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Author: Mr. Erik A. Hoff  
BLUECUBE Aerospace, United States

Mr. Kevin Simmons  
BLUECUBE Aerospace, United States

TRACKING AND AVOIDING SPACE DEBRIS USING CUBESATS

**Abstract**

Space debris poses a formidable challenge in Earth's orbit, necessitating innovative solutions for effective tracking and mitigation. The proposed strategy involves deploying a constellation of CubeSats, each armed with advanced radars, to monitor and manage the growing space debris population. With a multitude of objects in orbit, the risk of collisions with operational satellites and spacecraft is substantial.

The heart of this initiative lies in the deployment of 8U CubeSats, each equipped with six radars providing a 90-degree by 90-degree scope. This configuration ensures comprehensive coverage, allowing these CubeSats to monitor space debris from all directions. The compact 2x2x2 design enables them to be efficiently stacked together on launch vehicles, allowing for multiple deployments in a single mission. This approach not only optimizes launch resources but also facilitates a swift and widespread deployment of the tracking system.

To avoid signal interference and clutter among CubeSat, specialized systems are incorporated. These systems enable CubeSats to differentiate their radar signals, ensuring a clear and accurate representation of the surrounding space debris. Moreover, a larger 24U CubeSat variant will be developed, housing an advanced radar system with a smaller scope. This enables a more focused tracking approach, allowing the CubeSat to concentrate on a specific object of interest.

The 24U CubeSat is also equipped with a camera, providing a visual perspective of the tracked objects. This dual-functionality enhances the identification process, allowing for more precise analysis and cataloging of space debris. The CubeSats are equipped with Reaction Control System (RCS) thrusters to enable precise orientation and maneuvering, facilitating a directed focus on identified objects.

The CubeSats are designed to be energy-efficient in terms of power, utilizing solar panels to generate power continuously. This ensures a constant energy supply, allowing the CubeSats to operate seamlessly or focus on specific areas of interest within their orbital path. Strategically placed in orbits that enable scanning at various altitudes, these CubeSats contribute significantly to tracking and managing space debris. This comprehensive approach aims to minimize the risks associated with space debris, safeguarding operational satellites, and ensuring the sustainable use of Earth's orbital environment.