

Collaboration with aviation partner enables decades of innovation

INTRODUCTION

Fluorosilicones are versatile, high-performance silicone materials formulated to resist mechanical failure caused by exposure to hydrocarbons such as fuels and solvents. In addition, they remain flexible at extremely low temperatures and resist breakdown at very high temperatures.

The Avantor® NuSil® brand has been at the forefront of fluorosilicone formulation and innovation for decades. Working with our customers, we have helped address specific material performance and operational issues, improving materials for use in aircraft applications, including O-rings, gaskets, seals, coatings, gap fillers, adhesives, sealants and encapsulation solutions.

DEMONSTRATED EXCELLENCE IN SILICONE CUSTOMIZATION

NuSil has a strong, collaborative relationship with a major U.S.-based aviation company that spans more than three decades. The company produces a wide range of military and civilian aircraft, as well as other aerospace products and systems that require NuSil silicones and fluorosilicones in multiple applications.

"This company has a culture of forward-looking innovation, pushing technology to the next level," said Brian Burkitt, Director, Aviation and Defense. "We have a successful partnership with them because we operate in the same fashion, investing in advancing silicone technologies and supplying innovative solutions to solve our customers' challenges."

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The aviation company initially contacted NuSil representatives when they needed electrically conductive gap-filler materials for use on various aircraft surfaces. The material was required to fill very small cavities between surface elements in close proximity to electronics needing protection from static discharge. Having the right filler material to protect these electronics was critical to ensure the aircraft's systems operated without failure.

Equally important, the company required the ability to customize the flow rate, viscosity, conductivity and cure rate of the material — four key performance parameters — to match its application requirements. These advancements would help simplify the handling of the material, making it easier to apply while minimizing the amount of time the aircraft was held in a maintenance status rather than available for missions. Ultimately, the company selected NuSil for the brand's trusted reputation in the industry as a source of highly purified silicone materials, as well as for its flexibility in offering a customized material, meeting the key performance requirements for this application. "Not only were we able to formulate what the customer needed, but our material also had better ultraviolet resistance and better elastomeric properties over time and resisted degradation when exposed to altitudes up to 80000 feet — critical properties for use on the customer's aircraft," Burkitt said.



COLLABORATING ON NOVEL FLUROSILICONE SOLUTIONS

Successful implementation of a customized NuSil brand gap-filler material for the aviation company led to a new challenge: optimizing fluorosilicones for use in aircraft areas exposed to solvents and fuels. Standard silicones, known as dimethyl silicones, have some inherent solubility than fluorosilicones and absorb fuels and other hydrocarbon-based solvents more easily. When this occurs, dimethyl silicones swell, weakening the silicone network with a negative impact on mechanical properties and loss of dimensional shape.

Fluorosilicones are formulated to be less soluble, so they resist swell and maintain physical properties and dimensional shape. The aircraft company needed fluorosilicones for filling gaps in areas on the lower side of aircraft fuselages. These areas have a higher risk of exposure to fuels and solvent contaminants.

In addition, depending on the aircraft and the missions it performs, these exteriors are also subject to wide temperature variations, from extremely low temperatures at high altitudes to high heat generated by exhausts. These gap fillers are crucial to ensuring that the aircraft's exterior is completely sealed — and remains sealed — without requiring constant maintenance.

NuSil brand fluorosilicone gap fillers were customized to meet these requirements. This led to more collaborations with this company to apply fluorosilicones to additional areas of their aircraft, such as windshield coatings, adhesives and sealants.

REDUCING CURE TIME BY 95%

As the aircraft company and NuSil continued to work together to improve the use of fluorosilicones across a range of applications, one goal became increasingly important: significantly reducing the cure rates for adhesives, spray-on coatings and gap-filler materials.

"Turnaround time is critical for the aircraft this company supplies," Burkitt said. "The longer it takes for coatings or adhesives to cure, the longer the aircraft is out of action, increasing operational complexity and costs."

AVIATION AND DEFENSE — FLUOROSILICONES CASE STUDY

Well-versed in silicone technology, NuSil experts worked to optimize product formulations, adjusting the ratio of certain components to initially reduce cure times from seven days to 72 hours. After further activities to improve the formulation, cure time was reduced to just eight hours for fluorosilicone films and self-adhering sealant strips — a 95% decrease in cure time.

Reducing the downtime from one week to essentially one shift not only made the aircraft available for critical missions more quickly but also potentially lowered the cost of maintenance and provided fleet managers with more flexibility in scheduling quick-turnaround requests.

A PARTNERSHIP FOR OVER 30 YEARS

Successful collaboration with this customer to deliver customized fluorosilicone technology led to new project opportunities for the customer's aircraft — from custom-engineered adhesives, sealants and coatings to gels, foams and small-volume, precision-manufactured fluorosilicone parts. The partnership continues today, and the NuSil brand is a trusted choice to satisfy the customer's need for innovative materials that can be tailored to their unique requirements.

"Our decades of expertise, our processes and our proprietary technology allow us to customize silicones for our customers' end application and performance needs," Burkitt said. "Our ability to meet what are often very demanding requirements for applications in aviation, among other areas, reflects only some of the key advantages of choosing NuSil over other brands."

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When your advanced applications require high-performance fluorosilicones, the NuSil team is ready to supply you with the products you need.

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