Hubble Facts

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HUBBLE'S NEW SOLAR ARRAYS

Hubble gets an updated look and a boost in power during STS-109 with the addition of smaller, more efficient solar panels, called arrays. Unlike Hubble's first two pairs, which are so flexible that they roll up like window shades, Hubble's newest solar arrays are flat and rigid and fold up rather than roll up.

More Power for Discoveries

Though one third less solar cell area, these third-generation arrays will produce 20 percent more power than the current set. The new arrays collect the extra electricity needed to power a new generation of science instruments. This added power enables all the science instruments to be powered on and ready to operate simultaneously—allowing for more discoveries in less time.

Stronger and More Stable

The high efficiency solar panels have supporting frames made of aluminum-lithium, which is stronger and lighter than the type of aluminum commonly used in spacecraft construction. These supports are much less sensitive to the extreme temperature changes of Hubble's harsh environment.

During each 97-minute orbit, Hubble spends about two-thirds of its time in searing sunlight and the other third in the frigid darkness of Earth's shadow. These brutal, rapidly cycling conditions cause the temperature of the solar panels to fluctuate between minus 94 degrees Fahrenheit (minus 70 degrees Celsius) and 187 degrees Fahrenheit (86 degrees Celsius). The solar arrays reach their hottest temperature just ten minutes after leaving the chill of Earth's shadow.

Such dramatic, repeated temperature changes may cause tiny vibrations and movements within a spacecraft's solar array structure. If these movements are large enough, they cause motion of the main body of the telescope, and may affect the sensitivity of Hubble's pointing control instruments and interfere with long-term science observations.

This excessive movement was observed with Hubble's original solar arrays, which were replaced in 1993 with a much more stable pair. Since then, advances in solar cell technology and spacecraft design have led to the development of even more stable and efficient solar arrays.

Easy Maneuvering, Less Aero-drag

These smaller, stiffer arrays are easier for the astronauts to work around during servicing missions—easier to fold up and move out of their way. Their smaller size decreases on-orbit drag and slows the rate at which Hubble's orbit decays. Over time, all low Earth orbiting satellites feel the effects of atmospheric drag and lose altitude. These new arrays will slow that rate of altitude loss.

Saving Time and Money

The Hubble program bought these solar panels from the production line of a commercial system of communications satellites. At NASA's Goddard Space Flight Center in Greenbelt, Md., four of these panels were attached to an aluminum-lithium support wing structure to create each of the complete structures called "wings." A total of 8 panels were used in the construction of these two wings. Hubble team mem-

bers at Goddard fabricated the support wing structures, the composite mast assembly, and the electrical assembly for these wings. By using these off-the-shelf panels and fabricating the support systems at Goddard the Hubble program saved considerable time and expense.

The overall area of Solar Array 3 is 45 percent less than SA2

An International Team, a World-Class Test

Hubble's new solar arrays are just the latest chapter in a longstanding, international partnership between NASA and the European Space Agency (ESA). ESA built Hubble's first two sets of solar arrays. For the newest pair, ESA designed, developed and tested the Solar Array Drive Mechanisms, which maneuver the arrays to keep them constantly pointed at the Sun.

ESA also provided the ability to test the new arrays in a unique, never-before-done way. ESA's world-class test facility in The Netherlands features a huge test chamber that can realistically simulate the extreme temperature cycles of Hubble's orbit—including sunrise and sunset. This chamber, combined with the size of the new array and ESA's vast Hubble experience, made this facility the only place in the world capable of performing this test.

In October of 2000, one of the new arrays was shipped to the ESA test site, located at the European Space Research and Technology Center (ESTEC) in Noordwijk, The Netherlands. Here the combined ESA/NASA team conducted the special thermal test to measure the amount of movement produced within the solar array due to the harsh extremes of Hubble's environment. After extensive evaluation, the team verified that Hubble's new arrays would stay steady throughout the extreme temperature cycles of each orbit.

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