National Aeronautics and Space Administration

Robotics, Automation and Control

Monitoring and Control of Each Nanosatellite within a Cluster of Nanosatellites

A low-cost propulsion, navigation, and power sharing technology

NASA has developed an innovative combination of a Magnetometer, low-powered ElectroMagnets, and Resonant Inductive Coupling (MEMRIC) to create and control relative positioning of nano satellites within a cluster. This is a game-changing approach to enable distributed nanosatellite (nanosat) clusters. The focus is on low-cost propulsion, navigation, and power sharing. Each of these functions can share the same basic technology. With the combination of a magnetometer, low-power electromagnets, and resonant inductive coupling, several nanosats can be clustered without the need of propellant-based propulsion systems, or GPS for relative positioning. By separating distinct subsystems into their own nanosat and producing them as generic, off-the-shelf components, the mission-design process is simplified, enabling the selection of the number of subsystem components that is most beneficial to the mission. The cost saving in the design cycle will pay for the extra, off-the-self power unit.

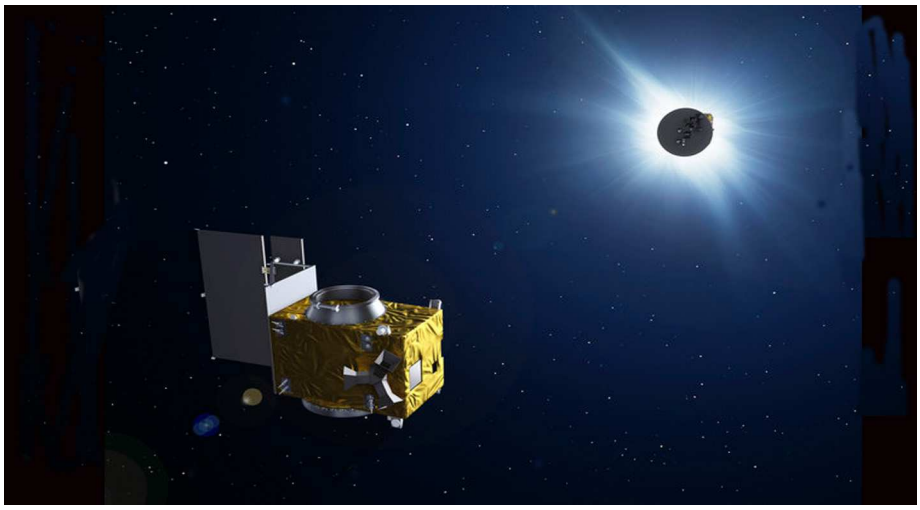
BENEFITS

- Reduced non-recurring development cost
- Increased reliability
- Reduced time from mission concept to flight
- Reduced cost of mission operations
- Increased efficiency with independent attitude control of basic units
- Evolution of cluster capabilities

technology solution

THE TECHNOLOGY

The key to ElectroMagnets, and Resonant Inductive Coupling (MEMRIC) is the use of low-power electromagnets for relative motion control, a magnetometer for relative distance determination, and a resonant inductive coupling system for power sharing. Traditional satellite buses house all of the major subsystems in one package. Nanosat clustering allows for the distribution of subsystems; each nanosat housing a specific subsystem (functional fractionation). MEMRIC makes this type of clustering possible, allowing a collection of system-specific nanosats to serve as a set of basic functional building blocks. Power collection, communication, navigation, computational, and propulsion units can all be combined to meet various mission requirements, greatly reducing the need for non-recurring design efforts. As new technologies for power, communications, and computation become available, these technologies can be incorporated into standardized nanosat units without the need for redesigning the other units or an entire system. Thus, the capabilities of spacecraft clusters composed of MEMRIC-enabled nanosats can evolve at the pace of technology, without incurring the large costs inherent to redesign of large, complex spacecraft.



Nanosatillite

APPLICATIONS

The technology has several potential applications:

- Space Exploration
- Earth Observation Systems
- Scientific Research
- CubeSat/NanosatelliteSystems

PUBLICATIONS

Patent Pending

More Information

National Aeronautics and Space Administration

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