

SAVING THE INTERNATIONAL SPACE STATION WITH CUSTOM CONTAINER EXPERTISE**OVERVIEW**

In 2012, NASA faced a critical logistical challenge: the safe transport of high-pressure oxygen and nitrogen cylinders to the International Space Station (ISS) amid the cessation of the U.S. Space Shuttle program. Without a reliable method for resupplying these essential gases, the ISS risked early decommissioning. Americase was tasked with developing a highly specialized packaging solution that adhered to stringent regulatory and safety requirements. After extensive and meticulous R&D and testing processes, Americase engineered a custom container that met all of the requirements, enabling NASA to transport the cylinders, ultimately ensuring the continued operation of the ISS.



photo: NASA/Kim Shiflett

THE PROBLEM

NASA needed a transportation solution for extremely large oxygen and nitrogen cylinders that was compliant with HM224B regulations (safety standards for transporting compressed oxygen and other oxidizing gases by air), with modifications suitable for space transport. The cylinder design itself presented additional complexities, including highly sensitive valves, extreme pressure of up to 6,000 PSI which increased the cylinder diameter by nearly an inch, a thick layer of carbon fiber around the inner Inconel cylinder that prevented the use of any straps or clamps, and the need to survive adverse conditions such as heat, shock, fire, and pressure changes during terrestrial and extraterrestrial transport.

THE SOLUTION

Americase collaborated closely with the NASA team to ensure alignment with all requirements. Leveraging its expertise in custom case design and problem-solving, Americase engineered a solution that revolved around a specially designed packaging system. Key elements included:

Certifications and Compliance: Americase obtained ISO 9001 and AS9100 certifications, solidifying its status as a preferred vendor for NASA. These certifications, paired with Americase's extensive experience meeting HM224B regulations, set the foundation for success. ▶

Custom Design and Testing: The packaging system featured a robust inner and outer container. The inner container uniformly touched the composite section of the cylinder without touching the valve while the inner container's shell design kept the cylinder in place.

Americase's oxygen cylinder containers are already built to withstand high heat environments. They pass all tests for thermal and fire protection as defined in 49 CFR 173.168 and all HM224B-required tests, such as:

- **Flame Penetration Test**
- **Thermal Oven Test**
- **ATA 300 Category 1 Drop Test**

However, in addition to the above, more tests were needed to meet the stringent and unique NASA requirements. The new container passed a range of terrestrial and space-based safety tests, including:

- **Fireproofing:** The case was built to withstand temperatures up to 400°F for three hours and not allow the cylinder to exceed 199°F.
- **Pressure Ventilation Testing:** When the cylinder's pressure release device was triggered, causing the cylinder to purge all of its contents in under 10 seconds, the case was able to safely vent the 6,000 PSI release of pressure at a high flow rate without compromising any other design elements.
- **Drop Testing:** To pass the exhaustive 280-drop requirement encompassing all surfaces, edges and corners of the container, Americase designed a custom algorithm to calculate the amount of cushioning needed to protect the cylinder.
- **Shock Absorption:** Americase developed a custom shock absorption system to ensure that shock and vibration levels on the high-value, sensitive valve remained under 50g during each impact drop, keeping the delicate components safe.

CONCLUSION

When NASA's mission to keep the ISS operational was at stake, Americase designed and delivered a custom solution that mitigated all risks concerning shock absorption, pressure relief, heat and fireproofing. Our expertise in custom case design, and our ability to overcome rigorous technical and regulatory challenges, saved the ISS program and extended its critical mission. Following the implementation, Americase has remained an integral partner for NASA, continuing the collaboration on the transportation solutions for the cylinders used in space missions. Today, eight tanks that were shipped in the containers designed by Americase continue to orbit the Earth on the ISS.

Recognized Results

Americase delivered a solution that not only guaranteed the safe transport of oxygen and nitrogen cylinders but played a critical role in preserving the operational life of the ISS. For their efforts, Americase employees were honored with NASA's Group Achievement Award in 2023.