The world changed on October 4, 1957 when the Soviet Union successfully launched the world’s first artificial satellite, Sputnik I, into Earth orbit. In reaction, the U.S. created the National Aeronautics and Space Administration (NASA) by the Space Act of October 1, 1958. The new agency inherited the National Advisory Council on Aeronautics (NACA) and other government organizations. NASA initiated America’s first manned exploration program, Project Mercury, within its first week of existence. However, Mercury was not the first U.S. program to develop a pressure suit for use in space. Both the X-15 rocket plane and the U.S. Air Force X-20 space plane (see Chapter 8) programs had preceding suit activity. These first suits were to keep the astronaut or pilot alive if the spacecraft cabin lost pressure anytime in their journey. Mercury also introduced integrated flotation systems.

The Gemini, Apollo, and Shuttle programs featured launch and entry-specific suit systems. Gemini and Shuttle included parachute systems and survival gear. By the end of the 1960s, the number of U.S. organizations offering operational launch and entry type spacesuits had effectively dwindled to two, where it stayed for the remainder of the 20th century.

The new millennium brought change. In April 2001, a private citizen named Dennis Tito became the first space tourist. With this milestone, low Earth orbit (LEO) became a recreational destination. 2004 brought the first private manned spacecraft, named SpaceShipOne, to fly into space twice within 14 days to claim a $10 million dollar prize. While SpaceShipOne had but a thin graphite composite pressurized shell and the pilot was not provided a spacesuit or backup life support system, this benchmark meant commercial human spaceflight was coming and that commercial space travel would be required to back up life support. In March 2010, the Obama administration elected to cancel Project Constellation in favor of private industry spacecraft to transport goods and people to the International Space Station. As LEO becomes a place where people are transported to work or play by private industry, safety will most likely require launch and entry spacesuits. This recognition
The need for U.S. launch and entry spacesuits started in 1954. The National Advisory Committee on Aeronautics (NACA) joined the U.S. Air Force (USAF) and Navy in a joint experimental aircraft/spacecraft named the X-15. The X-15 program’s mission was to expand significantly the horizons of aerospace research. Operating as an aircraft, the X-15 ultimately reached Mach 6.72. However, the X-15 was designed to resist the heat and friction of atmospheric entry. Powered by rocket engines that were not dependent on air for propulsion, the X-15 was also intended to be a suborbital space plane. Thus, X-15 pressure suits were also intravehicular activity (IVA) spacesuits.

Development and selection of X-15 suits started when the USAF invited several companies to provide pressure suit designs for consideration. Prototypes from International Latex Corporation (now ILC Industries), Rand Corporation, and David Clark Company were among the suits funded by and evaluated at Wright–Patterson Air Force Base in Ohio in 1957.

This evaluation saw the debut of International Latex Corporation as a pressure suit design and fabricating organization. Having combined internal resources with recruitment of B. F. Goodrich personnel, International Latex took a molded convolute joint approach that was pioneered by Goodrich (Figure 2.4) and developed it into a more effective mobility system. A curious feature of the International Latex prototype (Figure 4.1.1) was that it was not equipped with pressure gloves as the X-15 evaluation was for mobility elements and providing pressure gloves with the suit prototype was not a requirement.

Perhaps the most technically interesting facet of the X-15 evaluations was that the two most mobile of the competition prototypes might have evolved from a common technology concept. The first evolutionary trail is clear. The National Bureau of Standards (NBS) provided technical support to the commercial and defense sectors that included pressure suit technology. Starting in 1947, the NBS funded research headed by Arthur S. Iberall that resulted in a “netted” bladder restraint concept. Iberall explained this system with a theory that he called “lines of non-extension”. The theory recognized that if you were to mark the human anatomy with lines, there are areas where the skin stretches with the movement of joints and there are areas where it does not (lines of non-extension). These are now typically called the “flex” and “non-flex” areas of spacesuits, but those words would come later. The NBS funded two prototypes of this concept. The second prototype was completed by 1951 and was capable of 2 psi (14 kPa) pressurization. In 1954, Iberall left the NBS and secured a position with the Rand Corporation. At Rand, Iberall resumed pressure suit development to create a sophisticated multi-restraint layer, full pressure suit design that was Rand’s entrant in the X-15 suit competition. While the Iberall/Rand prototype (Figure 4.1.2) displayed excellent mobility for the