



**Omniseal Solutions**  
SAINT-GOBAIN

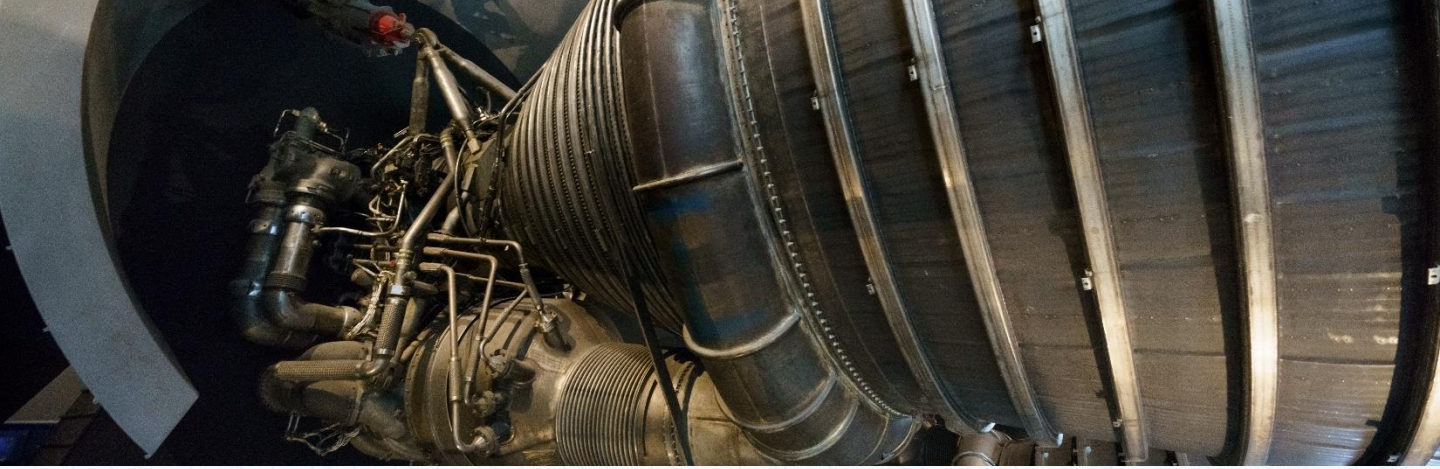
**BEYOND**  
the boundaries of possible



# SPACE CASE STUDY

## LAUNCH VEHICLE ENGINE TURBOPUMP





OMNISEAL® SPRING-ENERGIZED METAL C-SEALS

## Launch Vehicle Engine Turbopump

Hilde Joosen    October 2023

SPACE    LEAKAGE CONTROL    HIGH TEMPERATURE    HIGH PRESSURE

### Environment

A launch vehicle uses a turbopump that is driven by a hot gas turbine. Due to high levels of horsepower, RPM, flow rates and pressures in this system, specific design features, materials, and fabrication methods must be used to ensure high performance and space flight levels of reliability. For static sealing applications in this area, metal seals prevent leakage of a fluid through a joint that has no relative motion of the mating surfaces.

### Challenge

The sealing element is a complex and challenging component in the engine turbopump system, with hundreds of different seals such as metal seals being used for critical functionality. Typically, there is one pump for the fuel with hydrogen liquid or gas, and a second pump for the oxidizer with oxygen. All these liquids or gasses will then come together in the combustion chamber, which requires the highest level of efficient sealing. The lack of sealing control could cause improper operation or loss of hydrogen, leading to a potential fire or explosion. There may also be a loss of turbopump power, which means an aborted mission.



**Omniseal Solutions**  
SAINT-GOBAIN

## Solution

Omniseal® spring-energized metal C-Seal is a proven solution for this challenging application.

The seal has been used in many space programs for several decades, meeting the precise leakage requirement of this turbopump application in the range of  $10^{-5}$  sccs.



Metal C-Seals ensure superior leakage performance, which ensures the stability of your turbopump operation.

## Benefits

- Meets demanding leak rate
- Low load/high spring back requirements

## Specifications

<b>Solution</b>	• Omniseal® Spring-Energized Metal C-Seal
<b>Area</b>	• Engine
<b>Material</b>	• Inconel® 718 with silver plating & gold flash coating
<b>Precision part</b>	• Custom Spring-Energized Turbopump Metal Seal
<b>Technical details</b>	• Media: H <sub>2</sub> , O <sub>2</sub>
	• Temperature: Hot gas, 600°K
	• Leakage requirement: $10^{-5}$ sccs
	• Motion: Static
	• Pressure: 145 psi (10 bar)
	• Diameters: Between 150 & 450 mm



**Omniseal Solutions**  
SAINT-GOBAIN

## Design Expertise & Tailor-made Solutions for Your Critical Applications

Omniseal Solutions is a global engineering leader with over 65 years of historical legacy, relentlessly dedicated to the design and manufacture of precision sealing and material solutions that protect critical applications in the most demanding environments and passionately driven to push *Beyond the Boundaries of Possible*.



### About the Author

#### **Hilde Joosen**

Sales Engineer - Space

Kontich, Belgium

+32 486 33 88 91

[hilde.joosen@saint-gobain.com](mailto:hilde.joosen@saint-gobain.com)

Omniseal Solutions  
[help@omniseal-solutions.com](mailto:help@omniseal-solutions.com)  
[www.omniseal-solutions.com](http://www.omniseal-solutions.com)