# NASA SBIR/STTR Technologies

## High Energy, low temperature gelled bi-propellant formulation for long-duration in-space propulsion

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## Identification and Significance of Innovation

Gelled MON-30/Propane propellants are the first in a family of advanced, space-storable, cryogenic gelled bipropellant formulations specifically designed for long duration in-space missions. The space-storable propellants synthesized in Phase I will reduce spacecraft power, weight, and complexity resulting in increased reliability and lower cost deep space missions. These propellants do not require heating and stirring, exhibit low vapor pressure, and possess reduced toxicity. A competitive Isp-vac of more than 360 seconds is predicted.

**Enabling technology for:**

•in-space propulsion systems with minimal use of heaters for long-duration missions

•Mars in-situ resource utilization (gelled LOX and Methane with reduced boil-off)

•Earth-to-orbit (reduced toxicity, reduced boil-off)

## Technical Objectives

•Produce and characterize gelled propellants

- •Synthesis of gels in test quantities
- •Determine rheological properties and flow behavior
- •Evaluate the effects of loading and the effects on hypergolicity

•Enable tank-to-exhaust system design studies by incorporating models for gel rheology and flow behavior into NASA's Generalized Fluid System Simulation Program (GFSSP).

•Validate models through hot fire tests

## Work Plan

•Produce test quantities of loaded and unloaded MON-30 and propane gels at US Army AMRDEC facilities

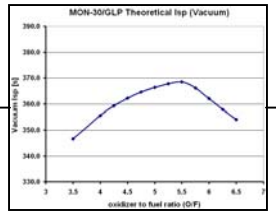
•Determine gel properties such as viscosity, vapor pressure, and freezing point

•Include gel rheology models and develop loss factors for major spacecraft propulsion system components

•Conduct hot fire tests at US Army AMRDEC facilities

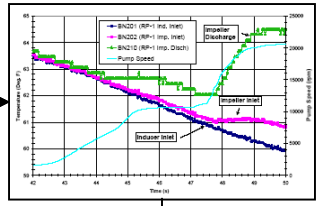
•Validate models with test results

**Gel Formulation**



**Gel Mixing Test Quantities**

**Gel System Tool Development**



**Gel Testing/Validation**

## NASA Applications

Spacecraft attitude control, orbit insertion, translunar injection, lunar descent and ascent, trans-Mars injection, Mars descent and ascent, as well as long term on-orbit propellant storage depots. Lessons learned can point the way for extension of gels to earth-to-orbit applications.

## Non-NASA Applications

Airbag inflators for automobiles, emergency escape systems for aircraft, underwater propulsion, demolitions of structures, and high-performance upper stage and divert & attitude control system (DACS) applications, especially for shipboard deployment of the Kinetic Energy Interceptor.

## Firm Contacts

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