NASAfacts

NASA's Launch Services Program

The Launch Services Program (LSP) was established at Kennedy Space Center for NASA's acquisition and program management of expendable launch vehicle (ELV) missions. A skillful NASA/contractor team is in place to meet the mission of the Launch Services Program, which exists to provide leadership, expertise and cost-effective services in the commercial arena to satisfy agencywide space transportation requirements and maximize the opportunity for mission success.

The principal objectives of the LSP are to provide safe, reliable, cost-effective and on schedule launch services for NASA and NASA-sponsored payloads seeking launch on ELVs. The Launch Services Program is responsible for NASA oversight of the launch service including launch vehicle engineering and manufacturing, launch operations and countdown management, and providing added quality and mission assurance in lieu of the requirement for the launch service provider to obtain a commercial launch license.

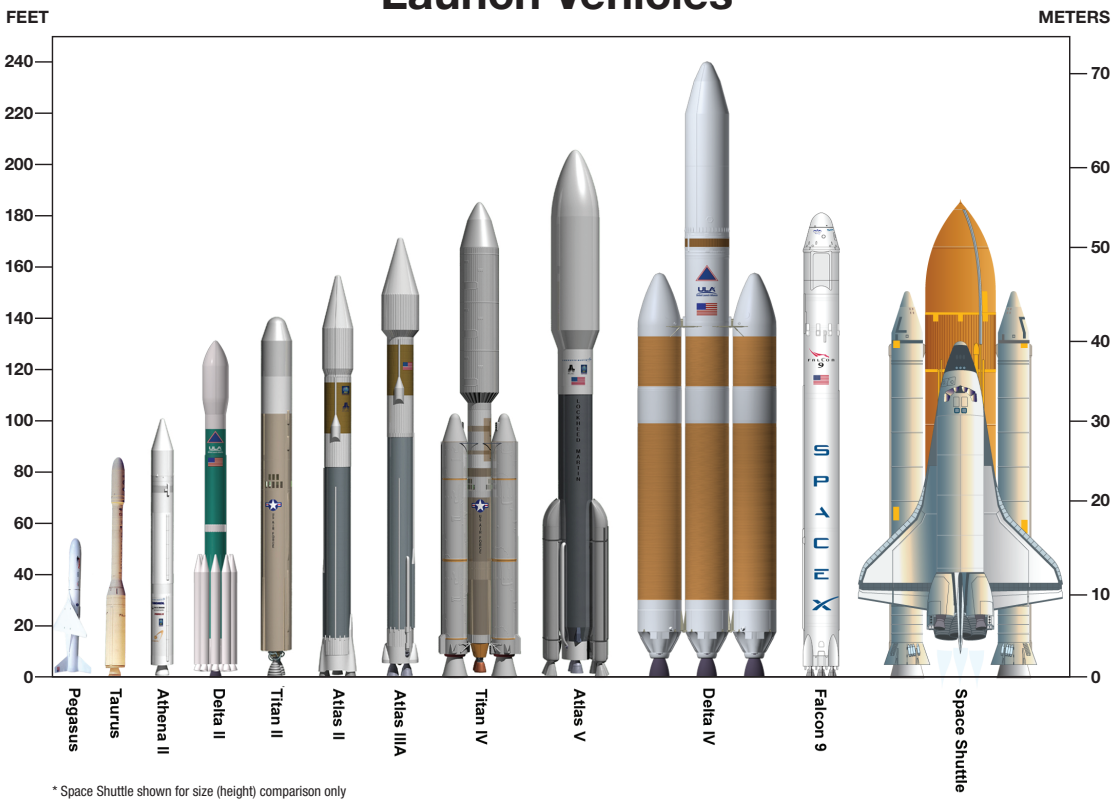
Primary launch sites are Cape Canaveral Air Force Station (CCAFS) in Florida, and Vandenberg Air Force Base (VAFB) in California.

Other launch locations are NASA's Wallops Flight Facility in Virginia, the Kwajalein Atoll in the South Pacific's Republic of the Marshall Islands, and Kodiak Island in Alaska.

Since 1990, NASA has purchased ELV launch services directly from commercial providers, whenever possible, for its scientific and applications missions. ELVs can accommodate all types of orbit inclinations and altitudes and are ideal rockets for launching Earth-orbit and interplanetary missions.

In September 2010, NASA's Launch Services (NLS) contract was extended by the agency for 10 years, through 2020, with the award of four indefinite delivery/indefinite quantity contracts. The expendable launch vehicles that NASA has available for its science, Earth-orbit and interplanetary missions are United Launch Alliance's (ULA) Atlas V and Delta II, Space X's Falcon 1 and 9, Orbital Sciences Corp.'s Pegasus and Taurus XL, and Lockheed Martin Space Systems Co.'s Athena I and II. With its unique contractual feature that allows new launch vehicles to be on-ramped annually, NLS II will continue to provide the agency with competitive, commercial launch services to address customers' needs.

Launch Vehicles



* Space Shuttle shown for size (height) comparison only

EXPENDABLE LAUNCH VEHICLES

All expendable launch vehicles use the same basic technology to get into space -- two or more rocket-powered stages, which fall away 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 ELV, such as Pegasus, can place a low-weight spacecraft into near-Earth orbit, whereas a large expendable vehicle, the massive Saturn V, was required to send a crewwed spacecraft to the moon during NASA's Apollo Program.

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 rockets sent several spacecraft to photograph and then impact the moon. The Atlas/Centaur helped send many of the larger spacecraft into Earth orbit and beyond.

To date, Delta launch vehicles have carried more than 200 NASA scientific, wind and communications payloads into orbit, or to other planets. NASA used the Athena I and II vehicles to launch scientific satellites from VAFB, CCAFS and Kodiak Island. The Pegasus is the only airborne launch vehicle in the ELV fleet. The Taurus XL vehicle is scheduled to launch NASA's Orbiting Carbon Observatory-2 (OCO-2) in 2013.

U.S. EXPENDABLE LAUNCH VEHICLE FLEET

Atlas/Centaur

The Atlas/Centaur vehicles first became operational in 1966. Lockheed Martin used the Atlas II and III rockets to launch military, commercial and scientific payloads into space from Space Launch Complex 36 at CCAFS and Space Launch Complex 3E at VAFB. More than 580 Atlas flights have taken place, including more than 170 flights with the Centaur stage added to create the Atlas/Centaur vehicle.

When launched by NASA through 1989, the Atlas/Centaur was the standard rocket for intermediate payloads that carried about 8,200 pounds (3,700 kilograms) to geosynchronous transfer orbit (GTO). The Centaur was the first high-energy, liquid-hydrogen/liquid-oxygen launch vehicle stage, and it 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 that accomplished flybys of Jupiter and Saturn; and Pioneers that orbited Venus and sent probes plunging through its atmosphere to the surface. The Atlas V system, the newest of ULA's fleet, first launched Aug. 21, 2002, carrying a commercial communications satellite. The Atlas V can carry 8,700 pounds (3,946 kilograms) to 19,100 pounds (8,663 kilograms) to GTO from Space Launch Complex 41 at CCAFS. NASA's Lunar Reconnaissance Orbiter and Lunar Crater Observation and Sensing Satellite (LRO/LCROSS) were launched on an Atlas V rocket, June 18, 2009, from Launch Complex 41 at CCAFS. Most recently, NASA launched the Juno spacecraft on Aug. 5, 2011, aboard an Atlas V rocket from Launch Complex 41 at CCAFS.

Delta

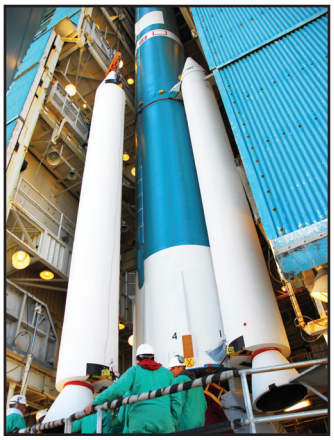
From 1960 to 1989, NASA was the responsible agency in the launch of 170 scientific, weather and communications spacecraft, along with some military satellites, aboard Delta launch vehicles from CCAFS and VAFB. These spacecraft include NASA's TIROS, Nimbus, ITOS, LANDSAT and Westar series, and more than 30 scientific Explorers. Numerous international satellites also were launched by NASA.

The Delta family of vehicles has been upgraded several times throughout the years. The Delta II, most recently produced by ULA, has solid strap-on motors, liquid-fueled first and second stages, and a solid-propellant third stage.

The Delta III launch vehicle was built as a transitional vehicle and launched only three times. The Delta IV system, the newest in Delta's fleet, launched the Geostationary Operational Environmental Satellite (GOES-N, O and P) series of spacecraft for NASA's Goddard Space Flight Center and NOAA as part of the delivery-on-orbit concept. The Delta IV can carry 9,285 pounds (4,211 kilograms) to 28,950 pounds (13,132 kilograms) to GTO and 17,900 pounds (8,119 kilograms) to 50,800 pounds (23,043 kilograms) into low Earth orbit, depending on vehicle configuration. Space Launch Complex 37, formerly a Saturn I launch pad, was reconstructed by The Boeing Company and turned over to ULA in 2006 to launch the Delta IV. A Delta IV rocket launched the GOES-O spacecraft on June 27, 2009, from Launch Complex 37 at CCAFS.

NASA's Genesis spacecraft launched aboard a Delta II on Aug. 8, 2001, from Launch Complex 17-A at CCAFS. Genesis collected samples of solar wind -- invisible, charged particles that flow outward from the sun. The particles will be studied by scientists to search for answers to fundamental questions about the exact composition of Earth's star and the birth of our solar system.

NASA's Gravity Recovery and Interior Laboratory (GRAIL) launched on the last Delta II heavy rocket to be used by the agency, on Sept. 10, 2011, from Launch Complex 17-B at CCAFS.



Falcon 1 and 9

Space X's Falcon 1 and 9 rockets will be available for future NASA expendable launch vehicle missions under the NLS II contract.

These rockets will be used to launch a variety of spacecraft into low Earth orbit, geosynchronous orbit or for interplanetary missions.

The Falcon 1 is designed to carry small satellites weighing up to 2,227 pounds (1010 kg) to low Earth orbit. The Falcon 9 is designed to carry medium to large satellites weighing up to 23,038 pounds (10,450 kg) into low Earth orbit, and up to 10,009 pounds (4,540 kg) into geosynchronous orbit.

Currently, the Falcon 9 is being tested for NASA's Commercial Orbital Transportation Systems (COTS) program to provide cargo transportation to and from the International Space Station, and will eventually be used under the Commercial Resupply Services (CRS) contract.

A successful test flight of the rocket occurred in December 2010, from CCAFS' Launch Complex-40. SpaceX and Orbital Sciences are two companies under contract for COTS to develop the near-term capability to launch and return pressurized cargo from space.

Pegasus XL

The Pegasus XL vehicle, attached beneath an Orbital Sciences carrier aircraft, a converted Lockheed L-1011, is carried to an altitude of 39,000 feet, and then released for launch. Pegasus has successfully placed more than 70 satellites into orbit. 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 rocket can be launched from almost any location in the world. There have been successful launches from VAFB, CCAFS, Wallops Flight Facility, the Kwajalein Atoll, and the Canary Islands in the Atlantic. Pegasus launched the Aeronomy of Ice (AIM) spacecraft, April 25, 2007, and NASA's Space Technology 5 (STS), on March 22, 2006, both from VAFB. Pegasus also launched NASA's Interstellar Boundary Explorer (IBEX) spacecraft, from the Reagan Test Site in the Kwajalein Atoll on Oct. 19, 2008.

Taurus XL

The Taurus vehicle is a four-stage solid motor rocket that can launch up to a 2,200-pound (1,000 kilogram) payload into low Earth orbit.

The Taurus was designed to operate from a wide range of launch facilities and geographic locations.

The Taurus launch vehicle successfully sent six satellites into orbit with six launches, all from VAFB.

It was used to launch NASA's Active Cavity Radiometer Irradiance Monitor (ACRIMSAT) spacecraft Dec. 20, 1999.

NASA is working with Orbital Sciences Corp. to understand recent launch anomalies of the Taurus XL.

Titan

The Titan launch vehicle was retired from service in 2005. The Titan was used by NASA to launch interplanetary missions from CCAFS. An earlier version of the Titan rocket, the Titan III-E/Centaur, built by Martin Marietta Corp. and General Dynamics Corp., 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 about our solar system and spectacular color photographs of the planets they explored, as well as some of their moons.

The Titan IV launched NASA's Cassini spacecraft to Saturn in 1997. The Titan III sent NASA's Mars Observer on its journey in 1992. The Titan II was used to launch many National Oceanic and Atmospheric Administration (NOAA) weather satellites. A Titan II also launched NASA's NOAA-M satellite, June 24, 2002, from Space Launch Complex-4 at VAFB.

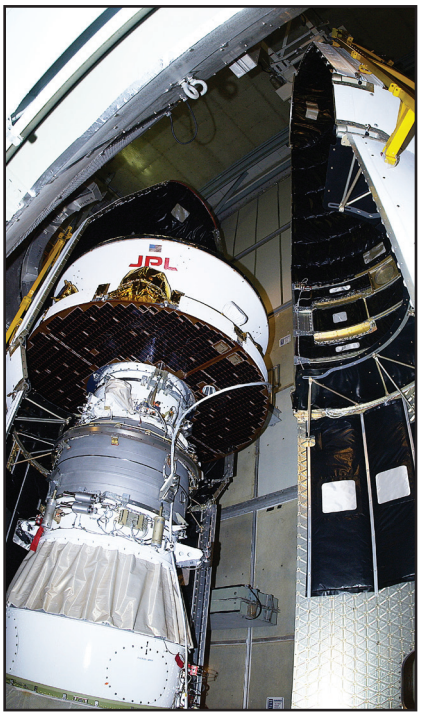
HISTORIC MISSIONS

Mars Exploration Rovers (MER-A & B) (Delta II)

NASA's Mars Exploration Rovers launched aboard Delta II vehicles from CCAFS. MER-A "Spirit" launched June 10, 2003, and MER-B "Opportunity" launched July 7 that same year. Both rovers reached Mars in January 2004. Information sent back to Earth from the rovers revealed the existence of water in the Red Planet's past. Previous missions to Mars include the 2001 Mars Odyssey spacecraft that launched from Space Launch Complex 17A at CCAFS on April 7, 2001.

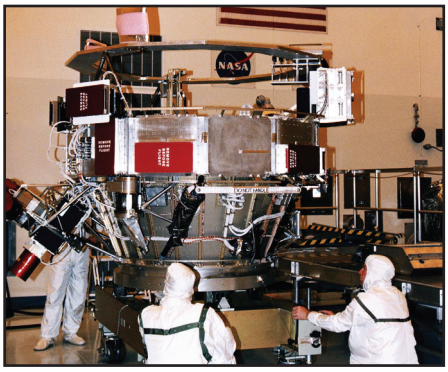
The Mars Pathfinder began its journey atop a Delta II that launched Dec. 4, 1996, from Launch Complex 17-B at CCAFS.

NASA's first return to Mars after the Viking mission began with the launch of the Mars Global Surveyor atop a Delta II on Nov. 7, 1996, from CCAFS's Launch Complex 17-A. The Surveyor traveled to the Red Planet and spent about two years mapping the Martian surface to achieve a global portrait.



Cassini (Titan IV)

Cassini was a NASA Jet Propulsion Laboratory spacecraft with international partners from the Italian Space Agency. Its seven-year journey to Saturn began Oct. 15, 1997, from Launch Complex 40 on a Titan IV at CCAFS. Cassini made observations of at least one asteroid and the planet Jupiter on its way to Saturn. Cassini arrived with the comet Wild 2 in January 2004. Stardust also collected samples of interstellar dust, including the recently discovered dust streaming into our solar system. This launch was unusual in that it was the first U.S. mission dedicated solely to the study of a comet.



Kepler, Deep Impact, Messenger (Delta II)

The Kepler mission, the 10th in NASA's Discovery missions, launched on a Delta II rocket, March 6, 2009, from CCAFS. The Kepler telescope was specifically designed to survey a portion of the region of the Milky Way galaxy for about three-and-a-half years to discover dozens of Earth-size planets in or near the habitable zone and determine how many of the billions of stars in the galaxy have such planets. The mission could be extended to six years.

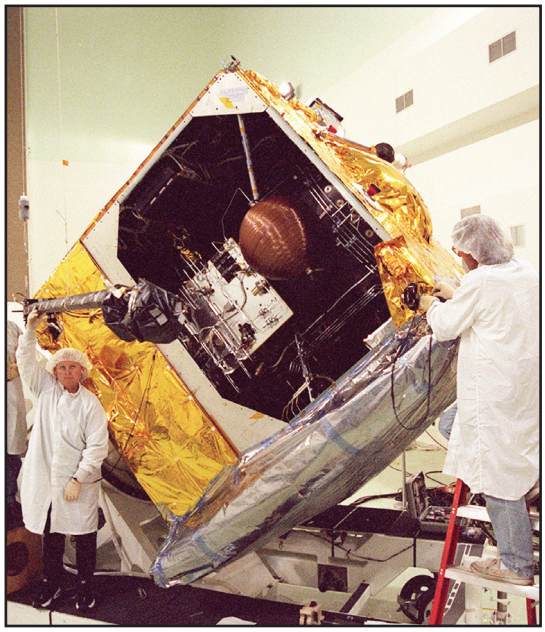
The Deep Impact mission launched Jan. 12, 2005, from CCAFS and reached Comet Tempel 1 in July 2005. The "flyby" spacecraft collected images of the comet before its "impactor" spacecraft reached the comet, and after the impact to study the pristine interior of one of its craters.

NASA's Mercury Surface, Space, Environment, Geochemistry, and Ranging (MESSENGER) spacecraft launched aboard a Delta II rocket Aug. 3, 2004 from CCAFS. The spacecraft made the 4.9-billion-mile trek to Mercury, with 15 trips around the sun and flybys of the Earth and Venus along the way. The spacecraft reached Mercury in 2008, with flybys of that planet in January and October, and again in September 2009. MESSENGER was only the second spacecraft sent to mercury.

Juno (Atlas V)

NASA's solar-powered Juno spacecraft launched on an Atlas V rocket on Aug. 5, 2011, from Launch Complex 41 at CCAFS, to begin a five-year journey to Jupiter. Juno will orbit Jupiter's poles 33 times to find out more about the gas giant's origins, structure, atmosphere and magnetosphere and investigate the existence of a solid planetary core.

GOES and TDRS Fleet of Satellites (Atlas II)



NASA used the Atlas II to launch the NOAA GOES weather satellites, left, and the TDRS communications series of satellites into orbit.

GOES-M launched July 23, 2001, aboard an Atlas IIA from CCAFS. It was the fifth spacecraft to be launched in the current advanced series of environmental satellites for NOAA and the first to have a solar X-ray imager.

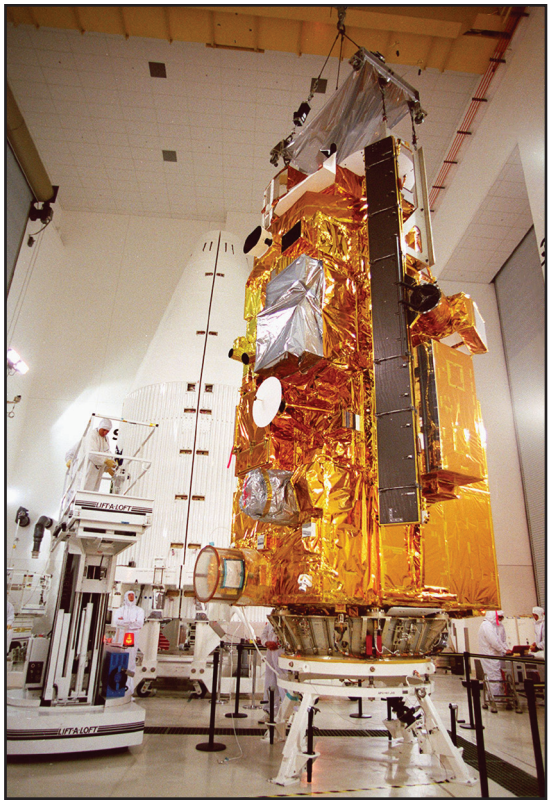
The most recent TDRS launch was the TDRS-J on Dec. 4, 2002 from Launch Complex 36A at CCAFS.

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

The Athena I vehicle carried NASA's Kodiak Star mission into orbit Sept. 29, 2001, from the Kodiak Launch Complex in Alaska. NASA's Starshine 3 and three U.S. Department of Defense satellites were launched into different orbits. Starshine 3 provided data on satellite orbit decay. 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.

TERRA (Atlas IIAS)

The Terra satellite launched on an Atlas IIAS on Dec. 16, 1999, from Space Launch Complex 3E at VAFB. Terra, which is Latin for Earth, was the first Earth Observing System scientific research satellite. The five Terra instruments on the satellite operated by measuring the sunlight reflected by the Earth and heat emitted by the Earth. At the end of its mission, Terra will have spent 15 years orbiting Earth and collecting data.



On Cape Canaveral Air Force Station in Florida, United Launch Alliance personnel in the Delta Operations Building prepare for the launch of NASA's Gravity Recovery and Interior Laboratory (GRAIL) mission aboard a Delta II Heavy rocket, Sept. 10, 2011, from Space Launch Complex 17B.

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