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Green Propellant Infusion Mission

Fueling the future with safer, cheaper, environmentally sound propellant alternative

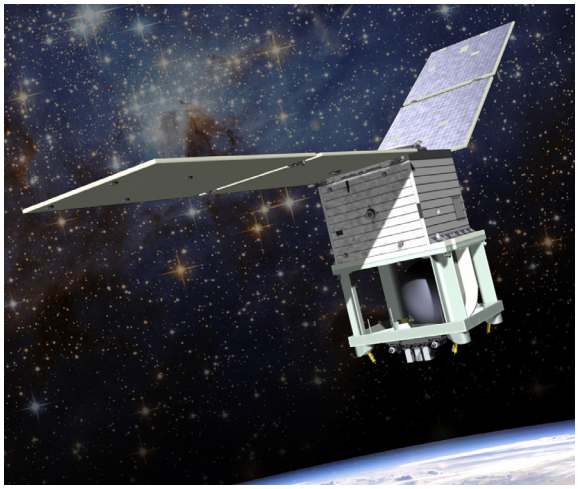
Through the Green Propellant Infusion Mission, NASA is developing a "green" alternative to conventional chemical propulsion systems for next-generation launch vehicles and spacecraft. With this green propellant, launch vehicle and spacecraft fuel loading will be safer, faster and much less costly. That improved operational environment will change ground processing time from weeks to days – delivering an enabling technology to benefit commercial spaceports operating across the nation.

NASA and Ball Aerospace & Technologies Corp. of Boulder, Colorado, are collaborating on the mission, which seeks to improve overall propellant efficiency while reducing the toxic handling concerns associated with the fuel hydrazine. The space technology infusion mission also strives to optimize performance in new hardware, system and power solutions while ensuring the best value for investment and the safest space missions possible.

GPIM is scheduled to launch aboard a SpaceX Falcon Heavy rocket in 2019 as part of the Air Force Space Test Program's STP-2 mission.

The technology demonstration will validate the practical capabilities of a Hydroxyl Ammonium Nitrate fuel/oxidizer blend called AF-M315E. This innovative, low-toxicity propellant, developed by the U.S. Air Force Research Laboratory at Edwards Air Force Base, California, is a high-performance, green alternative to hydrazine.

NASA and its partners maintain some of the strictest safety standards for storage, transport and use of rocket fuels. While all such fuels can be dangerous to handle without the proper safety precautions, AF-M315E has significantly reduced toxicity levels compared to hydrazine, making it easier and safer to store and handle. It also requires fewer handling restrictions and potentially shorter launch processing times, resulting in lowered costs.

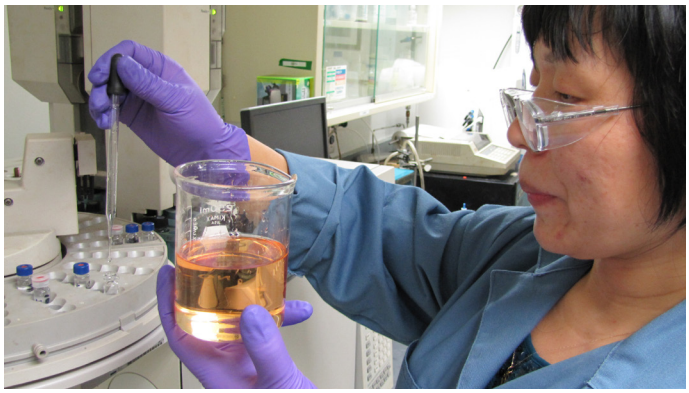


In this Ball illustration, the GPIM flight vehicle is carried to orbit on a Ball Aerospace SmallSat to test an innovative, efficient alternative to toxic conventional chemical propellants. (Ball Aerospace)

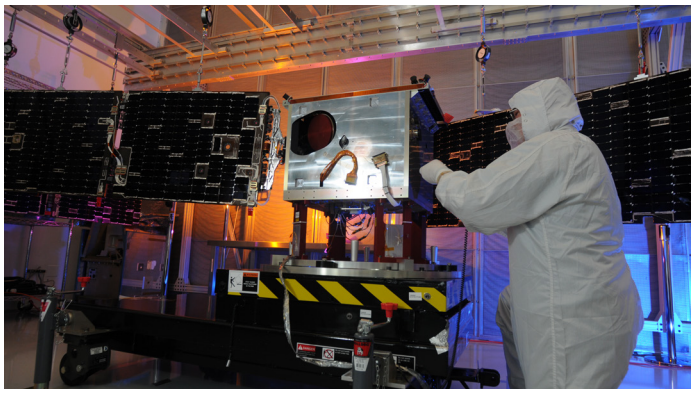
AF-M315E also is expected to improve overall vehicle performance. It is approximately 45 percent denser than hydrazine, meaning more of it can be stored in containers of the same volume. It delivers a higher specific impulse, or thrust delivered per given quantity of fuel, which provides roughly a 50 percent increase in spacecraft maneuvering capability for a given propellant volume. Additionally, AF-M315E has a lower freezing point, requiring less spacecraft power to maintain its temperature than an equivalent volume of hydrazine.

The GPIM payload will operate onboard a Ball compact small satellite, or SmallSat. During the test flight, researchers will conduct orbital maneuvers to demonstrate the performance of the propellant during attitude control operations and orbit lowering.

Once proven in flight, AF-M315E and compatible tanks, valves and thrusters will offer a viable, effective solution for future missions for NASA and the commercial spaceflight industry.



An Aerojet Rocketdyne researcher examines a container of AF-M315E during preparation for flight testing. (Aerojet)



Ball researchers, seen here testing the Ball SmallSat in a Ball Aerospace clean-room facility, and their NASA and Air Force partners will launch GPIM to space in 2019. (Ball Aerospace)

The project is spearheaded by Ball Aerospace, home to Chris McLean, GPIM principal investigator. Co-investigators are at Aerojet Rocketdyne Corp. in Redmond, Washington; NASA's Glenn Research Center in Cleveland, Ohio; NASA's Goddard Space Flight Center in Greenbelt, Maryland; NASA's Kennedy Space Center in Florida; and the Air Force Research Laboratory at Edwards Air Force Base, California. Additional support is provided by the U.S. Air Force Space and Missile Systems Center at Kirtland Air Force Base in New Mexico.

Managed by NASA's Marshall Space Flight Center in Huntsville, Alabama, GPIM is part of NASA's Technology Demonstration Mission Program within the Space Technology Mission Directorate. NASA's Space Technology Mission Directorate is innovating, developing, testing and flying hardware for use in NASA's future missions.

Demonstration Details

The demonstration mission will last approximately 13 months. Planned in-orbit maneuvers include attitude control demonstrations; spacecraft pointing and hold; thruster performance characterization and mapping; and orbit lowering.

The project is intended to bring AF-M315E and compatible tanks, valves and thrusters to an operational level for future NASA and commercial spaceflight missions.

For more information about NASA's investments in space technology to enable future science and exploration, visit: **http://www.nasa.gov/spacetech**

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