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**DUBAI**  
BY SHYAM A. KRISHNA  
Senior Associate Editor

Outer space is a harsh environment. The lack of oxygen and extreme temperatures make it impossible for humans to survive. That hasn't stopped Earthlings from space expeditions. A spacesuit — a pressurised garment — keeps alive astronauts and cosmonauts on their spacewalks and inside spacecraft if cabin pressure drops.

Over the years, space wardrobes evolved from ponderous spacesuits to flight suits that are sleeker and more flexible. The first human in space, Yuri Gagarin, and the first American in space, John Glenn, wore modified high-altitude jet suits; the first people to set foot on another world, moon-walkers Neil Armstrong and Buzz Aldrin, used bulky suits, while the UAE's Sultan Al Neyadi pulled on a sleek Starman suit for his trip to the International Space Station.

As humans plan their first mission to the Moon in more than 50 years, Nasa (National Aeronautics and Space Administration of the United States) recently unveiled the spacesuit for the Artemis III mission in 2025. The suit, designed by Axiom Space, is a giant leap from the 'Michelin-Man-like suits' of the Apollo missions. Its novel features will help astronauts conduct scientific experiments on the Moon easily.

Here's a look at spacesuits and their evolution.

■ **Why are spacesuits essential?**

Outer space is not fit for humans. Without spacesuits, humans will die a quick death. The vacuum (oxygen-free), extremely fluctuating extreme temperatures, and radiation make for a death trap.

■ **According to How Stuff Works, if a person steps outside a spacecraft without wearing a spacesuit, the following things could happen:**

1. A person could become unconscious within 15 seconds due to a lack of oxygen.
2. Blood and body fluids could "boil" and then freeze because there is little or no air pressure.
3. Tissues (skin, heart, other internal organs) could expand as the fluids boil.
4. Extreme temperatures. (From 120° C to -100° C.)
5. Exposure to radiation, such as cosmic rays and charged particles emitted from the sun.
6. Risk being hit by small particles of dust or rock moving at high speeds (micrometeoroids) or orbiting debris from satellites or spacecraft.

■ **How can spacesuits protect humans in space?**

To protect astronauts from the dangers of space, a spacesuit must:

1. Be pressurised
2. Provide oxygen and remove carbon dioxide
3. Maintain optimum temperature despite extreme temperature fluctuations
4. Provide protection from micrometeoroids and radiation
5. Allow for good visibility
6. Facilitate easy movement and communication

■ **What are the different types of spacesuits?**

There are three types of spacesuits for different purposes: intravehicular activity (IVA), extravehicular activity (EVA) and intra/extravehicular activity (IEVA).

IVA suits worn inside pressurised spacecraft are lighter and more comfortable.

EVA suits, or Extravehicular Mobility Units, were introduced in 1983. They are used outside spacecraft: for planetary exploration or spacewalks for repair and maintenance works. They protect against the hostile conditions of space, besides providing mobility and functionality.

IEVA suits are used inside and outside the spacecraft. They include protection in space, shielding from micrometeoroids and high temperature changes.

The fourth one is not strictly a space suit — the Manned Manoeuvring Unit. The astronaut propulsion unit allowed them to perform untethered extravehicular spacewalks from the shuttle.



UAE astronaut Sultan Al Neyadi uses 'Dreams' to study sleep in space

# FROM YURI GAGARIN TO SULTAN AL NEYADI: THE EVOLUTION OF SPACESUITS

BULKY SUITS OF APOLLO OVER 50 YEARS AGO GAVE WAY TO SLEEK, SLICK FLIGHT SUITS OF SPACE SHUTTLES AND SPACEX



■ **RUSSIAN SK-1 (1961)**

Yuri Gagarin of the Soviet Union wore the SK-1 spacesuit when he became the first human to go to space on April 12, 1961. The full pressure suit included life support systems, a visored helmet, a radio headset, and an inflatable collar (in the event of a water landing).

■ **MERCURY SUIT (1961-1963)**

America's first foray into space was through Project Mercury. John Glenn, the first American to orbit the Earth in 1962, used the Mercury suit, a modified high-altitude jet-aircraft pressure suit from the US Navy. The suit had a layer of neoprene-coated nylon inside and aluminised nylon outside to keep the temperature stable. Six astronauts used the suit before Nasa retired it.

■ **GEMINI SUIT (1965-1966)**

Nasa's second space programme, Gemini carried two astronauts into space for a two-week mission. The suits designed by the David Clark Company were more comfortable and more flexible than Mercury suits. These suits weighed 7-25kg and could be connected to a portable air conditioner before they were hooked up to the spacecraft.

The G4C Gemini suit was designed for spacewalks. So when the astronauts were in the harsh space environment, the suit was connected to the spacecraft through a hose for oxygen supply. Some variants of the suit provided up to 30 minutes of backup life support if the oxygen supply was disrupted. The heaviest weighed around 15kg.

■ **APOLLO SPACEWALK SUIT (1967-1975)**

The astronauts on the Apollo lunar programme needed more protection since they had to walk on the Moon. They had to be shielded from sharp dust (regolith) and wild swings in temperature. The suit had to be flexible enough to install gear and pick up moon rocks. With several layers of fabric and a life-support system for moonwalks, it weighed more than 81kg, but only one-sixth on the Moon due to its weaker gravity.

■ **SPACE SHUTTLE FLIGHT SUIT (1981)**

Nasa's first orbital flight of its space shuttle programme was called Space Transportation System-1 (STS-1). The first shuttle Columbia carried a two-person crew into space and orbited Earth 37 times before returning. Since there were no spacewalks, astronauts

## A BRIEF HISTORY OF SPACESUITS



only wore an emergency ejection escape suit, a modified version of a US Air Force high-altitude pressure suit.

■ **SPACE SHUTTLE FLIGHT SUIT (1988-2011)**

The bright orange colour suit, called a "pumpkin suit", was worn by all Space Shuttle crews for the ascent and entry portions of flight from STS-26 (1988) to STS-65 (1994). The Launch Entry (LES) suit was phased out and replaced by the Advanced Crew Escape Suit (ACES). The suit, made of high-tech clothing, is designed to hold communications equipment, oxygen tanks, parachutes and enough water for a day.

■ **EXTRAVEHICULAR MOBILITY UNIT (1983-PRESENT)**

Nasa created the Extravehicular Mobility Unit for astronauts on space shuttles to work in space to maintain satellites and the International Space Station (ISS). The suit's 14 layers could withstand the harsh void of space and keep astronauts alive for more than eight hours outside the shuttle. With gear and supplies, it could weigh about 145kg.

■ **SOKOL LAUNCH AND ENTRY SUIT (1973-PRESENT)**

The blue-lined suit, called the Sokol or "Falcon", was first worn by Soviet cos-

monauts in 1973 and is still in use. The 10kg sleek suit, similar to the space shuttle flight suit, is used aboard the Soyuz spacecraft, where there is no room for cosmonauts to wear extensive life support equipment.

■ **ORLAN EVA SUIT (1977-PRESENT)**

The Orlan (sea eagle in Russian) was used by cosmonauts during extravehicular activities (EVA) or spacewalks from orbiting space stations. First used in 1977 on a Salyut station, the suit underwent modifications, and newer versions were used on the Mir space station and the International Space Station. The suits, designed and built by Russia's NPP Zvezda, have been used by Russian, American, European, Canadian and Chinese astronauts.

Unlike other suits with detachable gloves, boots, and helmets, the Orlan was a semi-rigid single-piece design with flexible limbs and a rigid body. Instead of slipping into the suit, cosmonauts entered the suit through an opening in the back. The Orlan is still in use by cosmonauts on the International Space Station.

■ **SPACEX CREW DRAGON FLIGHT SUIT (2022-PRESENT)**

Elon Musk's SpaceX designed sleek spacesuits to protect astronauts flying aboard its Crew Dragon spacecraft to the International Space Station. The launch and re-entry suits were not intended for spacewalks, but they could hold pressure in the event of cabin depressurisation.

The gloves could work with the spaceship's touchscreen. Called Starman suits, the look of the one-piece suits was conceived by Hollywood costume designer Jose Fernandez, who has worked on Captain America: Civil War and Batman v Superman: Dawn of Justice.

■ **BOEING STARLINER FLIGHT SUIT (UNVEILED IN 2022)**

Boeing's bright blue suit, designed for the CST-100 Starliner spacecraft, has features to make it comfortable and mobile under pressure. That includes a helmet attached with a thick, air-tight zipper (no bulky neck ring required). According to Boeing, the 5.5kg suit is 40 per cent lighter than previous suits, and the gloves are touchscreen-friendly. The suit, unveiled in 2022, will be worn when Boeing begins flying astronauts on Nasa-contracted missions.