

Launch Vehicle Family Album

The pictures on the next several pages serve as a partial "family album" of NASA launch vehicles. NASA did not develop all of the vehicles shown, but has employed each in its goal of "exploring the atmosphere and space for peaceful purposes for the benefit of all." The album contains historic rockets, those in use today, and concept designs that might be used in the future. They are arranged in three groups: rockets for launching satellites and space probes, rockets for launching humans into space, and concepts for future vehicles.

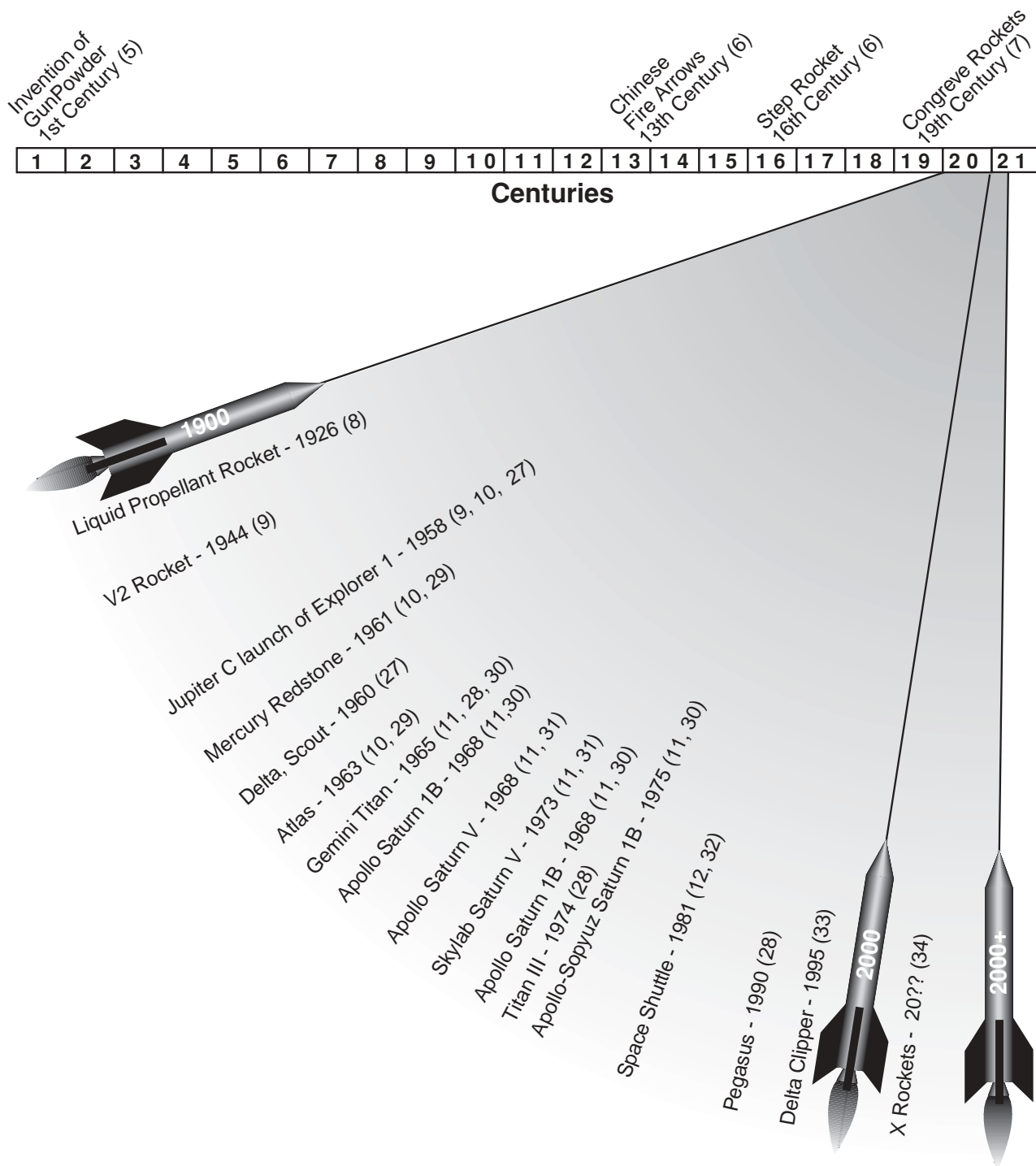
The album tells the story of nearly 40 years of NASA space transportation. Rockets have probed the upper reaches of Earth's atmosphere, carried spacecraft into Earth orbit, and sent spacecraft out into the solar system and beyond. Initial rockets employed by NASA, such as the Redstone and the Atlas, began life as intercontinental ballistic missiles. NASA scientists and engineers found them ideal for carrying machine and human payloads into space. As the need for greater payload capacity increased, NASA began altering designs for its own rockets and building upper stages to use with existing rockets. Sending astronauts to the Moon required a bigger rocket than the rocket needed for carrying a small satellite to Earth orbit.

Today, NASA's only vehicle for lifting astronauts into space is the Space Shuttle. Designed to be reusable, its solid rocket boosters have parachute recovery systems. The orbiter is a winged spacecraft that glides back to Earth. The external tank is the only part of the vehicle which has to be replaced for each mission.

Launch vehicles for the future will continue to build on the experiences of the past. Vehicles will become more versatile and less expensive to operate as new technologies become available.



Rocket Timeline



Most significant rocket developments have taken place in the twentieth century. After 1958, all entries in this timeline relate to NASA space missions. Provided here are the years in which new rocket systems were first flown. Additional information about these events can be found in this guide on the pages indicated by parentheses.

Rockets for Launching Satellites and Space Probes



The Jupiter-C rocket that carried Explorer I sits on the launch pad venting before launch, January 31, 1958.



NASA's Scout rocket is a four-stage solid rocket booster that can launch small satellites into Earth orbit. The Scout can carry about a 140 kilogram payload to a 185 kilometer high orbit. NASA used the Scout for more than 30 years. This 1965 launch carried the *Explorer 27* scientific satellite.

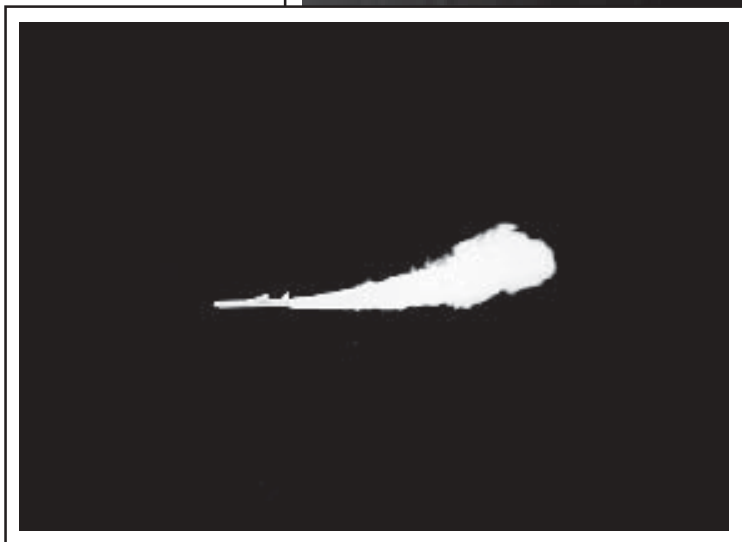
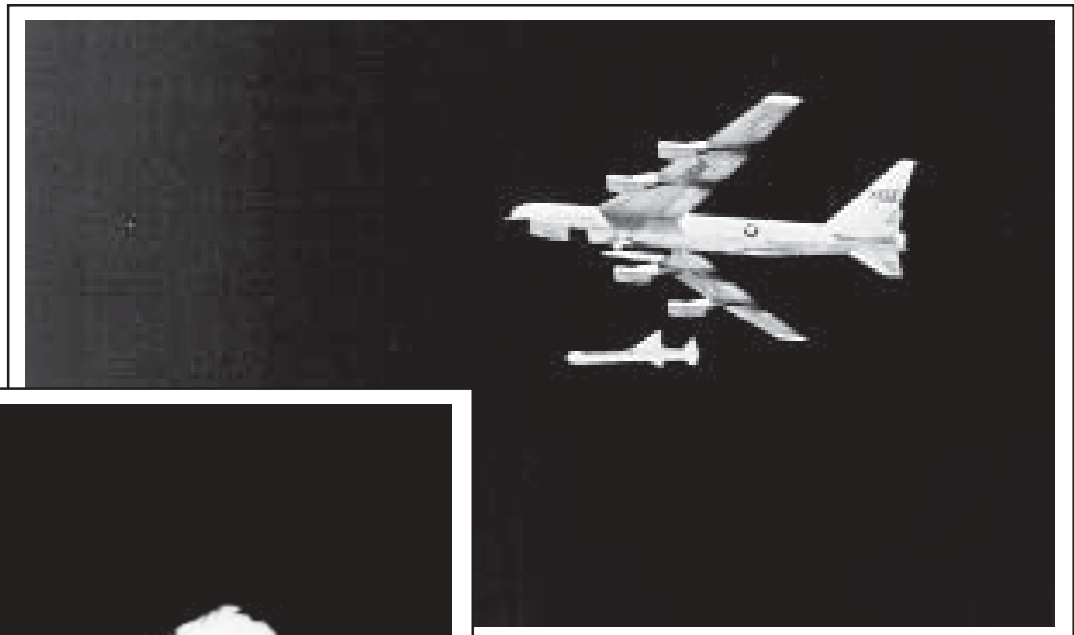


One of NASA's most successful rockets is the Delta. The Delta can be configured in a variety of ways to change its performance to meet needs of the mission. It is capable of carrying over 5,000 kilograms to a 185 kilometer high orbit or 1,180 kilograms to a geosynchronous orbit with an attached booster stage. This Delta lifted the *Galaxy-C* communication satellite to space on September 21, 1984.





A Titan III Centaur rocket carried *Voyager 1*, the first interplanetary spacecraft to fly by both Jupiter and Saturn, into space on September 5, 1975. The Titan, a U.S. Air Force missile, combined with NASA's Centaur upper stage and two additional side-mounted boosters, provided the needed thrust to launch *Voyager*.

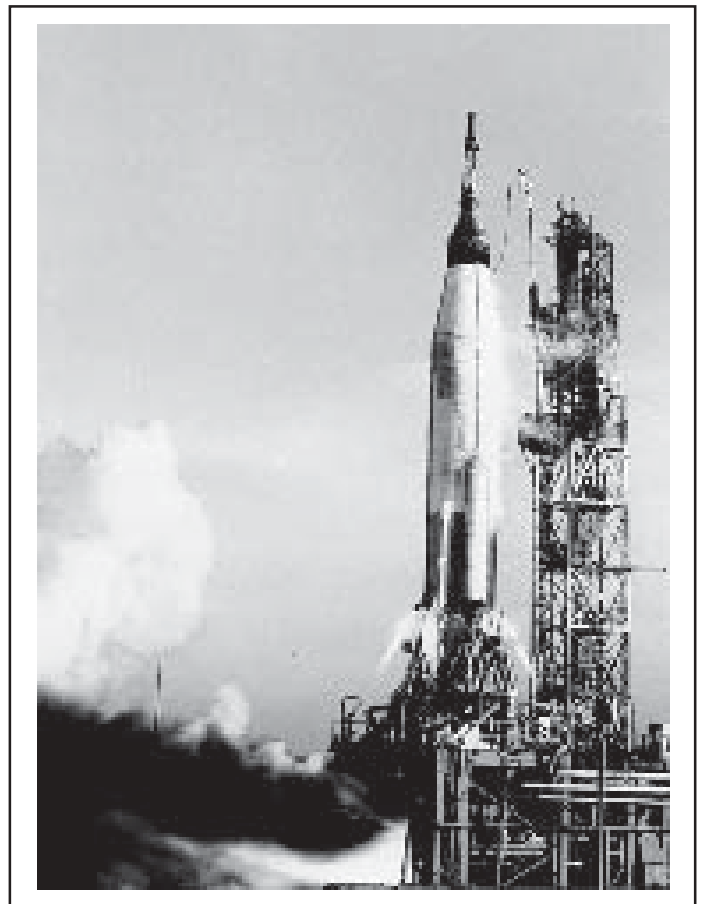


The Pegasus air-launched space booster roars toward orbit following its release from a NASA B-52 aircraft. The booster, built by Orbital Sciences Corporation and Hercules Aerospace Company, is a low-cost way of carrying small satellites to Earth orbit. This launch took place on April 5, 1990.

Rockets for Sending Astronauts Into Space

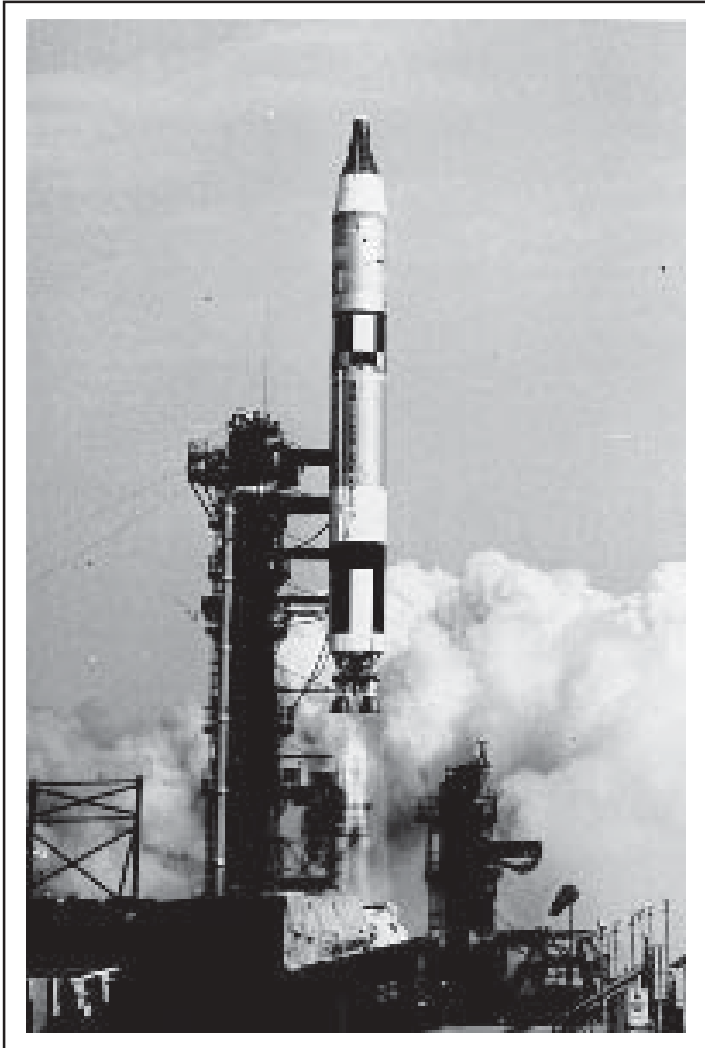


Allan Shepard became the first American astronaut to ride to space on May 5, 1961. Shepard rode inside a *Mercury* space capsule on top of a Redstone rocket.



An Atlas launch vehicle, with a *Mercury* space capsule at the top, underwent a static firing test to verify engine systems before its actual launch. The *Mercury*/Atlas combination launched four *Mercury* orbital missions including the historic first American orbital flight of John Glenn.





Virgil I. Grissom and John W. Young rode to orbit inside a *Gemini* spacecraft mounted at the top of this Titan rocket. The spacecraft reached an orbit ranging from 161 to 225 kilometers on March 23, 1965.

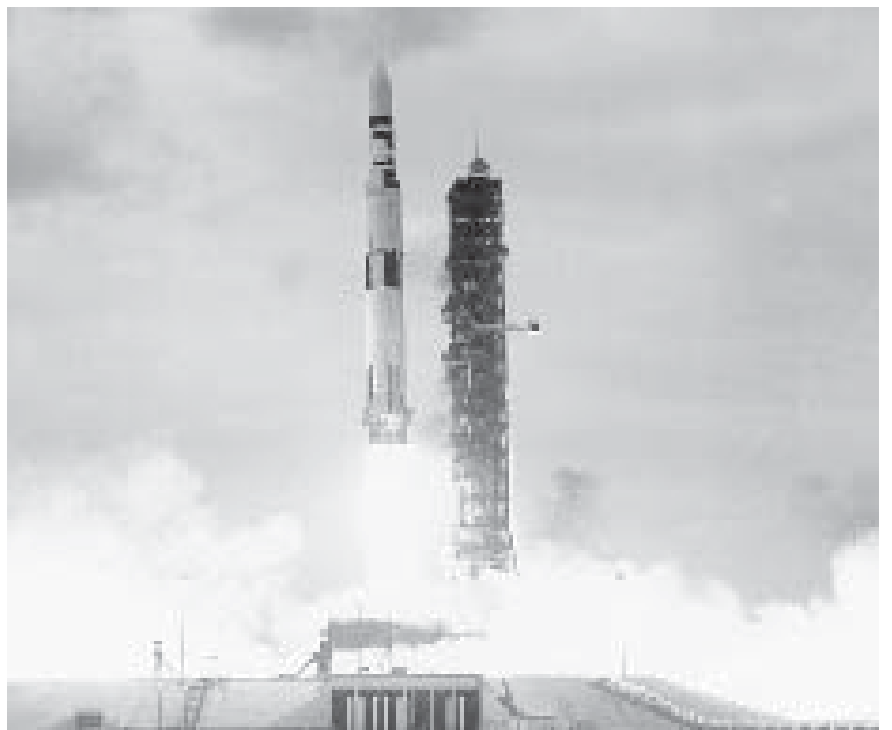


Used to lift *Apollo* spacecraft to Earth orbit, the nearly 70-meter-tall Saturn 1B rocket carries the *Apollo 7* crew on October 11, 1968. Saturn 1B rockets also transported crews for *Skylab* (1973-74) and *Apollo/Soyuz* missions (1975).



The 111-meter-high Saturn 5 rocket carried the *Apollo 11* crew to the Moon.

Using a modified Saturn 5 rocket, NASA sent the 90,600 kilogram *Skylab* Space Station to orbit on May 14, 1973. The space station replaced the Saturn 5's third stage.





Today, NASA Astronauts launch into space onboard the Space Shuttle. The Shuttle consists of a winged orbiter that climbs into space as a rocket, orbits Earth as a satellite, and lands on a runway as an airplane. Two recoverable solid rocket boosters provide additional thrust and an expendable external tank carries the propellants for the orbiter's main engines. This was the launch of STS-53 on December 2, 1992.

Concepts for Future Vehicles

The launch vehicles on this and the next page are ideas for future reusable launch vehicles. Most are variations of the winged Space Shuttle orbiter.



The Delta Clipper Experimental (DC-X) vehicle, originally developed for the Department of Defense, lifts off at the White Sands Missile Range in New Mexico. NASA has assumed the role of managing the vehicle's further development. The DC-X lifts off and lands vertically. NASA hopes this vehicle could lead to a low-cost payload launching system. The Delta Clipper was recently renamed the "Clipper Graham" in honor of the late space pioneer Lt. General Daniel O. Graham.



The X-34 is a reusable booster concept that could lead to larger vehicles in the future. This rocket would launch from a carrier aircraft to deliver a payload to orbit.



NASA has chosen this concept to replace the Space Shuttle fleet in the 21st century. The X-33 will be a single-stage-to-orbit vehicle in which the entire vehicle lifts off into space and returns to Earth intact.

Looking like a Space Shuttle orbiter, this new launcher concept is also a single-stage-to-orbit vehicle.

