

Space Suits On Parade



You'll probably never see a fashion show runway with astronauts displaying the latest styles in flight suits. Trends in space gear don't often make front-page news, but over the years, significant improvements have been made. Unlike popular fashion, the modifications made to flight suits and space suits are much more practical than style driven.

Astronauts wear more than one uniform.

The flight suit is worn on the ground; it's a cloth jumpsuit that provides little protection. Flight suits are more closely aligned with uniforms than with space protection gear. As space travelers board the Space Shuttle to prepare for launch, however, they wear bright orange launch suits, or partial pressure suits. During the launch and entry phases of flight, these suits have a parachute harness assembly and a parachute pack, as well as helmet, communication assembly, torso, gloves, and boots. The suit provides protection from the changes in pressure and temperature extremes that the crew could face if it must parachute to safety. Without the suit pressing on the abdomen and legs, the blood would pool in the lower part of the body and cause the astronaut to black out as the spacecraft returns from microgravity to Earth's gravity. This suit could also support a crew member in a life raft for 24 hours without danger of exposure.



During orbit, whether working on the Space Shuttle or International Space Station, astronauts do not wear special uniforms. They work in flame-retardant civilian clothes because the pressure and temperature in these space environments are controlled. When they venture out of the craft's protective walls, however, astronauts change into the extravehicular mobility unit (EMU), better known as a space suit.

Over the years, EMUs (space suits) have changed significantly. The current suits feature a primary life support system and several other special items designed for comfort and safety as space walkers brave the new frontiers. Space suits are made of components that can be mixed and matched to accommodate the many sizes of astronauts that go into space.



To prepare for a space walk, the astronaut goes into the airlock and puts on several unique parts of the EMU including:

- A urine collection device that receives and stores urine for transfer later to the waste management system
- A one-piece liquid-cooling and ventilation garment that has water-cooling tubes running through it to keep the wearer comfortable during work periods
- An in-suit drink bag containing 21 ounces of drinking water
- A communications carrier assembly with headphones and microphones
- A biomedical instrumentation subsystem to monitor the astronaut's vital signs



The space suit is rigid, but it has jointed sections to allow for movement. The upper and lower torso sections are put on separately and connected to allow circulation of water and gas lines. Gloves and helmet are added to create a sealed protection against meteoroids and radiation. A basic space suit weighs about 100 pounds on Earth, but far less in reduced-gravity conditions, and should last 8 years under normal conditions. Space suits are white because that color reflects

heat most effectively.

The primary life support system (PLSS) is a permanently mounted backpack that attaches to the upper torso of the suit, with displays mounted on the suit chest. The backpack unit supplies oxygen for breathing, suit pressurization, and ventilation. The unit also cools and circulates water used in the ventilation garment, controls ventilation gas temperature, and absorbs carbon dioxide.

When astronauts walk in space, the manned maneuvering unit (MMU) latches to the PLSS. This “jet pack” allows an astronaut to fly in and around the vehicle, cargo bay, or nearby structures.

They've Come A Long Way



The first space suits used on the Mercury spacecraft were modified versions of Navy high-altitude jet aircraft pressure suits with an inner layer of Neoprene-coated nylon fabric and a restraint layer of aluminized nylon. Because the astronauts stayed inside the craft at all times, space walking needs were not considered. The suits could be pressurized if needed in the event of a cabin pressure loss.



When Edward White opened the Gemini IV hatch and became the first American to walk in space, a 25-foot oxygen line attached to a chest-mounted pressure regulator and ventilation assembly supported him. It worked, but as space travel progressed, so did the design of space suits.

Landing on the Moon meant that astronauts needed to be fully independent from the spacecraft. A self-contained supply of breathing and pressurizing oxygen, filters for removing carbon dioxide, and cooling water, mounted in a backpack system, gave Apollo crewmen the independence they needed.

Apollo suits featured greater mobility and flexibility for walking on the Moon's surface and riding in the lunar buggy, greater comfort for the wearer, and greater protection from Moon rocks, meteorites, and high heat.

The Suit Of The Future

NASA continues to explore new ideas in space suits. The suits of the future will be designed for comfort, mobility, range of motion, and flexibility. Suits must protect astronauts from radiation, micrometeoroids, and manmade debris, and allow the wearer to breathe in comfort and safety. Current space suits require a prebreathing procedure to adapt the body for the space walk; future designs may increase the pressure to require less prebreathing time.



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