NASAfacts

What We Do at KSC

The role of Kennedy Space Center is to enable the NASA vision by successfully processing and launching space shuttles, rockets and their cargo into space.

Since 1981, Kennedy Space Center has sustained America's human space flight heritage by preparing and launching space shuttle orbiters for NASA's Space Shuttle Program. The Center also supports launch services for NASA and agency-sponsored payloads on expendable launch vehicle missions through the Launch Services Program by providing processing, mission analysis and spacecraft integration.

Since 1998, the International Space Station Program has relied on the center to integrate, test and process every U.S.-launched element currently assembled on orbit. Kennedy Space Center matches every stride as NASA makes its first steps toward America's new Vision for Space Exploration.

Kennedy Space Center is the primary NASA center for the test, checkout and launch of space shuttle vehicles and their payloads, as well as the turnaround of orbiters between missions. It is the primary landing site for the shuttle. Manned space shuttles launch from KSC's Launch Complex 39, located on Merritt Island, Fla., just north of Cape Canaveral.

Many of the Launch Complex 39 facilities originally supported the Apollo lunar landing

program. They currently include the Orbiter Processing Facility, Space Shuttle Main Engine Processing Facility, Vehicle Assembly Building and Launch Control Center. The launch support facilities in the Industrial Area include the Operations and Checkout Building, Canister Rotation Facility and Space Station Processing Facility.

Preparing For Shuttle Launches

Routine servicing of the orbiter takes place in the Orbiter Processing Facility. The process includes safing ordnance devices, off-loading hazardous materials, reconfiguring payload accommodations, verifying and testing systems, and examining, repairing and waterproofing thermal protection system materials. In addition to reconfiguring orbiters for upcoming missions, Kennedy Space Center has also assumed responsibility for implementing many major vehicle modifications and upgrades.

When processing is complete in the facility, the orbiter is transferred to the Vehicle Assembly Building where it is mated to the external tank/solid rocket booster stack, already in place on the mobile launcher platform. After the mating, the crawler transporter moves underneath the launcher platform, lifts it and rolls it out to the launch pad. After several weeks of system checks, the shuttle is ready to launch.

The two elements needed for launch — an external tank and solid rocket boosters — are partially processed at Kennedy Space Center. The external tank is manufactured at the Michoud Assembly Facility in New Orleans and shipped by barge to Port Canaveral. One of NASA's solid rocket booster retrieval ships tows the barge. At the port, tugboats take over and move the barge upriver to the turn basin in the Launch Complex 39 Area. Once docked there, the tank is offloaded and transported to the nearby Vehicle Assembly Building where it is stored in a checkout cell until needed.

The solid rocket boosters are recovered after each launch and towed back to Hangar AF at Cape Canaveral Air Force Station in Florida. The empty propellant-carrying segments are transferred to the rail yard, installed in railroad cars and sent to the manufacturer in Utah for propellant reloading.

The inert segments of the boosters are reconditioned at the hangar and taken to the Assembly and Refurbishment Facility for assembly and testing.

On their return, the reloaded segments go to the Rotation/Processing Building and eventually are integrated with the reconditioned segments. They are stored until needed in the Vehicle Assembly Building for stacking.

Processing payloads

Shuttle payloads may be installed in the orbiter's payload bay vertically at the launch pad or horizontally in the Orbiter Processing Facility. Some horizontally handled payloads are space station elements and scientific payloads that remain attached to the payload bay.

Vertically handled payloads include deployable communications, scientific spacecraft and space station elements. They are transferred to the shuttle's payload bay through the payload changeout room, a clean room located on the rotating service structure.

Launching Payloads On Rockets

The Launch Services Program was established at Kennedy Space Center for NASA's acquisition and program management of expendable launch vehicle (ELV) missions. Some of these ELV missions have expanded our knowledge of planets, stars and comets, while others have added to our knowledge of Earth. Historic missions include the Mars Exploration Rovers, Stardust, Genesis, Deep Impact, Cassini, and GOES and TDRS satellites.

All ELVs use the same basic technology to get into space: two or more rocket-powered stages that 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 the size of the vehicle required for launch.

Some of the more prominent ELVs are the Atlas/Centaur, Delta (from II to IV), Taurus, Titan and Pegasus.

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 Vandenberg AFB, Cape Canaveral and Kodiak Island. The Pegasus, an Orbital Sciences fleet vehicle, is the only airborne launch vehicle in the ELV fleet. The Taurus vehicle, also built by Orbital Sciences, may be used for future NASA launches.

More Than Shuttles And Rockets

Beyond vehicle and payload processing, Kennedy Space Center pursues other programs.

Environmental leadership is one. The center recognizes the significance of being situated on a wildlife refuge and its Environmental Program applies both proven and new techniques to conserve and protect local and global resources. KSC is addressing the energy concerns facing our nation today. Corn and other grain products are now providing ethanol fuel for several hundred vehicles at KSC.

Another role is that of **education leadership**. Equipped

Kennedy Space Center Visitor Complex: The Rocket Garden is in the background. The Astronaut Memorial Mirror is in the foreground. In between is the Center for Space Education.

with the center's unique facilities and more than 200 years of combined teaching experience, Kennedy's Education Programs and University Research Division prepares students to pursue careers related to exploration, and educates the public in NASA's activities and discoveries. The center participates in NASA's Explorer Schools program, which focuses on fourth- through ninth-grade educators and students, as well as co-hosting the regional FIRST (For Inspiration and Recognition of Science and Technology) Robotics Competition with the University of Central Florida.

Through summer education programs and grants, KSC has benefited from the skills of more than 100 university interns and faculty members, representing 66 colleges and universities, 26 college majors and 27 states. Participants have worked on KSC technology development and applied research tasks.

To further interest in NASA, the Center has an active **outreach program,** beginning with the Visitor Complex. The KSC Visitor Complex has continued to effectively spread NASA's message to more than 1.4 million guests annually from all over the world. This number is expected to grow as new attractions and experiences are realized from the 10-year master plan unveiled in 2006. Each key addition of the plan will provide the public with a deeper learning opportunity, and broaden the depth and diversity of NASA as an agency committed to space exploration as a destiny, as well as a destination.

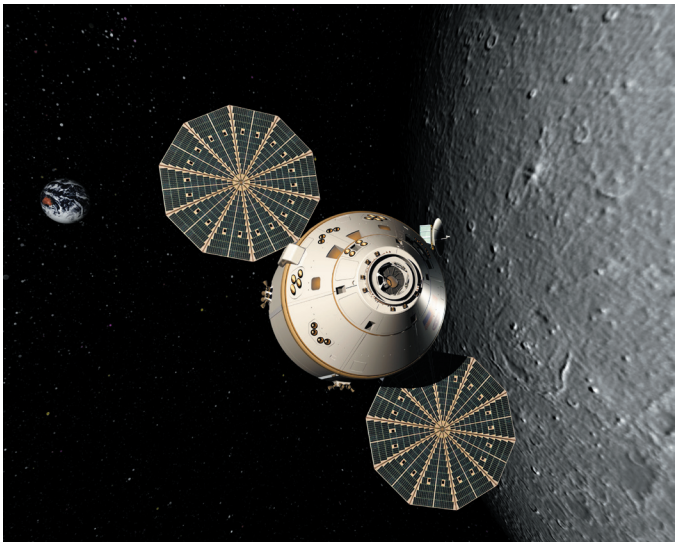
Traveling exhibits and a speakers bureau reach more people worldwide, from minority, library, university and retirement community groups to women leadership programs, girls in math and science programs, engineering and science organizations, aerospace groups, education and business conferences, and church and scouting groups.

The Future at KSC

The Exploration Operations Integration Office at KSC has led the center's support of NASA's Constellation Systems, which is responsible for developing the vehicles and infrastructure that will allow us to return to the moon, then travel to Mars and beyond.

Along with NASA, KSC will transition from launching space shuttles to launching new vehicles in NASA's vision for space exploration.

The KSC team has helped define Constellation operations requirements and provided technical leadership in the areas of ground processing, test and verification, logistics, launch, landing, recovery, safety and mission assurance. The ability to travel and explore the solar system will rely on KSC's experience in ground processing, systems engineering, integrated test and verification, logistics, systems integration, launch, landing and recovery, facility and ground systems design and development, and human factors. NASA has selected Lockheed Martin Corp. as the prime contractor to design, develop, and build America's spacecraft for the new generation of explorers. Named Orion (concept shown below), the vehicle will succeed the space shuttle as NASA's primary vehicle for human space exploration. Orion is named for one of the brightest, most familiar and easily identifiable constellations.



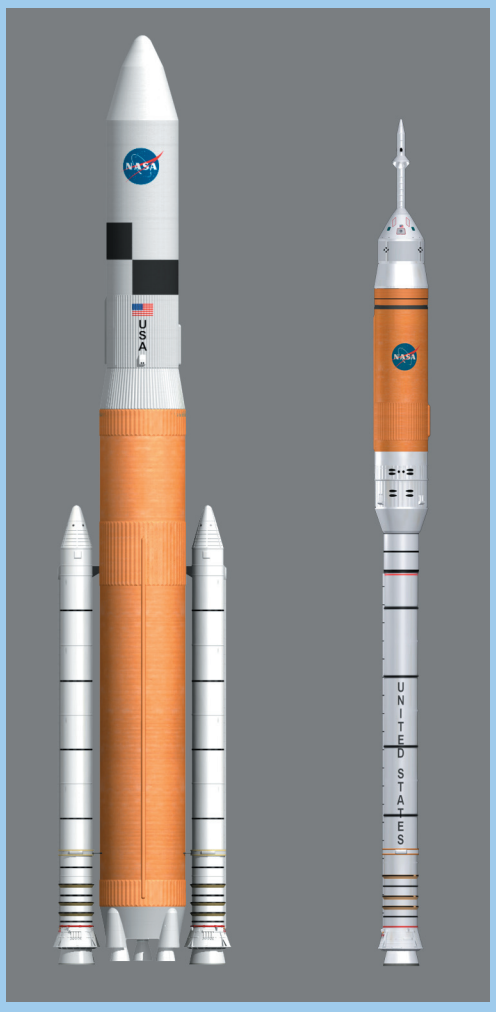
Orion's first flight with astronauts onboard is planned for no later than 2014 to the International Space Station. Its first flight to the moon is planned for no later than 2020. Orion will be capable of transporting cargo and up to six crew members to and from the International Space Station. It can carry four crew-members for lunar missions. Later, it can support crew transfers for Mars missions.

NASA announced the launch vehicles under development by the Constellation Program have been named Ares, a synonym for Mars. The booster that will launch Orion will be called Ares I, and a larger heavy-lift launch vehicle will be known as Ares V.

Ares I uses a single five-segment solid rocket booster, a derivative of the space shuttle's solid rocket booster, for the first stage. A liquid oxygen/liquid hydrogen J-2X engine derived from the J-2 engine used on Apollo's second stage will power the crew exploration vehicle's second stage. The Ares I can lift more than 55,000 pounds to low Earth orbit.

Ares V, a heavy lift launch vehicle, will use five RS-68 liquid oxygen/liquid hydrogen engines mounted below a larger version of the space shuttle's external tank, and two five-segment solid propellant rocket boosters for the first stage. The upper stage will use the same J-2X engine as the Ares I. The Ares V can lift more than 286,000 pounds to low Earth orbit and stands approximately 360 feet tall. This versatile system will be used to carry cargo and the components into orbit needed to go to the moon and later to Mars.

The "I" and "V" designations pay homage to the Apollo program's Saturn I and Saturn V rockets, the first large U.S. space vehicles conceived and developed specifically for human spaceflight.



Ares V (left) and Ares I will carry on the space launch tradition at Kennedy Space Center in Florida.

Photos on front page:

(Left) July 4, 2006 – Making history with the first-ever launch on Independence Day, Space Shuttle Discovery rockets off the mobile launcher platform on Launch Pad 39B on mission STS-121. During the 12-day mission, the STS-121 crew of seven tested new equipment and procedures to improve shuttle safety, as well as delivered supplies and made repairs to the International Space Station.

(Right) May 24, 2006 – A Boeing Delta IV rocket roars off the launch pad to lift the GOES-N satellite on top into space. Liftoff from Launch Complex 37 at Cape Canaveral Air Force Station was on time at 6:11 p.m. EDT. GOES-N is the latest in the Earth-monitoring series of Geostationary Operational Environmental Satellites developed by NASA and the National Oceanic and Atmospheric Administration.

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