

NASA Facts

National Aeronautics and
Space Administration

John F. Kennedy Space Center
Kennedy Space Center, Florida 32899
AC 321-867-2468



FS-2001-10-016-KSC

NASA's Expendable Launch Vehicle (ELV) Program Center



In 1997, Kennedy Space Center was assigned lead center program responsibility for NASA's acquisition and management of Expendable Launch Vehicle (ELV) launch services.

The ELV Program Office provides a single focal point for the acquisition and management of ELV launch services, while affording NASA the benefits of consolidated and streamlined technical and administrative functions. The program, with its vision statement, "Global Leadership In Launch Service Excellence," provides launch services for NASA, NASA-sponsored payloads and other government payloads.

Primary launch sites are Cape Canaveral Air Force Station (CCAFS), Fla., and Vandenberg Air Force Base (VAFB), Calif. NASA's Wallops Island, Va., flight facility, Kwajalein Atoll in the Republic of the Marshall Islands in the North Pacific, and

Kodiak Island, Alaska, are other launch locations.

Since 1990, NASA has been purchasing ELV launch services directly from commercial providers, whenever possible, for its scientific and applications missions that are not assigned to fly on the Space Shuttle. ELVs can accommodate all types of orbit inclinations and altitudes and are ideal vehicles for launching Earth-orbit and interplanetary missions.

Kennedy Space Center is responsible for NASA government oversight of launch operations and countdown management. A motivated and skillful team is in place to meet the mission of the ELV program, "To provide launch service

excellence, expertise and leadership to ensure mission success for every customer."

Expendable Launch Vehicles

All Expendable Launch Vehicles use the same basic technology to get into space – two or more rocket-powered stages, which are discarded when their engine burns are completed. Whatever a launch vehicle carries above the final discarded stage is considered the payload.

A payload's weight, orbital destination and purpose determine what size launch vehicle is required. A small expendable launch vehicle like Pegasus can place a low-weight spacecraft into near-Earth orbit, while an expendable vehicle like the massive Saturn V was required to send manned Apollo spacecraft to the Moon.

The powerful Titan/Centaur combination carried large and complex robotic scientific explorers, such as the Vikings and Voyagers, to examine other planets in the 1970s. Among other missions, the Atlas/Agena vehicle sent several spacecraft to photograph and then impact the Moon. And Atlas/Centaur vehicles launched many of the larger spacecraft into Earth orbit and beyond.

To date, Delta launch vehicles have carried nearly 200 NASA scientific, wind and communications payloads into orbit, or to other planets. NASA has used the Athena I and II vehicles to launch scientific satellites from VAFB, CCAFS and most recently, from Kodiak Island, Alaska. Pegasus, an Orbital Sciences fleet vehicle, is the only airborne launch vehicle in the ELV fleet. Taurus is the newest vehicle in Orbital's fleet.

NASA ELV Fleet

Atlas/Centaur

The Atlas IIA, IIAS, IIIA and IIIB are the latest versions of the Atlas/Centaur vehicles that first became operational in 1966. Lockheed Martin uses these three vehicles to launch

military, commercial and scientific payloads into space from Space Launch Complex 36 at Cape Canaveral Air Force Station and Space Launch Complex 3B at Vandenberg Air Force Base. More than 500 Atlas flights have taken place, including more than 100 flights with the Centaur stage added to create the Atlas/Centaur vehicle.

When launched by NASA through 1989, the Atlas/Centaur was the standard vehicle for intermediate payloads that carried about 8,200 pounds (3700 kilograms) to geosynchronous transfer orbit. The Centaur was the first high-energy, liquid-hydrogen/liquid-oxygen launch vehicle stage, and provided the most power for its weight of any proven stage then in use.

The Atlas/Centaur was the launch vehicle for Surveyor I, the first U.S. spacecraft to soft-land on the Moon. Other spacecraft launched by Atlas/Centaurs include the Orbiting Astronomical Observatories; Applications Technology Satellites; the Intelsat IV, IV-A and V series of communications satellites; Mariner Mars orbiters; a Mariner spacecraft that made a flyby of Venus and three flybys of Mercury; Pioneers, which accomplished flybys of Jupiter and Saturn; and Pioneers that orbited Venus and sent probes plunging through its atmosphere to the surface. Most recently, NASA launched the NOAA GOES-M weather satellite on an Atlas IIA.

Lockheed Martin developed the Atlas III launch system that debuted in 2000. This vehicle can carry more than 8,819 pounds (4,000 kilograms) to geosynchronous transfer orbit. The Atlas V system, expected to debut in early 2002, will be able to carry up to 18,893 pounds (8,570 kilograms) to geosynchronous transfer orbit, from Space Launch Complex 41 at Cape Canaveral Air Force Station.

Delta

From 1960 to 1989, NASA was the responsible agency in the launch of 170 scientific, weather and communications spacecraft, along with some military satellites, from Cape Canaveral Air Force Station and Vandenberg Air Force Base. These spacecraft include NASA's TIROS, Nimbus, ITOS, LANDSAT and Westar series, and more than 30 scientific Explorers. Numerous international satellites were also launched by NASA.

The Delta family of vehicles has been upgraded several times over the years. The Delta, produced by Boeing, currently has solid strap-on motors, liquid-fueled first and second stages, and a solid-propellant third stage.

The Delta III launch vehicle debuted in 1998. This upgraded model carries 8,400 pounds (3,810 kilograms) to geosynchronous transfer orbit. The Delta IV system, expected to debut in first quarter 2002, will be able to carry 8,818 pounds (4,000 kilograms) to 27,778 pounds (12,600 kilograms) up to geosynchronous transfer orbit, depending on vehicle configuration. Space Launch Complex 37 at CCAFS, formerly a Saturn I launch pad, is being reconstructed to launch the Delta IV.

Pegasus

The Pegasus XL vehicle is the only airborne, commercially developed launch vehicle currently used. The Pegasus



Pegasus is attached underneath the Lockheed L-1011, ready for release.

vehicle is carried to an altitude of 39,000 feet attached beneath an Orbital Sciences carrier aircraft, a converted Lockheed L-1011 (above), and then released for launch. Pegasus has successfully placed 70 satellites in orbit with 29 launches. Its three-stage solid motors can deliver up to a 970-pound (440-kilogram) payload into low-Earth orbit.

Because of its unique launch platform, this vehicle can be launched from almost any location in the world. There have been successful launches from Vandenberg Air Force Base, Cape Canaveral Air Force Station, NASA's Wallops Island, Va., flight facility, Kwajalein Atoll in the Republic of the Marshall Islands in the Pacific, and the Canary Islands in the Atlantic. On Oct. 9, 2000, Pegasus launched NASA's High Energy Transient Experiment (HETE-2) into an equatorial orbit from Kwajalein Atoll.

Taurus

The Taurus vehicle is a four-stage solid motor vehicle. The Taurus was designed to operate from a wide range of launch facilities and geographic locations. The Taurus launch vehicle has successfully sent nine satellites into orbit with five launches, all from Vandenberg Air Force Base. It was used to launch NASA's Active Cavity Radiometer Irradiance Monitor Satellite (ACRIMSAT) spacecraft on Dec. 20, 1999.



Taurus 4

Taurus was privately developed by Orbital Sciences to launch up to a 2,200-pound (1,000-kilogram) payload into low-Earth orbit.

Titan IV

The Titan has been used by NASA to launch interplanetary missions from Cape Canaveral Air Force Station. An

earlier version of the Titan vehicle, the Titan III-E/Centaur, built by Martin Marietta and General Dynamics, was used to launch two Helios missions to the Sun, two Viking missions to Mars, and two Voyager missions to Jupiter and Saturn beginning in the 1970s. One of the Voyagers also continued on to Uranus and Neptune. All of the missions provided remarkable new scientific data on our solar system and spectacular color photographs of the planets they explored, as well as some of their moons.



Titan IV

The Titan IV most recently was used to launch NASA's Cassini spacecraft to Saturn in 1997. And the Titan III sent NASA's Mars Observer on its journey in 1992.

The Titan II is still used today to launch NOAA weather satellites from Vandenberg Air Force Base.

The current Titan IV is the primary heavy lift vehicle for the Air Force and has undergone some changes. The Titan IVB vehicle has upgraded solid rocket boosters and an avionics system. The Titan IVB can deliver 39,000 pounds (17,690 kilograms) into low-polar orbit, and 13,000 pounds (5,897 kilograms) into a geosynchronous orbit.

Historic Missions

Mars Odyssey (Delta II)

NASA's 2001 Mars Odyssey spacecraft was launched successfully from Space Launch Complex 17A at Cape Canaveral Air Force Station aboard a Delta II on April 7, 2001.

The Mars Odyssey will travel to and orbit the Red Planet in order to determine its composition. The Odyssey will be able to detect water and shallow buried ice and will study the radiation environment of the planet's surface to help gauge the radiation risk to human explorers. The science instruments aboard the 2001 Mars Odyssey orbiter include a Thermal Emission Imaging System, Gamma Ray Spectrometer and Mars Radiation Environment Experiment.

Mars Pathfinder (Delta II)

NASA's Mars Pathfinder began its journey to Mars atop a Delta II that launched Dec. 4, 1996, from Launch Complex 17B at Cape Canaveral Air Force Station. The Mars Pathfinder traveled to the Red Planet and arrived there in July 1997. It sent a lander and small robotic rover, the Sojourner, to the surface of Mars to collect valuable data about the Martian surface. The primary objective of the mission was to demonstrate a low-cost way of delivering a science package to Mars using a direct entry, descent and landing with the aid

of small rocket engines, a parachute and airbags.

Mars Global Surveyor (Delta II)

NASA's first return to Mars since the Viking mission began with the launch of the Mars Global Surveyor atop a Delta II on Nov. 7, 1996, from Launch Complex 17A at Cape Canaveral Air Force Station. The Surveyor traveled to the Red Planet and spent approximately two years mapping the Martian surface to achieve a global portrait. Using sophisticated remote-sensing instruments, the Mars Global Surveyor mapped the Red Planet's topography, magnetism, mineral composition and atmosphere.

Near Earth Asteroid Rendezvous (NEAR) (Delta II)

NASA's Near Earth Asteroid Rendezvous (NEAR) spacecraft was launched aboard a Delta II on Feb. 17, 1996, from Space Launch Complex 17 at Cape Canaveral Air Force Station. The NEAR mission was NASA's first mission for its Discovery Program for "faster, better, cheaper" planetary explorations, and is the first spacecraft powered by solar cells to operate beyond the orbit of Mars. NEAR reached the asteroid Eros in December 1998 and sent back more than 1100 images, including color images, from as close as 2500 miles above its surface.

In May 2000 it achieved orbit around the asteroid and continued to send back information. On Feb. 12, 2001, NEAR began its slow descent to the surface of Eros and continued to transmit 69 close-up images of its surface before it came to rest.

Stardust (Delta II)

On Feb. 7, 1999, a Delta II was launched from Launch Complex 17-A, Cape Canaveral Air Force Station, carrying the Stardust spacecraft. Stardust's primary goal is to collect comet dust and volatile samples during a planned close encounter with the comet Wild 2 in January 2004. Stardust will also bring back samples of interstellar dust, including the recently discovered dust streaming into our



Delta II

solar system. This launch was unusual in that it was the first U.S. mission dedicated solely to the study of a comet.

Solar and Heliospheric Observatory (SOHO) (Atlas IIAS)

The Solar and Heliospheric Observatory (SOHO) spacecraft, a joint venture between NASA and the European Space Agency, was launched aboard an Atlas IIAS, Dec. 2, 1995, from Space Launch Complex 36 at Cape Canaveral Air Force Station.

The SOHO spacecraft's primary mission was to study the internal structure of the Sun, its extensive outer atmosphere and the origin of the solar wind. It also studied the stream of highly ionized gas that blows continuously through the Solar System. The information SOHO provided helped scientists understand better the interactions between the Sun and the Earth's environment.

Cassini (Titan IV)

Cassini is a NASA-JPL spacecraft with international partners from the European Space Agency and Italian Space Agency. Its seven-year journey to Saturn began Oct. 15, 1997, from Launch Complex 40 on a Titan IV at Cape Canaveral Air Force Station. Cassini has made observations of at least one asteroid and the planet Jupiter on its way to Saturn. When it arrives at Saturn in July 2004, it will spend four years exploring the planet, its rings and 18 known

moons. Cassini will deploy the European Space Agency's Huygens probe to specifically study the surface of Titan, one of Saturn's moons, and send the information back to Earth.

Terra (Atlas IIAS)

The Terra (Latin for Earth) satellite was launched on an Atlas IIAS, Dec. 16, 1999, from Vandenberg Air Force Base Space Launch Complex 3E. Terra was the first Earth Observing System scientific research satellite. The five Terra instruments on the satellite operate by measuring the sunlight reflected by Earth and heat emitted by Earth. Terra will spend 15 years orbiting the Earth and collecting data.

Kodiak Star (Athena I) Lunar Prospector (Athena II)

The Athena I vehicle carried NASA's Kodiak Star mission into orbit from the new Kodiak Launch Complex in Kodiak, Alaska, on Sept. 29, 2001. NASA's Starshine 3, and three Department of Defense satellites, were launched into different orbits. Starshine 3 will provide data on satellite orbit decay and also has an amateur radio transmitter.

The first successful launch of an Athena II carried NASA's Lunar Prospector spacecraft on a mission to search for traces of water or ice on the moon. It was launched from Complex 46 on CCAFS, Jan. 6, 1998.

