MODPROP MODULAR PROPULSION

1 TANK, 1 PROPELLANT, 2 CAPABILITIES

ModProp resupply for satellite propulsion (artists concept)
Credit: AFRL

KEY BENEFITS RELATIVE TO HYDRAZINE

- Increased propulsion-system delivered performance
  - › Reduced footprint for same total impulse
  - › Increased total impulse for the same volume
  - › Standardized mechanical and electrical interfaces for spacecraft integration
  - › Standardized refueling interface and propellant for satellite system architectures
  - › Enables responsive launch
  - › Enables sustained maneuver
  - › Provides refuel capability via depot/servicer or "direct inject"
  - › Provides for replaceability of failed/worn thrusters
  - › Provides for upgrade of thruster module for new capability/repurpose
  - › Propulsion module for modular "minimaneuver enhancement vehicle"
  - › Reduced ground operations effort
  - › Accelerated Spacecraft Assembly
- Integration and Test (AI&T)
  - › Accelerated spacecraft fueling
    - » Decreased personnel
    - » Decreased equipment overhead

WHAT IS IT?

Modular Propulsion (ModProp) will enable U.S. Space Force and U.S. Space Command to perform Dynamic Space Operations (DSO), Tactically Responsive Space (TacRS), and Space Mobility and Logistics (SM&L) across the Space Domain. ModProp capabilities are enabled via Advanced Spacecraft Energetic Non-Toxic (ASCENT) propellant, also known as AF-M315E, is an advanced monopropellant formulation developed by the Air Force Research Laboratory (AFRL) Rocket Propulsion Division. ASCENT delivers a 50 percent increase in density specific impulse over the present state-of-the-art hydrazine monopropellant. In addition to its performance advantages, and due to its other improvements over hydrazine, ASCENT enables accelerated operations tempo and even allows space vehicles to be fueled at anytime including from the manufacturer.

DIFFERENTIATED THROUGH DELIVERED PERFORMANCE

Similar to hydrazine, ASCENT monopropellants are decomposed by a reactor based thruster to produce high temperature and velocity gas. Like hydrazine, the reactor requires a minimum preheat temperature to ensure reaction. ASCENT differentiates itself from hydrazine through:

1. Significantly higher delivered performance
2. Greatly reduced hazards

First, ASCENT's high density results in great volumetric efficiency resulting in greater delivered velocity impulse from similarly sized systems or ability to use smaller systems with equal delivered velocity impulse. It provides flexibility we have not had in more than 50 years. Secondly, ASCENT's reduced hazards reduce required crew training, size, and personal protective equipment. Space vehicle fuel loading operations are significantly simplified and can be done without shutting down launch preparations, greatly accelerating launch operations. ASCENT is class 1.3C DoT with Class 1.4 for shipping.

Close-up of the ASCENT propellant.
Photo Credit: R. Fair/Media Fusion

SUMMARY

ASCENT provides performance and operability capabilities to the end user for a variety of platform envelopes and mission objectives. It accelerates spacecraft integration and fueling operations. ASCENT provides capabilities to the USSF for sustained maneuvers.

ASCENT

Find more information about the ASCENT program including a video, poster and additional reading.

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ABOUT AFRL

The Air Force Research Laboratory (AFRL) is the primary scientific research and development center for the Department of the Air Force. AFRL plays an integral role in leading the discovery, development, and integration of affordable warfighting technologies for our air, space, and cyberspace force. With a workforce of more than 11,500 across nine technology areas and 40 other operations across the globe, AFRL provides a diverse portfolio of science and technology ranging from fundamental to advanced research and technology development. For more information, visit: www.afresearchlab.com.