

INTRODUCTION

At the close of the twentieth century, the Pew Research Center surveyed Americans and asked what they felt were this country's greatest achievements since the year 1900. There are a lot of possibilities when you consider all the technological strides we made as a nation during that period. What ended up coming out on top, not surprisingly, was advancements in science and technology and specifically space exploration and humans on the moon.¹

The culmination of our manned space programs produced results that established this nation as the world leader in science and technology. Arguably, the position we occupy today still puts us ahead of other nations, thanks in large part to these early programs. But this leadership and success was not a foregone conclusion. The Soviets initially dominated the race into space, and NASA and the US industrial and aerospace complex faced staggering challenges in their efforts to meet President Kennedy's 1961 proclamation that we would land a man on the moon and return him safely by the end of the decade. Kennedy delivered that speech only twenty days after our first astronaut, Alan Shepard, made his fifteen-minute flight, barely crossing the boundary into space. Kennedy's pronouncement sent shock waves through those within NASA who knew how difficult it had been just to launch Shepard on his mission. To get men to the moon and back within nine years was considered a joke by everyone who knew better.

The Lunar Suit

The forerunners of the modern space suit were pressure suits developed for early adventurers who flew their airplanes to altitudes higher than the human body could tolerate. Pioneer Wiley Post flew his unpressurized wooden plane to an altitude of 50,000 feet in September 1934 and in the process discovered the jet stream. These early daredevils knew that they had to have pressurized air to breathe or they would likely not survive. Attempting to pressurize a wooden plane such as Post's would have resulted

in catastrophic results, so the best option at the time was to offer a suit that could be pressurized. These first, one-off, custom-made suits were awkward and hampered mobility when pressurized, but that was OK because they still afforded the basic protection and motion needed.

With the advent of high-performance jet aircraft in the late 1940s and early 1950s, the military became very interested in pressure suits for pilots who were flying at increasingly higher altitudes. Again, these suits were designed for a sedentary human seated in an aircraft who only truly needed to move their arms and hands. A small handful of companies offered mass-produced suits for such a purpose but their focus remained on the aircrew population.

True space suits didn't receive serious attention until the US manned space program began in earnest. Would the early pressure suits support President Kennedy's challenge to land a man on the moon and return him safely to earth? The pressure suits used in the Mercury and Gemini missions were derivatives of the military pressure suits of the 1950s, but even with various modifications, could they meet the challenges of the Apollo missions that were to come? This is where International Latex Corporation (ILC) stepped up with its design and manufacture of the first suits intended solely for use in space, suits that were not derivatives of military pressure suits.

The journey of the Apollo space suit begins in 1952 when ILC employee Leonard (Len) Shepard set out to build the first true space suit. Four years later, George Durney joined him and further developed Shepard's basic space suit design through the early 1960s. The team worked tirelessly to make this suit perform better than anything else on the market and ultimately win all the marbles in the contest to be the first to safely deliver a man to the moon and bring him back alive.

As the challenges of Apollo grew, ILC Industries hired many people with great talent to reach each successive level. This next generation included college-trained engineers who had great vision. Space suit design was not taught in any of the colleges. Mechanical engineers could transfer what they learned through education and work experience to the world of designing and building rockets and capsules for our space program, but the art of designing and building space suits was very abstract in many respects and only a select few could understand the nuances of it all. There really were no previous space suit models to look at. This was all new territory. These garments were 0 percent fashion and 100 percent function; anything "fashionable" about the suits was arrived at serendipitously.

This business wouldn't have succeeded if not for the women who brought the sewing skills that were necessary to stitch together this life-sustaining garment. Theirs was a women-only trade, learned mostly at home from their mothers and solidified through years of experience in the local commercial garment businesses. Some women simply transferred over from ILC's parent Playtex division, where they made bras and girdles. These suits would have to function in an environment that would take a human life within seconds; the seamstresses could not fail at their jobs of sewing the seams together properly, and everyone involved in this business was aware of that fact, including the astronauts.

Many hurdles faced the men and women who accepted the responsibility of seeing to it that the moon-walking astronauts of Apollo would survive the unknowns of the hostile environment they would face. Some of the more obvious obstacles were described in the following observation I found buried deep within a document written at the time the Apollo suits were being developed. It provides just a slight glimpse into what some of the challenges were. The author, a NASA contracts administrator, was attempting to shed light on the challenges and the unique nature of the work of making the Apollo space suits while at the same time justifying the high costs of the suits.

It has been correctly observed that the suit is the only "spacecraft" to go all the way to the moon and back. Designing it to be so versatile that it is comfortable during a 14-day mission for intravehicular wear and also provide extravehicular capability to let an astronaut on the moon's surface leap, climb, and creep, place his hands on top of his helmet, reach behind his back and touch the opposite shoulder with either hand with 100 percent safety is no easy engineering job. It required the expertise of a strange blend of such diverse disciplines as bio-engineering, metallurgy, fluid control and sewing. After the suit is designed and qualified there are still many recurring problems encountered in custom fitting the suits to the specific astronaut. First, the pattern cannot even be cut until the crews are selected, which is done at the sole discretion of the astronaut office. Second, ILC is required to physically locate the astronaut, make certain plaster casts and tailor measure him. Thirdly, after the suit has been cut and stitched, ILC is required to coax the astronaut to Dover, Delaware, for a fit check at which time special design changes may be generated due to the subject's idiosyncrasies such as weight fluctuations, 99th percentile bicep,

extra-long neck, etc. Other problems result from the coordinating, integrating and interfacing with the other Apollo systems such as the Portable Life Support System, Command and Service Module, Lunar Module and the Space Suit Communications Systems.²

Of the several varieties of space suits used since the beginning of human space flight, the Apollo suits are among the most iconic objects ever photographed, particularly when seen in the photos from the lunar surface. They represent the human species leaving the gravity of Earth and traveling to another world—an absolute first for humankind. Take for instance that famous photo Neil Armstrong took of Buzz Aldrin posing with the “magnificent desolation” of the moon as a backdrop. As with all the images of the Apollo astronauts taken on the lunar surface, the men who occupied the suits are all but invisible. This is the story of that suit.

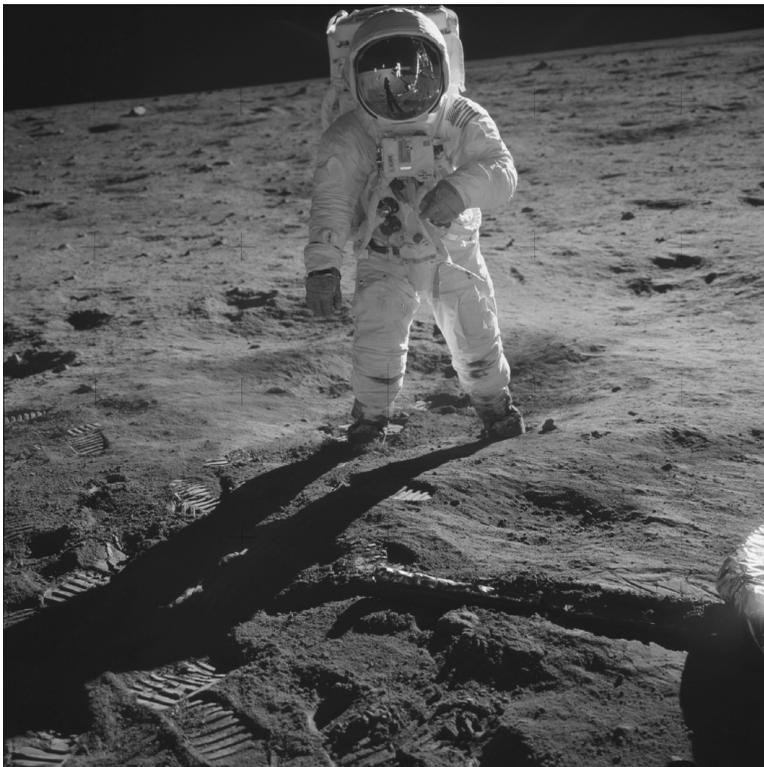


Figure 0.1. The iconic photo of Buzz Aldrin taken by Neil Armstrong just minutes after Apollo 11 landed on the moon. Aldrin is wearing the ILC Industries Model A-7L space suit. Courtesy NASA.