

Lockheed Martin-Built Hubble Space Telescope Marks 20 Years Of Astronomical Discovery

NASA's Hubble Space Telescope (HST), built and integrated at the Lockheed Martin Space Systems facility in Sunnyvale, was launched 20 years ago aboard Space Shuttle Discovery, on April 24, 1990, ushering in a new golden age of astronomy. HST was released by the crew into Earth orbit the next day and the universe hasn't looked the same since.

"HST has had a fundamental impact on astronomical research and how we view our universe. It is a source of enormous pride to us all that the HST originated at Lockheed Martin in 1977 when we were awarded the prime contract for building and integrating the spacecraft," said Joanne Maguire, executive vice president of Lockheed Martin Space Systems Company (LMSSC). "We've been at NASA's side on this incredible journey ever since."

Since its launch in 1990, the Hubble Space Telescope has established itself as a premier astronomical observatory that continues to make dramatic observations and discoveries at the forefront of astronomy, while opening up the universe to the public through its beautiful and inspiring pictures. Among a long list of achievements:

- Hubble's ability to detect faint supernovae contributed to the discovery that the expansion rate of the universe is accelerating, indicating the existence of mysterious "dark energy" in space.
- Observations of Cepheid variable stars in nearby galaxies were used to establish the current expansion rate of the universe to better than 10 percent accuracy.
- In 2009, Hubble provided our deepest view yet into the universe's distant past. The faintest and reddest objects in the image are galaxies that formed just 600 million years after the Big Bang. No galaxies have been seen before at such early times. This latest deep field view also provides insights into how galaxies grew in their formative years early in the universe's history.
- Hubble provided the first direct measurements of the three-dimensional distribution of dark matter in space.
- Peering into nearby regions of star birth in the Milky Way galaxy, Hubble has revealed flattened disks of gas and dust that are the likely birthplaces of new planets.
- When Sun-like stars end their lives, they eject spectacular nebulae. Hubble has revealed fantastic and enigmatic details of this process.
- Hubble made detailed measurements of a Jupiter-sized planet orbiting a nearby star, including the first detection of the atmosphere of an extra-solar planet.
- The explosive collision of Comet P/Shoemaker-Levy 9 with Jupiter in 1994 gave Earthlings a cautionary tale of the danger posed by cometary impacts.
- Hubble observations have shown that monster black holes, with masses millions to billions times the mass of our sun, inhabit the centers of most galaxies.
- Hubble played a key role in determining the distances and energies of gamma-ray bursts, showing that they are the most powerful explosions in the universe other than the Big Bang itself.

During its 20 years in space, HST has traveled more than 2.97 billion miles along its orbit, taken more than 900,000 exposures of over 30,000 celestial objects that have generated over 8,842 peer reviewed scientific publications reporting Hubble results.

Hubble was conceived to tackle scientific goals that could be accomplished only by an observatory in space. Its mission was to spend at least 20 years probing the farthest and faintest reaches of the cosmos. Crucial to fulfilling this objective was a series of on-orbit servicing missions by Space Shuttle astronauts.

The First Servicing Mission took place in December 1993 and the Second Servicing Mission was flown in February 1997. In December 1999, Servicing Mission 3A was performed followed by Servicing Mission 3B in March 2002.

After years of arduous planning and rehearsing, the Space Shuttle Atlantis and the STS-125 crew launched successfully on May 11, 2009 and completed Servicing Mission 4, the final astronaut visit mission to the orbiting Hubble Space Telescope. In an incredible 13-day high wire ballet of humans and machines, the Atlantis crew retrieved, upgraded, sustained and repaired the telescope, then set it free to continue exploring the universe well

into the next decade.

During the mission's five dramatic spacewalks, astronauts installed two new science instruments, repaired two others, replaced all six batteries and all six gyros, installed a new science data computer, attached a soft capture mechanism to the Telescope, and fitted new insulation panels to three of Hubble's equipment bays. The two new instruments the crew installed were the Cosmic Origins Spectrograph and the Wide Field Camera 3, both of which will significantly expand Hubble's astronomical observing capability by as much as 70 times. Each mission extended Hubble's scientific power with new instruments, modernized its systems with new technology, and performed critical maintenance and repairs.

"All of the past and present members of the HST team here at the NASA Goddard Space Flight Center (GSFC), and in Sunnyvale and Denver, feel a profound sense of satisfaction as we look back on our roles in building, testing, deploying, operating and servicing this magnificent observatory," said Tony Cruz, Lockheed Martin Space Systems HST program manager. "It really is not boasting to say we've all helped make history with our contributions to HST and its continuing legacy."

The Lockheed Martin Hubble servicing mission team included individuals from Lockheed Martin Space Systems and Lockheed Martin Information Systems & Global Services and was responsible for:

- Spacecraft Systems Engineering and Design Integration
- Payload Integration and Test at GSFC and Kennedy Space Center
- Astronaut Training Support
- Replacement Satellite Hardware Design and Development
- Space Shuttle Support Equipment Design and Development
- Spacecraft Mission Operations and Control
- Ground Software
- Spacecraft Flight Software
- Servicing Mission Planning and Timeline Development.

The NASA Goddard Space Flight Center in Greenbelt, Md. manages the HST program for the Science Mission Directorate, NASA Headquarters. The Space Telescope Science Institute in Baltimore, Md. selects observing programs from numerous proposals and analyzes, archives and disseminates incoming astronomical data. The Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency.

Lockheed Martin Space Systems Company (LMSSC), a major operating unit of Lockheed Martin Corporation, designs and develops, tests, manufactures and operates a full spectrum of advanced-technology systems for national security and military, civil government and commercial customers. Chief products include human space flight systems; a full range of remote sensing, navigation, meteorological and communications satellites and instruments; space observatories and interplanetary spacecraft; laser radar; ballistic missiles; missile defense systems; and nanotechnology research and development.

Headquartered in Bethesda, Md., Lockheed Martin is a global security company that employs about 136,000 people worldwide and is principally engaged in the research, design, development, manufacture, integration and sustainment of advanced technology systems, products and services. The Corporation reported 2009 sales of \$45.2 billion.

Media Contact: Buddy Nelson, (510) 797-0349; e-mail, buddynelson@mac.com

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