AEROSPACE

Space is rapidly evolving into a more dynamic and challenging domain, requiring more resilient and responsive architectures and processes. These processes will accelerate and streamline access to orbit while harnessing cutting-edge innovations to provide greater flexibility and adaptability for space systems.

Slingshot 1 is a 12U CubeSat launched by Aerospace in July 2022. Hosting 19 payloads requiring on-orbit testing for evolution and maturity, Slingshot 1 carries a myriad of autonomous technologies, robotics, novel propulsion, onboard processing, and communications systems.

Slingshot leverages the potential of open standards and nonproprietary interfaces to simplify and expedite payload development and integration. The mission's modular architecture and autonomous technologies are a precursor to a new era of increased space system agility, resilience and extended spacecraft lifespans by allowing for onboard components to be more efficiently upgraded or replaced as needed.

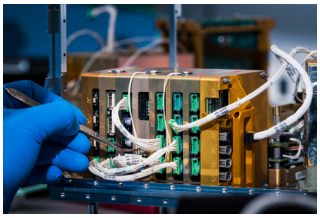
Customized interfaces have traditionally played a major role in payload development and turnaround times. With Slingshot, payloads conform to a basic standard that can plug in and work even if late in the development timeline.

Faster Development, Faster Access to Space

Current satellite mission architecture relies predominantly on methods tailoring to different proprietary standards, requiring lengthy development cycles to ensure commands to payloads, power distribution, and data systems are operating effectively. Slingshot's modular approach provides greater cost and schedule efficiencies, enabling opportunities to accelerate research, development, and testing. The simplification of interfaces presents tremendous advantages to getting payloads to space.

Modular Payloads, Open Standards

The payloads onboard Slingshot 1 are integrated through a standard interface, enabling a broad range of new technologies to plug together with greater flexibility and adaptability. The experimental payloads heading to orbit include Vertigo, a modular attitude control system that can enable satellites to point at targets on Earth; Blinker, a GPS transponder for space traffic management; HyPer, a hydrogen peroxide thruster; and LaserComm, a next-generation space-to-ground laser communication downlink. In addition, they are joined by payloads that provide the enabling capabilities of the modular architecture to work.



Slingshot

- is a 12U CubeSat prototyped in the Aerospace xLab facility
- launched July 2022 aboard Virgin Orbit's Straight Up Mission
- is carrying 19 separate payloads, 16 of which are Aerospace-developed technologies
- uses modular architectures to allow for technology upgrades to get to space more quickly
- operates as a testbed for new technologies to mature onorbit

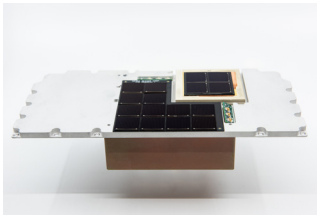
HANDLE | An essential component of mission operations is Handle, an electrical interface module for satellite payloads designed to streamline the integration using “plug and play” technology. Previously, payloads had to be designed with a specific, proprietary bus in mind. Handle enables the other payloads to communicate with the host satellite bus and other payloads regardless of underlying bus implementation and design specifics. Handle also eliminates the need for any tailoring of the flight system to incorporate new payloads, allowing for manifest changes at any time in the development process.

SATCAT5 | The mission will also demonstrate the capability of the Handle module’s SatCat5 Ethernet switch, which will allow communication between payloads using commercial tools and open-source code from the extensive Ethernet ecosystem. SatCat5 is functionally equivalent to commercially available, unmanaged Ethernet switches for home use. Its blend of higher-rate and lower-rate data links allow nearly any device to participate in the same local communication network, regardless of its capability level.

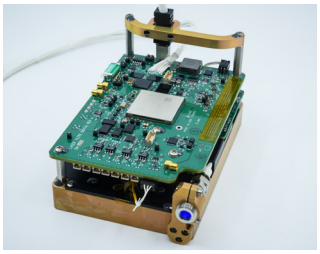
SDR 2.0 | Providing satellite-to-ground communications for Slingshot is Software Defined Radio (SDR) 2.0, a next-generation S-band downlink that can remotely provide firmware updates of onboard hardware to suit customer needs. Slingshot is enabling a fast track for testing newer, more advanced iterations of commercial technologies, such as SDR, for use in space applications.

STARSHIELD | Starshield protects spacecraft from cyberattacks by detecting signs of cyber intrusion and mitigating attacks onboard the spacecraft. Starshield uses machine learning and other methods including advanced analytics capable of detecting new types of attacks. If an attack is detected, Starshield can automatically intervene to prevent or stop the spread of the attack, moving the defensive capabilities from ground to onboard the spacecraft.

TECHNOLOGY	PAYLOAD	DESCRIPTION
MODULAR TECH	Handle	Plug-N-Play payload electrical interface module
	SatCat5	Onboard ethernet and network routing
	t.Spoon	Modular mechanical interface
	t.Spoon Camera	Plug-n-play camera module
	Starshield	Onboard malware detection
ONBOARD PROCESSING	CoralReef	Coral Tensor Processing Unit (TPU) onboard processing
	t.Spoon Processor	Zynq Ultrascale+ onboard processing
	STarfish	Secure ARM Cortex-M33 onboard processing
COMM	SDR	S-band Software-Defined Radio (SDR) downlink
	KeySpace	Cryptographic services for smallsats
	Lasercom	Next-gen space/ground lasercom downlink
	ROESA	Using Internet of Things (IoT) protocols to connect payloads
BUS TECH	Vertigo	Reconfigurable Attitude Control System (ACS)
	Blinker	GPS transponder for space traffic management
	HyPer	Smallsat, hydrogen peroxide thruster
AI	ExoRomper	AI and machine learning testbed

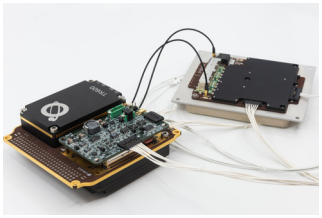


Blinker, Slingshot’s GPS transponder for space traffic management.



Lasercom, Slingshot’s next-gen laser communications downlink.

Handle, Slingshot’s payload electrical interface module.



SDR 2.0, Slingshot’s S-band Software-Defined Radio downlink.

The Aerospace Corporation

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