

# Then and Now

## A Mercury-Space Shuttle Comparison

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Capsules have become winged spacecraft, astronauts have become both pilots and scientific specialists, and the world has gone from Cold War to cooperation in the years following John Glenn's historic orbital flight.

The Mercury spacecraft, at the pinnacle of human technical achievement in 1962, pales in comparison to today's spacecraft that are capable of carrying up to seven humans and millions of dollars worth of sophisticated research instruments into orbit and returning them to Earth with a soft runway landing. And the engineering expertise that built that small vehicle has matured to the point that is ready to undertake the next greatest human engineering achievement, the construction of an orbiting International Space Station.

John Glenn's mission initially was set to launch on Dec. 20, 1961, then Jan. 16, 1962, then Jan. 23, 1962, then Jan. 27, 1962 when the Mercury-Atlas rocket was finally fueled, but the countdown was scrubbed at T-13 minutes by adverse weather. Subsequent launch attempts on Feb. 13, 14, 15, and 16 also were scrubbed by adverse weather or technical problems and the launch was reset for Feb. 20. By comparison, NASA in 1997 launched eight shuttle missions, all of them on schedule or within 30 minutes of the planned launch time.

Friendship 7 was launched from Cape Canaveral, Fla., Launch Complex 14 into a 162.2 by 100 statute mile orbit, inclined 32.54 degrees to the equator. By comparison, the STS-95 mission will launch from Kennedy Space Center's Launch Pad 39B and put Columbia into a 325-mile-high orbit at an inclination of 28.45 degrees. The Mercury-Atlas 6 launch put the single occupant through 7.7 Gs, while the shuttle launch will make its seven occupants weigh only three times their normal weight.

Glenn's first flight completed only three orbits and lasted 4 hours, 55 minutes, 23 seconds and covered 75,679 land miles. His second flight will mark 14 orbits and last about 8 days, 20 hours, and cover some 3.6 million miles. The Mercury spacecraft made only one flight and now is in the Smithsonian's Air and Space Museum, while *Discovery* has covered a total of almost 69 million miles on 23 other missions and is slated for continued use through the first decade of the new millennium. The Mercury program clocked a total of just under 54 hours over six missions, while the shuttle fleet has logged more than 18,000 hours over 89 missions.

The 4,256-pound Mercury spacecraft could support a maximum mission duration of 1.5 days, while the shuttle, weighing in at 153,819 pounds, can stay aloft for 18 days or slightly more with an Extended Duration Orbiter pallet.

America's first orbital flight had no payload other than its occupant and some 48 items of basic experimental and observational gear. By contrast, the STS-95 mission will carry 2,600 items including a large Spacehab research module, a Hubble Orbital Systems Test Platform, an International Extreme Ultraviolet Hitchhiker and several Getaway Special Canisters. In addition, it will launch and retrieve the free-flying

Spartan-201-05 mission to study the Sun and the solar wind. Glenn could look out of one window in 1962, while in 1998 he'll be able to view the Earth and stars from 10 different windows in the shuttle.

The Atlas launch vehicle could generate a total 360,000 pounds of thrust with its one and a half-stage liquid propellant sustainer and two booster engines, while the shuttle system develops 7 million pounds of thrust when its three main engines and two solid rocket boosters are combined.

The electrical power for the Mercury capsule came from three primary batteries producing 9,000 ampere hours, while the shuttle's three fuel cells each produce 7 kilowatts of continuous power by combining liquid hydrogen and oxygen; a byproduct of this process is all drinking water needed by the crew. Mercury had four electrical buses; *Discovery* has 110. Mercury had 20 circuit breakers; *Discovery* has 961. Mercury had 100 sensors, while *Discovery* has more than 7,800.

Thermal control of the Mercury capsule's 36 cubic feet of volume was achieved through cabin gas cooling and a water boiler. The shuttle has two Freon-21 coolant loop systems, cold plate networks for its avionics units, liquid to liquid heat exchangers, deployable radiators, flash evaporators and ammonia boilers to control the temperature of its 1,300 cubic feet of crew compartment space. The shuttle's crew compartment allows 187 cubic feet for each of seven crew member and could hold 64 crew members if each was allotted just 36 cubic feet. Mercury astronauts breathed 100 percent oxygen, while shuttle astronauts breathe an Earth-like mixture of oxygen and nitrogen that can be adjusted for varying pressures.

Although both vehicles are designed for automatic control, both also are fitted for manual control. Mercury's pilot could control the spacecraft attitude in case the automatic system malfunctioned, while the shuttle uses manual control to rendezvous or fly around another spacecraft and is routinely landed manually after slowing to subsonic speeds. Mercury had 143 cockpit display components; the shuttle has 2,312. Mercury had 56 toggle switches, 8 push-button switches and 19 event indicators; *Discovery* has 856 toggle switches, 219 push-buttons and 559 event indicators.

Mercury used three solid-fuel rockets for reentry retrofire maneuvers, drag braking, and a main and drogue-stabilization parachute system for ocean splash-downs. Shuttles use a traditional aircraft tricycle landing gear configuration that features a steerable nose gear and shock strut main gears to land on a runway. Mercury had a 63-foot-diameter main parachute, while the shuttle has only a 39-foot drag chute.

Mercury used an ablative heat shield on the blunt face and heat-radiating shingles on its afterbody to protect against the heat of reentry, while the shuttle uses reinforced carbon-carbon tiles on its nose cap and leading edges, high-temperature reusable surface insulation tiles on its lower surface, low-temperature reusable surface insulation tiles on its upper wing and fuselage sides, advanced flexible reusable surface insulation on parts of its payload bay doors, fuselage and upper wing. □



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1) View of Astronaut John Glenn insertion into the Mercury Spacecraft. 2) View of Astronaut John Glenn, Dr. William Douglas, astronaut's flight surgeon, and Equipment Specialist Joe Schmitt leaving crew quarters prior to Mercury-Atlas 6 mission. Glenn is in his pressure suit and is carrying the portable ventilation unit. 3) The Mercury-Atlas 6 "Friendship 7" spacecraft is retrieved from the Atlantic Ocean following John Glenn's three-orbit space mission. In this view, the capsule is still in the water, with the retrieval cable connected to it. 4) Launch of the Mercury-Atlas 6 mission on Feb. 20, 1962.



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