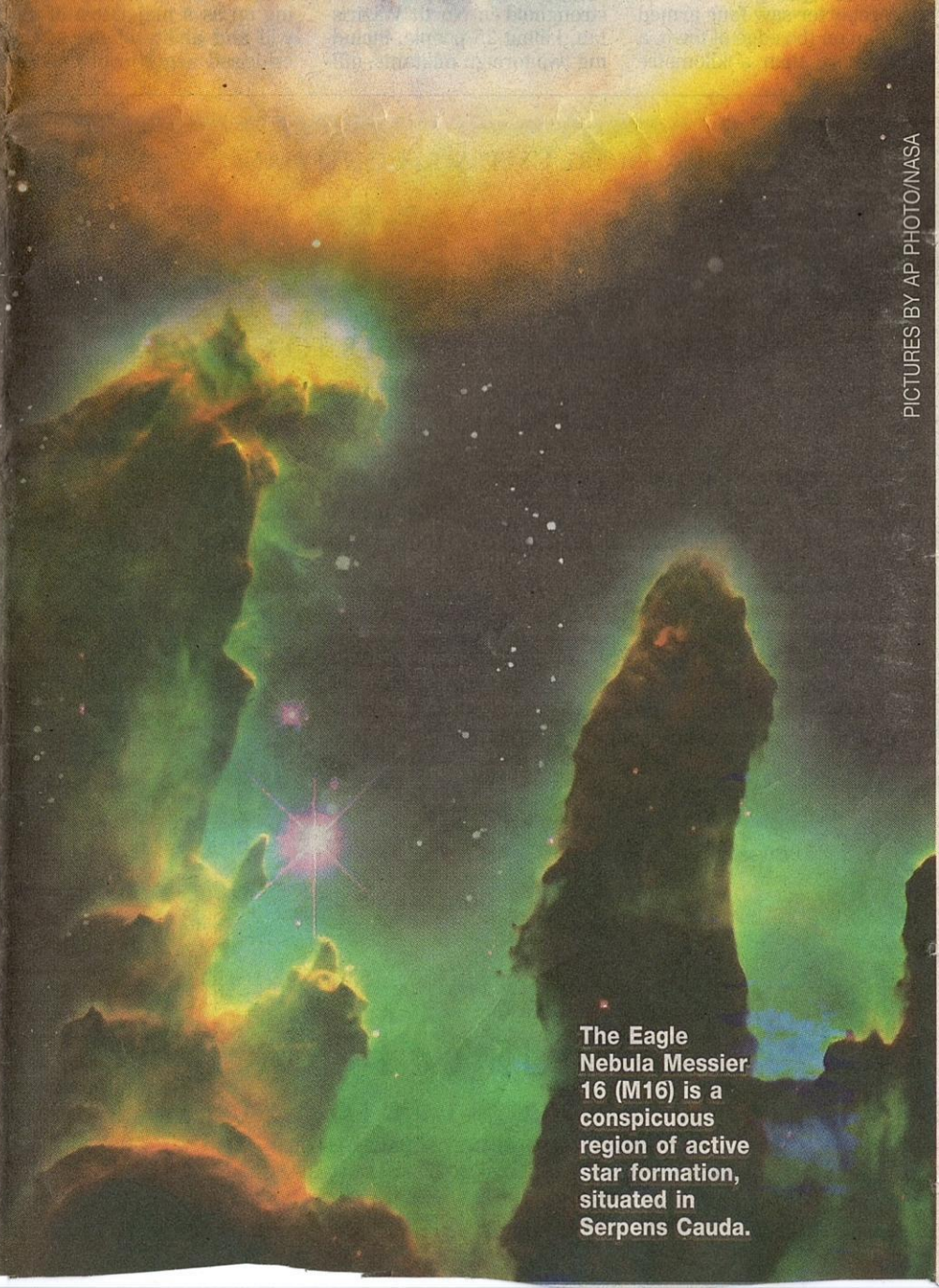
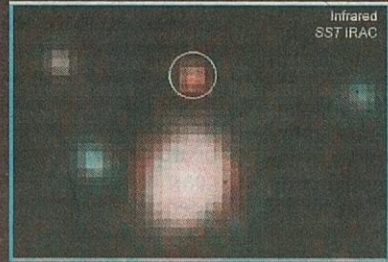
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Nasa astronomers detected a “big baby” galaxy in 2005, vastly heavy for its young age of 800 million years, and its location in the early universe. At upper left, the galaxy, named HUDF-JD2, was pinpointed among approximately 10,000 others in a small area of sky called the Hubble Ultra Deep Field (HUDF).



A blow-up of one small area of the HUDF (above) is used to identify where the distant galaxy is located (inside green circle). At centre left, the galaxy was detected using Hubble's Near Infrared Camera and Multi-Object Spectrometer. But at near-infrared wavelengths it is very faint and red. At bottom left, the Spitzer Infrared Array Camera, easily detects the galaxy at longer infrared wavelengths. The brightness of the infrared galaxy suggests that it is quite massive.



The Eagle Nebula Messier 16 (M16) is a conspicuous region of active star formation, situated in Serpens Cauda.