

High-Performing, Low-Temperature-Operating, Long-Lifetime Aerospace Lubricants

For use in aerospace and terrestrial applications

Long-duration space exploration will require spacecraft systems that can operate effectively over several years with minimal or no maintenance. Aerospace lubricants are key components of spacecraft systems. Physical Sciences Inc., has synthesized and characterized novel ionic liquids for use in aerospace lubricants that contribute to decreased viscosity, friction, and wear in aerospace systems. The resulting formulations offer low vapor pressure and outgassing properties and thermal stability up to 250 °C. They are effective for use at temperatures as low as -70 °C and provide long-term operational stability in aerospace systems. In Phase II, the company scaled several new ionic liquids and evaluated a novel formulation in a NASA testbed.

The resulting lubricant compounds will offer lower volatility, decreased corrosion, and better tribological characteristics than standard liquid lubricants, particularly at lower temperatures.

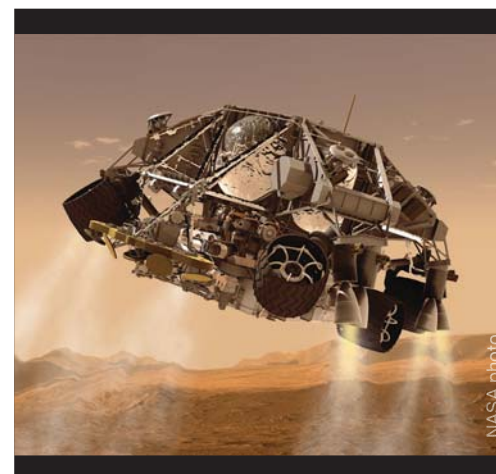
Applications

NASA

- ▶ Aerospace systems that require minimal or no maintenance over extended periods of time:
 - Rovers
 - Machinery used to construct lunar habitats

Commercial

- ▶ Industrial transportation systems
- ▶ Construction vehicles
- ▶ Military vehicles and equipment
- ▶ Gyroscope bearings on satellites



Phase II Objectives

- ▶ Synthesize and characterize 12 novel (>98 percent purity) ionic liquids
- ▶ Establish vapor pressures <math><10^{-7}</math> Torr at 25 °C and stability up to 250 °C
- ▶ Demonstrate a reduction in corrosion and a 20 percent viscosity decrease from -70 °C to +60 °C
- ▶ Demonstrate a lower coefficient of friction (COF) and a reduction of wear effects of lubricant formulations
- ▶ Scale four ionic liquids to 25 grams each
- ▶ Achieve a lower COF and reduced wear and volatility in a NASA testbed

Benefits

- ▶ Low volatility
- ▶ Chemically stable
- ▶ Excellent tribological characteristics at low temperatures

Firm Contact

Physical Sciences Inc.
Prakash Joshi
joshi@psicorp.com
20 New England Business Center
Andover, MA 01810-1077
Phone: 978-689-0003

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