AEROSPACE

A defining feature of a standard CubeSat is its containerization—the shape, volume and design—which makes it rideshare-friendly. This shape has been historically important since these devices have comprised a minor part of a total payload. Containerization has ensured that CubeSats would not endanger the launch vehicle or primary payload on rideshare missions.

Without the need for rideshare, satellite design options can be expanded beyond the CubeSat. DiskSat is an alternate approach to containerization, providing the benefits—standardized launch interface, low launch costs, and simple mechanical design—with large aperture, surface areas that can be dedicated to large antennas or instruments that need exposure to space, and high power.

The plate-shaped DiskSat satellite measures 1 m in diameter and 2.5cm thick and can accommodate the volume of a 20 U CubeSat. For launch, several DiskSats can be stacked to fit within a launch vehicle's fairing and deployed one at a time after the launch vehicle reaches orbit—an ideal approach to building large constellations of small spacecraft, allowing 20 or more satellites to be containerized in a single small launch vehicle.

An Alternate Approach to Small Satellite Construction

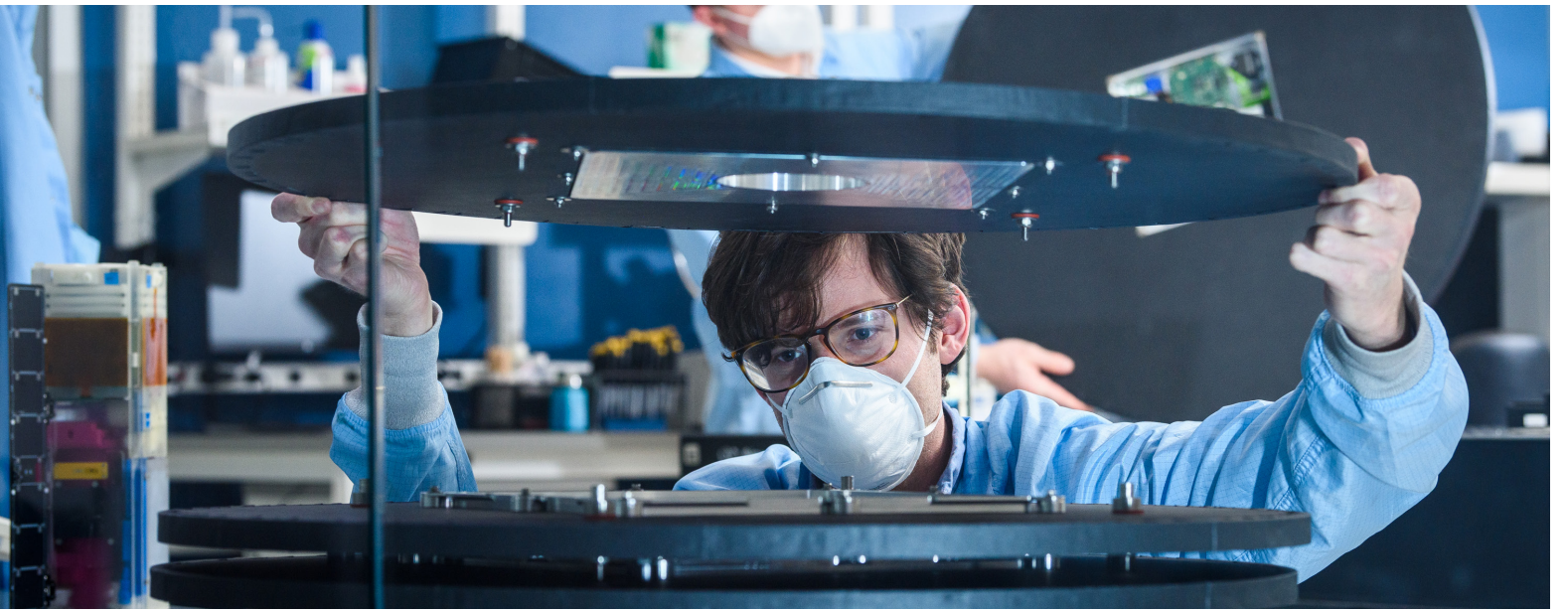
The DiskSat concept originated as part of a study of large constellations using CubeSats. Recognizing the mission would need more power and aperture than a CubeSat could supply, Aerospace engineers and scientists reevaluated whether a standard CubeSat would be the best shape for a mission. Additionally, placing the constellation in well-defined orbits would require dedicated small launch vehicles.

With DiskSat, the payload and bus are decoupled across the standard interface, and the payload is no longer volume constrained. This promises a variety of improvements such as shorter design, build, integration, and test schedules, all accompanied by lower costs.

Like the traditional CubeSat, the DiskSat design is adaptable. Dimensions can be increased or decreased to match the launch vehicle, without changing the deployment system. In most DiskSats, the electronics and other subsystems that comprise a typical small spacecraft are arranged within the internal volume. With more payload volume available and a flat layout making internal components more easily accessible, the build and test process is simplified.

DiskSat Facts

- DiskSat 1 m in diameter and 2.5 cm thick
- Offers high power and large aperture
- Can accommodate the volume of a 20 U CubeSat
- Will use electric propulsion for maneuvering
- Can operate down to approx. 200 km because of low drag
- Will be tested with its launcher mechanism in 2024



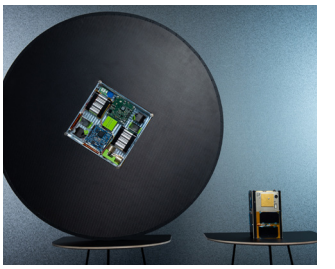
Missions involving radio frequency and other kinds of signaling can benefit from DiskSat's larger surface area. The high power and low mass make electric propulsion for maneuvering an ideal option. Additionally, while typical satellites do not operate below 300-400 kilometers in altitude, DiskSat's low drag means it can potentially operate down to about 200 kilometers with electric propulsion—an ability that can provide better resolution or sensitivity.

DiskSat Demonstration Mission for NASA

NASA's Small Spacecraft Technology program, residing within the agency's Space Technology Mission Directorate hosted at NASA's Ames Research Center, is sponsoring the DiskSat demonstration mission.

In 2024, four spacecraft will be deployed in low Earth orbit to verify baseline DiskSat performance. The mission will also test the DiskSat launch dispenser mechanism, essential to the mission as dispensing must be done in a way that prevents contact between satellites. The four demonstration satellites will use electric propulsion and operate in pairs: one pair will fly at low altitude, and the other will demonstrate high-altitude operations to showcase DiskSat's maneuverability.

Beyond LEO and Earth science, there is potential for DiskSat to perform in lunar communications and resource mapping missions, and the form factor has appeal for the wider space and defense sectors.



DiskSat compared with a traditional 1.5U CubeSat.

DiskSat is a plate-shaped satellite (1 meter in diameter, 2.5 centimeters thick) that could provide the required power and aperture needed for future missions.

The Aerospace Corporation | 2310 East El Segundo Boulevard, El Segundo, California 90245-4609 USA | www.aerospace.org