

As an interest in missions to Mars continues to grow, NASA strives to build a space shuttle refueling depot on the moon. This depot will work similarly to a gas station; however, the stored fluid will be liquid oxygen rather than gasoline. The refueling station on the moon is important for long distance space travel because it would allow spaceships to travel further without the needing to return to Earth. We designed a reusable connector to transfer subzero fuel from a storage tank to the spacecraft. This requires a design that will provide a tight seal to prevent any leakage. However, transferring liquid oxygen through the connector produces problems. Liquid oxygen boils at around negative 300 degrees Fahrenheit, so the materials in contact must withstand the temperature variations. Therefore, stainless steel and Kel-f, a thermoplastic used for sealing, are needed for these space applications. Unlike most materials, they remain functional in the extreme conditions caused by liquid oxygen and the moon.

Most connections require twisting motions to screw parts together. This causes problems with astronauts as they use bulky gloves which make it hard to handle small objects and perform twisting motions. Therefore, we designed a system with three latches and three hooks that will easily seal the connection. The connector has two valves that will control the flow with long handles. These design components were selected to help the astronauts carry out their missions with ease.

Life cycle testing was done using liquid nitrogen and helium gas since liquid oxygen can easily ignite. The connector was tested at low temperatures to show the seal's ability to prevent leakage. The result of these tests confirms the reusable connector can be used for multiple missions and refueling needs.