



# Revolutionizing Aerospace and Military Applications with Advanced Materials

**Unparalleled Performance for Extreme Environments**



## Innovating the Future of Aerospace and Defense

The aerospace and defense industries are advancing rapidly, propelled by innovations in privatized space exploration, lightweight materials, and next-generation defense systems. As these sectors expand to meet global demands, they face unparalleled challenges from extreme environmental conditions, underscoring the need for cutting-edge materials to ensure reliability, safety, and peak performance.

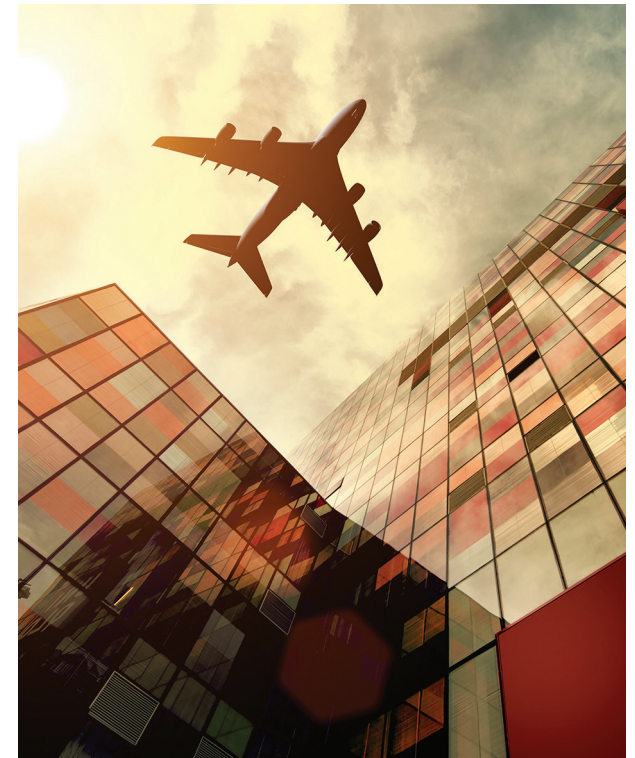
The pressures of air travel and the unforgiving environments outside our Earth's atmosphere can disrupt the electronic signals and critical components used to maintain flight. Likewise, the severe conditions surrounding equipment used in military operations are equally demanding, putting lifesaving protective systems and sensitive equipment at risk.

Equipment reliability and performance are non-negotiable in such unforgiving

environments. Crucial applications like these require exceptional materials and high-performance lubricants that can withstand unrelenting, punishing conditions while delivering reliable, consistent high performance for extended periods of time.

As the aerospace and defense industries push the boundaries of innovation, sustainability has become a critical focus. Chemours' advanced materials—engineered to extend equipment lifespan, reduce maintenance needs, and enhance fuel efficiency—help our partners achieve their performance objectives while aligning with environmental and sustainability goals.

In this white paper, we will explore how Chemours' advanced materials—Teflon™ fluoropolymers, Krytox™ oils and greases, and Viton™ fluoroelastomers—are engineered to withstand extreme conditions while meeting the rigorous



demands of aerospace and military applications. Parts made from these various polymers can meet MIL-SPEC and AMS, ensuring that these materials prioritize performance, safety, and durability while enabling technological breakthroughs that are shaping the future of these industries.



# Krytox™ High-Performance Lubricants: Exceptional Performance in Critical Conditions

## When There's No Margin for Error, Krytox™ Lubricants Are There

For over six decades, Krytox™ perfluoropolyether (PFPE)-based oils and greases have provided consistent, superior, extended performance that reduces maintenance requirements and improves safety and reliability. Known for their thermal stability, resistance to extreme environments,

and compatibility with a wide range of materials, Krytox™ lubricants deliver consistent performance across a variety of commercial and military aviation applications. Additionally, Krytox™ lubricants offer unique compatibility with the complex, sensitive systems used in

military technologies. By extending the operational lifespan of critical components, Krytox™ oils and greases minimize waste and enhance overall system efficiency, making them indispensable for aerospace and military applications that extend the lifespan of critical components.

## Key Features of Krytox™ Lubricants

- **Thermal Stability:** Operates reliably across an ultra-wide temperature range of -70 to 399°C (-100 to 750°F)
- **Environmental Resistance:** Resistant to shock, vibration, heat, pressure, radiation, and corrosive chemicals found in rocket fuels and oxidizers
- **Material Compatibility:** Safe for use with most metals, elastomers, plastics, paints, and finishes
- **Vacuum Performance:** Minimal vapor loss, ideal for high-altitude, orbital, and deep-space flight operations
- **Safety:** Nontoxic, nonflammable, inert, and 100% oxygen-compatible. Non-migrating and deliver superior, long-lasting lubricity

## Military Applications

### Strong enough to serve in the toughest military applications

In 1964, new Krytox™ PFPE-based grease formulations were developed jointly with the U.S. Navy and Air Force, resulting in military specification MIL PRF-27617. Since then, Krytox™ lubricants have served as an indispensable solution in a number of critical military applications:

- Radar and communication equipment
- Satellite components and space electronics
- Antennas and solar panel actuators
- Torpedo guidance and propulsion systems
- Heavy artillery and weapon platforms
- Periscopes and sonar components
- Gyroscopes and bearings

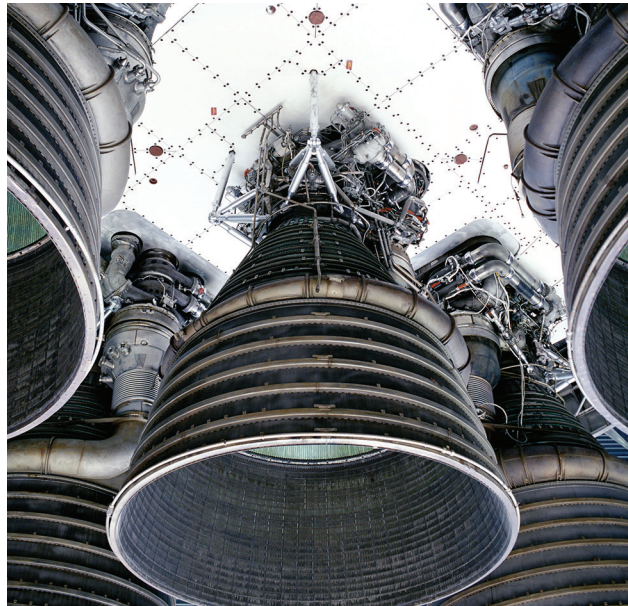
## Aerospace Applications

### Exceeding aerospace applications needs since 1960

Krytox™ aerospace grade oils and greases have established a reputation for providing high-quality, effective solutions in vital applications since the early 1960s:

- Oxygen system couplings, valves, regulators, and seals

- Bearings, fan motors, and rocket engine assemblies
- Liquid-fueled rocket engines and ground support systems
- Anti-friction mounts and engine oil tanks
- Rocket engine assemblies
- Space suit joints and articulation points



### Summary:

Krytox™ lubricants have been trusted in deep-space missions, where their ability to prevent lubricant vaporization in vacuum environments has extended the operational lifespan of critical equipment.

# Teflon™ Fluoropolymers: Meeting the Demands of Tomorrow



## Versatile, Lightweight, and Built to Last

Teflon™ fluoropolymers have revolutionized aerospace and defense technologies by enabling lightweight, durable designs that enhance fuel efficiency and mission readiness. Teflon™ fluoropolymer films, resins, and coatings

can be easily fabricated into thin, smooth-surfaced materials and molded into high-performance mechanical parts. From Mars rovers to advanced military vehicles, the unique properties of Teflon™ fluoropolymers deliver

exceptional thermal resistance, chemical inertness, and dielectric strength, making them indispensable for aerospace and military applications that extend the lifespan of critical components.

## Key Features of Teflon™ Fluoropolymers:

- **Thermal Stability:** Reliable at elevated temperatures—up to 300C (572F) for PTFE, and up to 260C (500F) for FEP and PFA
- **Durability:** Resistant to creep and chemical attack
- **Flexibility:** Maintains performance under repeated bending and twisting
- **Water and Corrosion Resistance:** Ideal for use in caustic and wet environments
- **Dielectric Properties:** Best-in-class insulation under extreme conditions
- **Nonflammable:** Useful in applications where fire hazards must be kept to a minimum

## Military Applications

### Advancing military equipment, vehicles and power supplies

Military operations require durable, state-of-the-art technology that will work without failure in the harshest conditions. The unique properties of Teflon™ fluoropolymers enable this to happen throughout a diverse variety of applications:

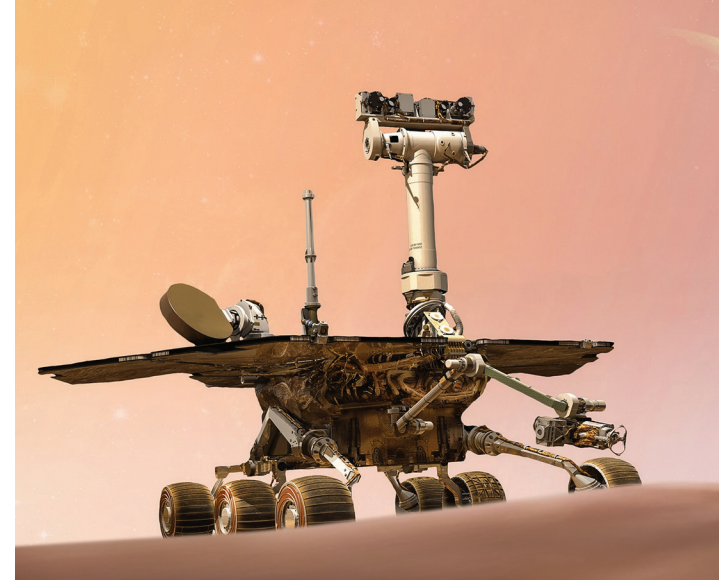
- Pneumatic cylinders
- Aircraft fuel pump systems
- Production tooling
- Handheld and manpack radios
- Military tablets and computers
- Military all-terrain and remote aerial and ground vehicles
- Advanced tactical equipment, communication, and data devices
- Pyrotechnics and munitions used in missile systems

## Aerospace Applications

### Mars rovers, Spirit and Opportunity, included critical components manufactured with Teflon™ fluoropolymers

Teflon™ fluoropolymers contributed to the extended mission life of Opportunity and Spirit. Opportunity maintained operations well past its intended duration of 90 days, lasting 55 times longer than its intended lifespan. Spirit's mission effectively functioned more than 20 times longer than NASA's original plan. Teflon™ fluoropolymers are widely used to improve safety and protect transmissions throughout aviation, spaceflight, and satellite communication applications including:

- Electrical components and electronic device trays
- Aircraft wings
- Tank fuel and throttle box seals
- Control panel surfaces



- Rocket nozzles and thrusters
- Spacecraft solar panels
- Antennas and reflectors
- Satellite components

### Summary:

Teflon™ fluoropolymers are increasingly critical for lightweight composite materials, enabling greater fuel efficiency and improved performance in next-generation aircraft and satellites.



# Viton™ Fluoroelastomers: Unmatched Sealing and Reliability for Mission-Critical Systems

## Engineered for Extreme Durability

With space exploration and satellites relying on advanced engine and propulsion technologies, they require parts durable enough to operate in the most demanding conditions. Repairs and maintenance on these

spacecrafts and satellites is often a costly, resource-intensive process. Renowned for their chemical resistance and mechanical integrity, Viton™ fluoroelastomers are the ideal polymer for sealing applications in these

critical pieces of equipment as they allow for longer equipment life, less frequent replacement of parts during maintenance, and improved safety by avoiding equipment failures.

## Key Features of Viton™ Fluoroelastomers

- **Exceptional Resistance:** Resistant to degradation from extreme temperatures, wear, UV light, and the most aggressive chemicals (fuels, hydraulic fluids, oils, oxidizers, acids)
- **Mechanical Integrity:** Maintains elasticity and mechanical properties in harsh conditions
- **Low Permeability:** Offers superior containment across a broad range of substances
- **Dielectric Strength:** Delivers reliable insulation for sensitive equipment
- **Compression Set Resistance:** Ensures long-term durability and reliable sealing performance
- **Compliance:** Parts fabricated from Viton™ FKM can meet key MIL-SPEC and AMS

## Military Applications

### Ensuring the safety and success of military operations

The critical nature of military operations requires exceptional material performance, durability, and reliability in hazardous, unpredictable environments. Viton™ fluoroelastomers meet stringent military specifications by offering superior, broad-based resistance to permeability, making them ideal for many military applications:

- Protective gear, including boots, helmets, and body armor
- Seals and gaskets in engines, fuel systems, hydraulics, and ammunition storage
- Rubber mounts, bushings, and isolators
- Liners, tubing, hoses, and sheets used for hazardous fluid transfer and containment
- Explosives, pyrotechnics, and booster charge formulations used in munitions

## Aerospace Applications

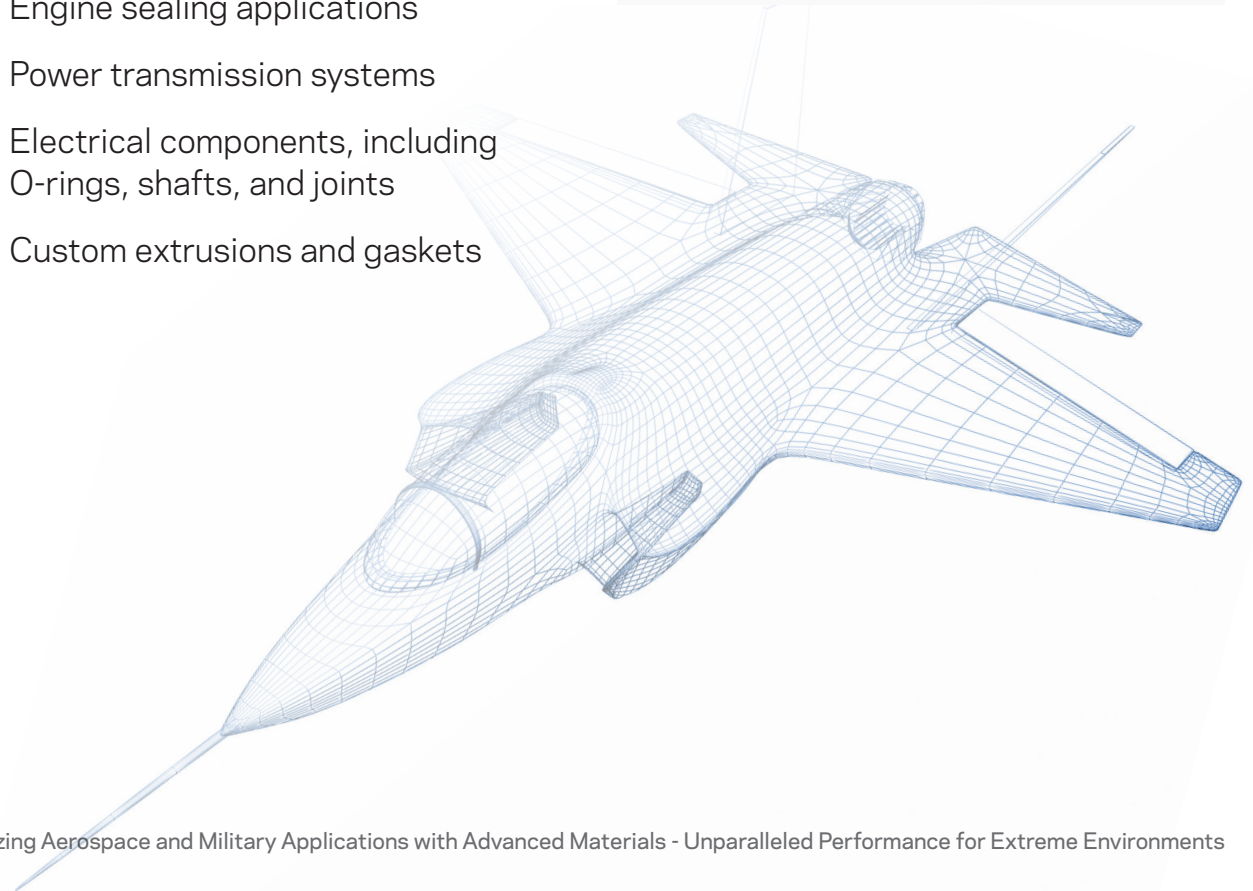
### Accelerating the performance of new aerospace technologies

The superior reliability of Viton™ fluoroelastomers enables extended service intervals and increased safety in a number of essential applications:

- Fuel handling systems, including hoses, pumps and valves
- Engine sealing applications
- Power transmission systems
- Electrical components, including O-rings, shafts, and joints
- Custom extrusions and gaskets

### Summary:

Viton™ fluoroelastomers deliver unmatched reliability in aerospace and military applications, enabling extended maintenance intervals and enhanced safety.



# A history of solving tomorrow's challenges

Chemours is at the forefront of innovation, delivering advanced materials that drive the future of aerospace and military technologies. By combining unmatched performance, reliability, and sustainability, we empower our partners to tackle the toughest challenges in the most extreme environments. We are committed to meeting the rigorous demands of aerospace and military operations and advancing global efforts toward a more sustainable future.

To learn more about Chemours offerings, please visit [chemours.com](https://chemours.com)

Discover how Chemours' advanced materials can help you meet today's toughest challenges while preparing for tomorrow's opportunities. Contact our Krytox™, Teflon™, and Viton™ teams to start building solutions together.

**Contact the Krytox™ Team**

[www.krytox.com/en/contact](https://www.krytox.com/en/contact)

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**Contact the Viton™ Team**

[www.viton.com/en/contact-us](https://www.viton.com/en/contact-us)

## Responsible Manufacturing at Chemours

Responsible Manufacturing is Chemours' environmental approach to the invention, production, and use of high-performance materials essential to societal advancement. We manufacture our materials conscientiously in ways that incorporate circularity, limit environmental impact, lower natural resource consumption, mitigate emissions, and keep our communities safe. In doing so, we're taking meaningful steps toward meeting our ambitious Corporate Responsibility Commitment goal of reducing fluorinated organic chemicals emissions to air and water by 99% or greater by 2030. For more information, visit <https://www.chemours.com/en/chemistry-in-action/critical-chemistries/responsible-manufacturing>



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