National Aeronautics and Space Administration

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Shuttle Astronauts to Upgrade Hubble Again **10.31.06**

NASA has announced it will once again send a space shuttle crew to upgrade the Hubble Space Telescope, bringing a pair of new instruments and opening the door to an exciting new era of science from the world's most powerful observatory.

“The Hubble Space Telescope will once again feel the touch of astronauts as they install new equipment and make Hubble an even more amazing science discovery machine,” said Ed Ruitberg, Deputy Director for Astrophysics at Goddard.

Just a few decades ago, astronomy was a lonely profession. Astronomers spent their nights in frigid mountaintop observatories, far from glaring city lights. They ventured to breathless altitudes to maximize the quality of their observations.

Now, the Hubble Space Telescope sits atop the ultimate mountaintop, hundred of miles above Earth. From its lofty perch, Hubble can make observations with far greater precision than any ground-based optical telescope. The observatory also peers into the infrared and ultraviolet realms, wavelengths that are largely blocked from reaching the ground by the atmosphere.

Hubble Gets Better With Age

The true beauty of Hubble lies in its ability to be serviced and improved as technology advances. From the outset, Hubble was designed to be visited and upgraded over the years by NASA astronauts. There have been four servicing missions so far -- designated SM1, SM2, SM3A and SM3B. The new mission is designated SM4.

With each servicing mission, Hubble’s overall performance has been greatly enhanced. The observatory today is tremendously more powerful than when it launched in 1990, and after the next mission, Hubble will be at its peak, performing anywhere from 10 to 100 times better in various areas.

The reason for this vast improvement: Hubble's versatility. Its powerful mirrors focus celestial light onto an array of on-board instruments. This setup has allowed older instruments to be replaced with newer ones that, much like a new personal computer, are often hundreds of times more efficient and powerful.

Aside from new "nuts and bolts" to keep Hubble running smoothly, new gyroscopes will improve steering, new batteries will keep things operating, and thermal blankets will insulate sensitive components. In addition, astronauts will install two new instruments and try to repair an important older one that lost power in 2004. The science planned for Hubble in the coming years with these new instruments is nothing short of revolutionary.

The New Instrument Lineup

Two star members of the new Hubble lineup are the Cosmic Origins Spectrograph (COS) and the Wide Field Camera 3 (WFC3). COS will measure the structure and composition of the ordinary matter concentrated in the "cosmic web," long, narrow filaments of galaxies and intergalactic gas separated by huge voids. COS will use faint distant quasars as "cosmic flashlights," whose beams of light pass through the cosmic web. Absorption of this light by "stuff" in the web reveals characteristics of that material. This allows scientists to determine its composition and its specific location in space.

These observations, covering vast distances across space and time, will illuminate both the large-scale structure of the universe and the progressive changes in chemical composition of matter as the universe has grown older.

The WFC3 will extend Hubble's capability to see deep into the universe, with the power to observe in multiple wavelengths (colors) of light including infrared, visible and ultraviolet light. WFC3 can, for example, observe young, hot stars that glow predominantly in ultraviolet and older, cooler stars that glow predominantly in infrared in the same galaxy. The first stars and galaxies to form in the universe are so old and distant that their light is now relegated to infrared wavelengths. WFC3 could bring us at last to this era and blaze a trail for the NASA’s future James Webb Space Telescope, scheduled for launch sometime in 2013.

Looking for Clues to a 'Dark' Mystery

The upgraded Hubble probably will not solve this dark energy dilemma, but it will make important contributions to narrowing down the range of possible explanations.

The mysterious dark energy is tied to the telescope's namesake, Edwin Hubble, who discovered in the 1920s that the universe was expanding and taking all of its contents -- galaxies, stars and planets -- along for the ride. The rate of the expansion is now called the Hubble constant. Using Hubble and other observatories, scientists have concluded the universe is expanding.

However, starting in 1998, scientists began to realize that, instead of slowing down as expected; the expansion set loose in the Big Bang began speeding up about 4 to 5 billion years ago. It is as if some mysterious force -- the dark energy — had overcome the force of gravity and is now pushing the universe apart.

With COS, WFC3 and the Advanced Camera for Surveys (installed during the last servicing mission), Hubble will map galaxy and stellar evolution from our nearest neighboring galaxies all the way out to the era about 13 billion years ago, when the universe first became

transparent to light.

Before flying to Hubble, the new instruments and components will be put through their paces on the ground, subjected to extreme vibration to simulate launch and extreme hot and cold to simulate the temperatures of space.

Hubble's launch in 1990 -- followed by the landmark first servicing mission in 1993 -- marked the most significant advance in astronomy since Galileo's telescope. With more than 16 years of historically astounding science already under its belt, Hubble will be reborn once again with Servicing Mission 4.

Our view of the universe and our place within it will never be the same.

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