SpaceLoft® XL Sub-Orbital Launch Vehicle

The SpaceLoft® XL is *UP Aerospace's* workhorse space launch vehicle -- ideal for significant-size payloads and multiple, simultaneous-customer operations.

SpaceLoft® XL is a single-stage unguided sub-orbital launch vehicle flight proven to provide highly reliable, low-cost access to space. The system offers numerous advantages including minimal on-pad effort and simplified pre-launch and launch operations.

The SpaceLoft® XL has an overall height of 6.1 meters, a maximum diameter of 26.4 centimeters, and a maximum lift-off weight (including payloads) of 354 kg in its standard mission configuration.

Our Business headquarters are located in Denver, Colorado with launch operations at Spaceport America in Southern New Mexico. Payload integration services are provided by our business partner Schafer Corporation in Albuquerque, New Mexico.

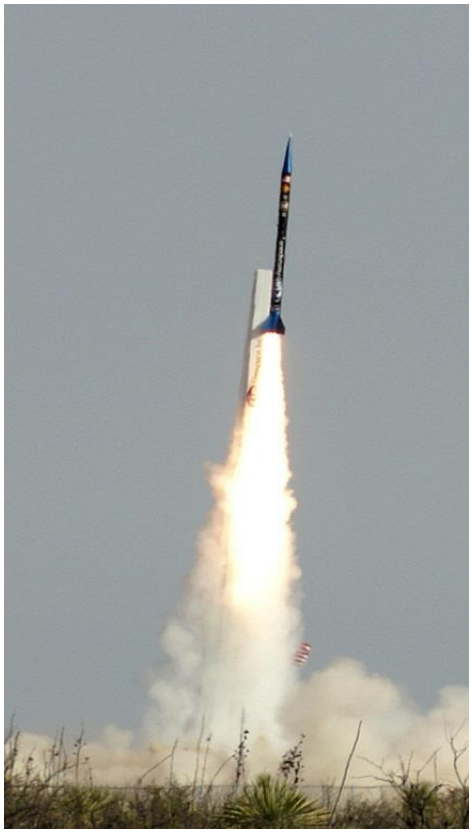
Flight Capabilities

The SpaceLoft® can transport up to 36 kg of payloads and experiments to a standard mission apogee of 115 km. With lower-mass payloads, the rocket can be configured to reach 160 km.

Payload Options

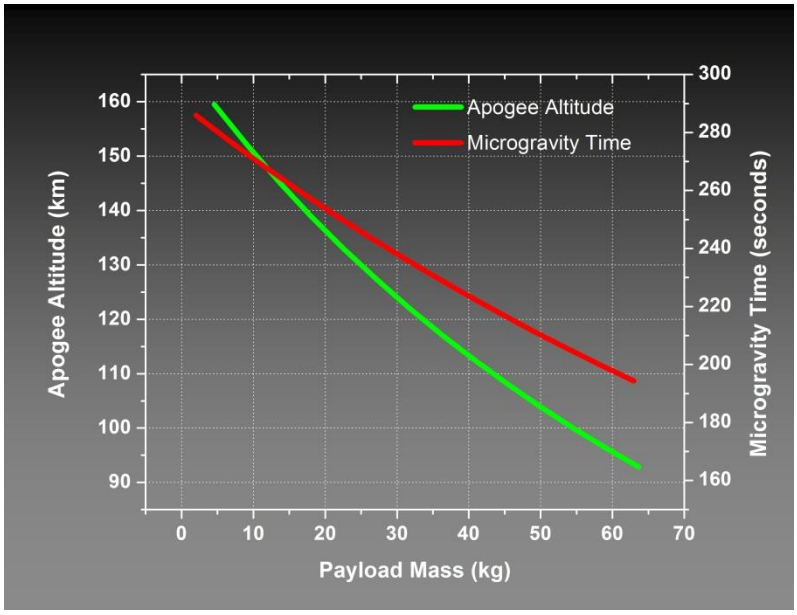
UP Aerospace offers payload systems for simple and reliable transportation and recovery of space-borne payloads and experiments.

Payload options include our patent-pending PTS4 and PTS10 modules (page 4). Internal to each PTS we also provide a Payload Command Module (PCM, page 5), optional Power Modules (PM), and external access connectors for activation and test functions.



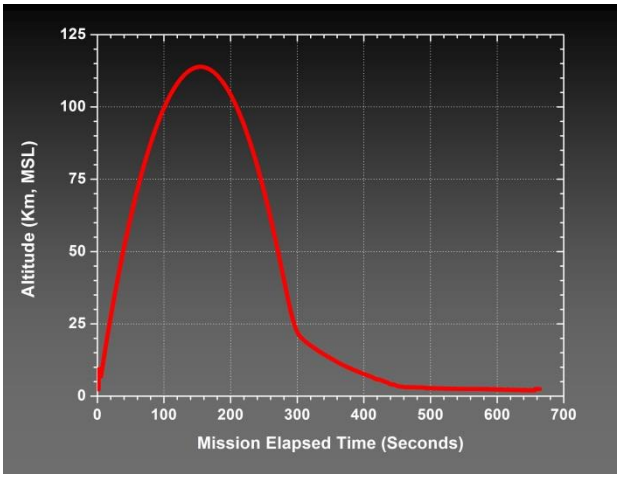
Mission Scheduling

UP Aerospace applies over 6 years of professional aerospace integration and launch management services to efficiently orchestrate every aspect of a mission. From contract to launch, our typical mission schedules span 4 to 6 months.



SpaceLoft® XL Standard Mission Profile

The SpaceLoft® XL standard flight profile is a sub-orbital trajectory that reaches 115 km in altitude and achieves 4 minutes of microgravity time.

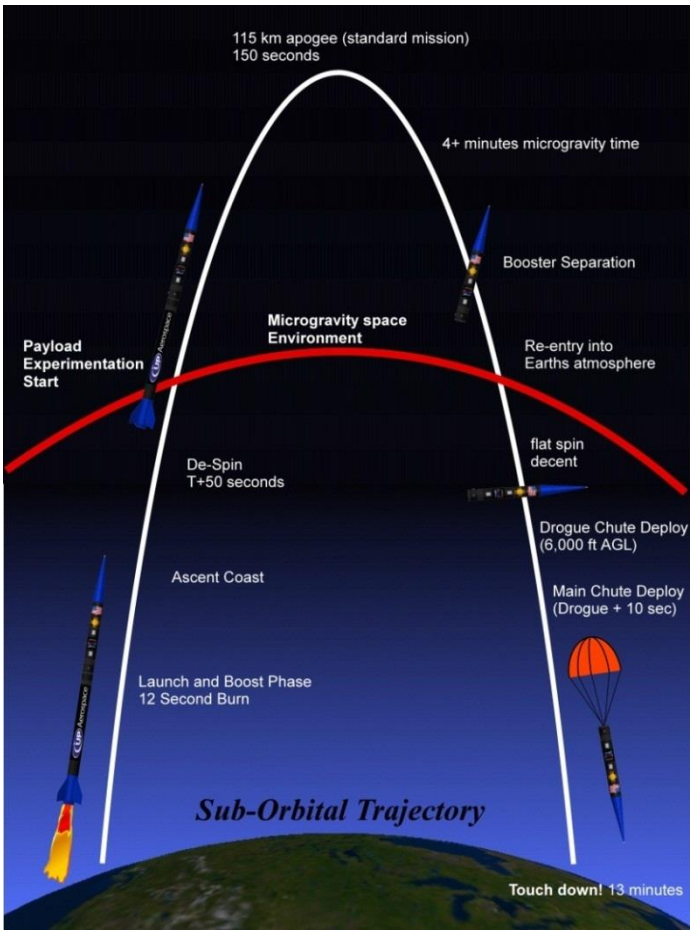


Boost

Lift-off begins with the solid rocket motor ignition and lasts for 12.5 seconds. For maximum trajectory accuracy, the vehicle is spun aerodynamically with the four canted fins at the base of the booster section. At motor burnout the vehicle is at 12.5 km and senses 3 g's of deceleration which diminishes rapidly to near zero over the following 15 seconds.

De-Spin

At T+ 55 seconds the vehicle is exo-atmospheric and the De-Spin system is actuated de-spinning the vehicle to a few degrees per second. Microgravity experimentation usually begins just after de-spin completion.



Recovery

As the vehicle re-enters earths atmosphere, the payload section is separated from the booster allowing the payload section to aerodynamically trim to minimize terminal velocity. At 3.3 km above mean sea level redundant barometric sensor activated avionics initiate the deployment of the drogue. The drogue slows the vehicle and re-orients the payload section vertically for main parachute deployment 10 seconds after recovery initiation.

Touch down on White Sands Missile Range typically occurs 5-6 minutes after the main parachute is fully deployed.

Event	Time (seconds)	Altitude (MSL, km)
Booster Ignition	0	1.4
Booster Burnout	12.5	17
De-Spin System Initiated	55	66.5
Apogee	155	115
Payload Separation from Booster	240	79.5
Recovery Deployment	454	3.3
Vehicle Touchdown	799	1.2

SpaceLoft® XL Flight Environments

Vehicle Acceleration loads

Payloads onboard SpaceLoft experience a variety of axial and radial flight loads during boost , re-entry, recovery, and landing. A summary of these loads are shown in the table below.

Event	Axial Load g's	Radial Load g's
Launch	14	4
Ascent Maximum Acceleration	16	18.5*
Payload Separation	18[f]	5[f]
Atmospheric Re-entry Deceleration	1-2	5 - 9
Recovery System Deploy	5-8	18-12
Vehicle Touchdown	14[‡]	8[‡]

* Based on the maximum spin rate and the inside radius of the PTS module
f 1/100 second duration shock
‡ 1/10 second duration shock

Electromagnetic and RF Environments

A 50-watt radar transponder, operating at the frequency of 4.2 GHz, is in continuous operation on the launch vehicle from T minus 60 minutes through recovery operation. An S-Band transmitter is also operating during the mission providing real-time telemetry.

Vehicle Spin

For maximum trajectory accuracy, the SpaceLoft® XL is spun about its longitudinal axis during the initial ascent portion of the flight. The maximum spin rate is 6.9 cycles per second, which is achieved at 12.5 seconds after liftoff. At T+55 seconds the De-Spin System is activated reducing the spin rate to within a few degrees per second.

Acoustic Exposure

The greatest acoustic pressures occur during the 12.5 seconds of motor operation. Internal sound pressures will typically not exceed 110 dB.

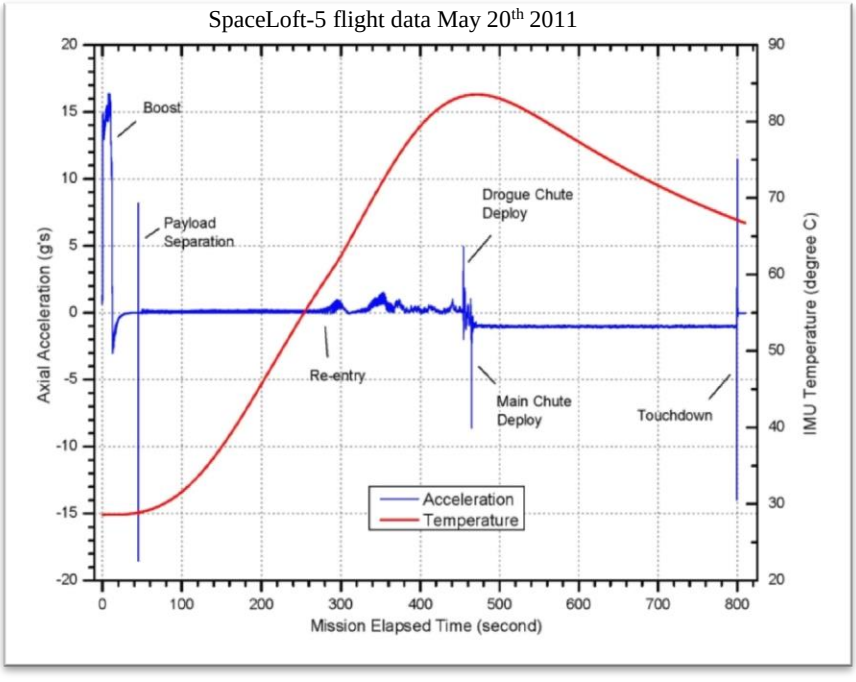
Thermal Exposure

Aerodynamic heating of the vehicle's airframe during flight is the dominant source of thermal energy to internal components. The airframe structure greatly disperses the thermal energy delaying the maximum internal temperature past the microgravity experimentation portion of flight. Maximum measured temperatures generally don't exceed 85 degrees C at parachute deployment. 30 to 60 degrees C is the typical temperature range during the microgravity portion of flight. Care must be taken with components that are mounted close to the access openings and external flow field.

Atmospheric Pressure Change

Pressure within the SpaceLoft® XL payload section diminishes as the vehicle ascends through the atmosphere. Vent holes within the vehicle maintain equilibrium with the ambient pressure throughout the entire vehicle flight.

SpaceLoft-5 flight data May 20th 2011



SpaceLoft® XL Payload Transportation System

PTS Modules – Payload Transportation System

UP Aerospace has developed a patent-pending Payload Transportation System™ (PTS) for simple and reliable transportation and recovery of space-borne payloads and experiments.

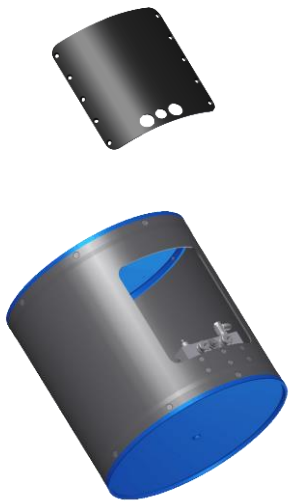
Two styles of PTS modules are available: PTS4 and PTS10. Both are precision machined 6061-T6 aluminum cylinders with end closures for mounting hardware.

Four PTS10 and three PTS4 comprise the five PTS modules that fly on each SpaceLoft mission.

PTS4 Module and access panel

Exposure to the Space Environment

Both PTS designs offer, as a standard feature, opportunities for unrestricted exposure to the space environment through mating access panels in the rocket's airframe. These openings also allow for pre-launch activation of payload electronics and related systems.



PTS10 Module and customizable access panel window to space

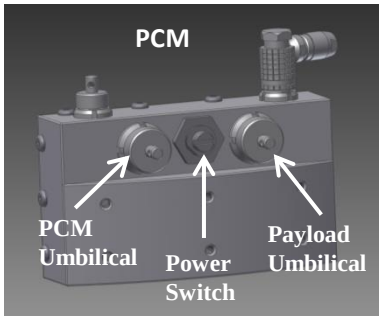
Nose Cone Payload Sections

There are also three payload sections within the nosecone: NC-1, NC-2, and NC-3. They have no access to space and are ideal for bulk or unusually shaped payloads. Payloads mounted in the nose section that require power and external access to space can be combined with the PTS4-4 location.

	NC-1	NC-2	NC-3	PTS4-4	PTS10-X
Maximum Inside Height (cm)	35.6	34.3	21.6	8.3	23.5
Maximum Inside Diameter (cm)	8.4	15.9	20.3	24.8	24.8
Maximum Payload Volume (cm^3)	868.5	5,915.7	6,980.9	3,982.0	11,323.4
Maximum Useable Payload Weight (kg) excluding the PTS module	0.9	3.2	4.5	1.5	3.2
Payload weight including the PTS Module or Bulkhead (kg)	1.1	3.7	5.3	3.4	5.8
Access to Space	No	No	No	Yes	Yes

SpaceLoft® XL Payload Command Module® (PCM)

PCM – Payload Command Module®
The UP Aerospace patent-pending Payload Command Module® (PCM) provides all the interfaces for payload systems in flight and on the ground. Each PTS module is fitted with a PCM allowing for independent sequencing for each payload system on-board the SpaceLoft launch vehicle.

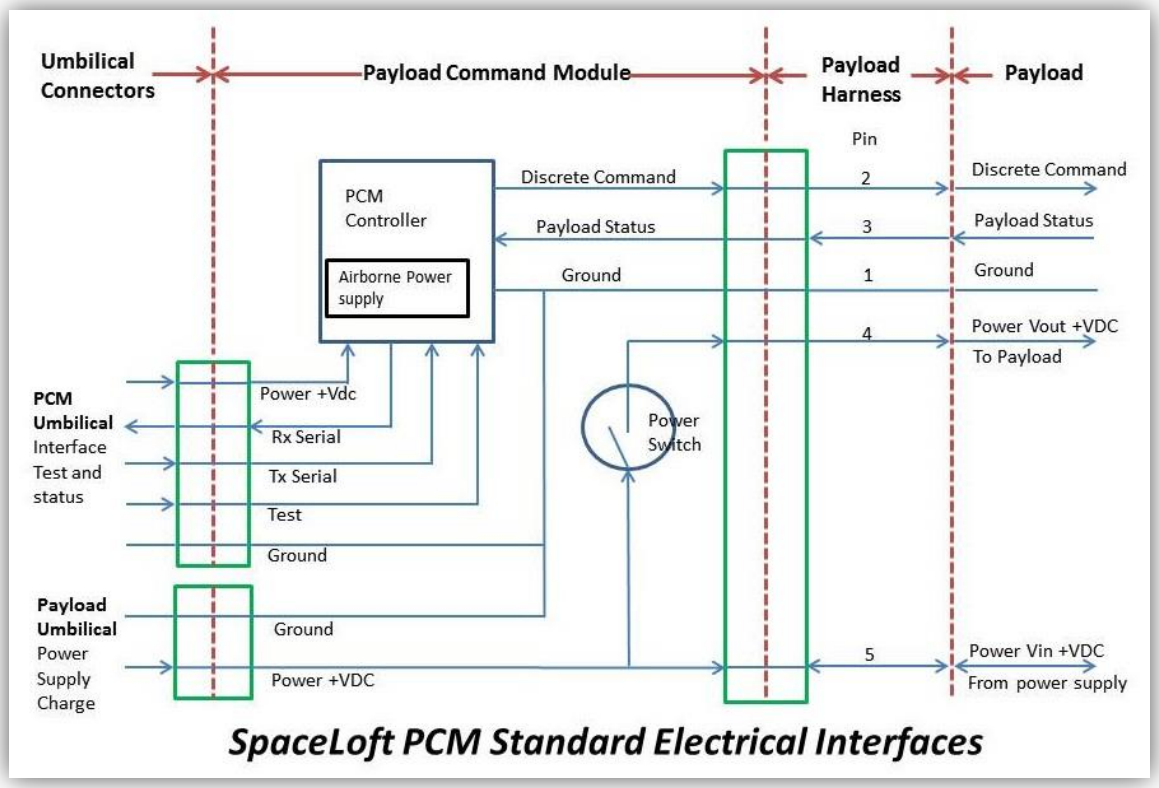


Discrete Signals
The PCM can send up to 4 discrete signals (5.0 VDC for 1 second each) to command payload experimentation functions throughout the mission.

Payload Go, No-Go Status
Payload systems status communication for flight readiness is facilitated by closing the circuit on pin 3, providing ground controllers with positive payload status prior to launch.

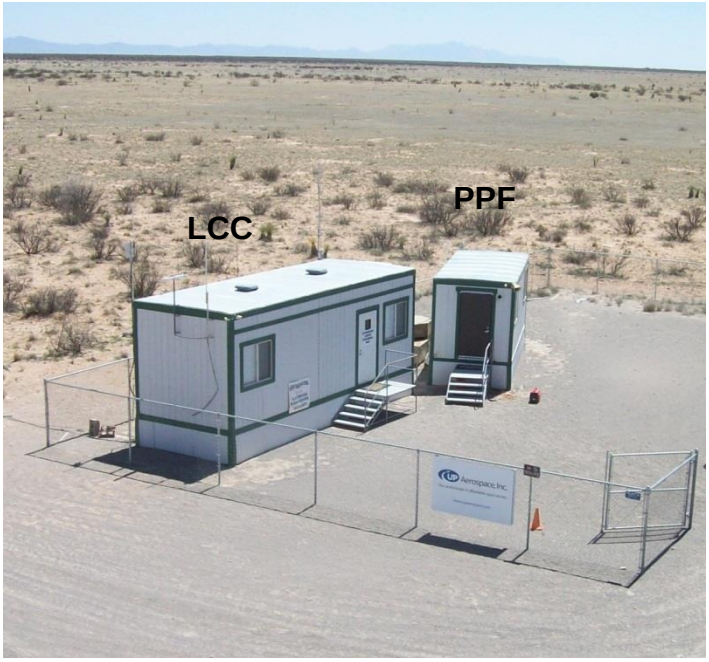
Payload Charging
The PCM has a built in Payload Power Umbilical interface which allows users access to charging of power supplies without removing the payload from the vehicle.

Power-On Switch
The built in power rotary switch mounted on the PCM has two poles, simultaneously powering on the Payload and PCM with a single turn of a standard screw driver.



SpaceLoft® XL Launch Facilities

UP Aerospace has dedicated launch facilities to support the SpaceLoft operations at Spaceport America in New Mexico. All buildings have air-conditioning, heating, and lighting. The site has restroom, and wireless internet to support all day operations.



Launch Control Center (LCC)

The operations Control Center is the heart of launch operations activities. The launch crews process the vehicle, and conduct the launch operations of the SpaceLoft vehicle from the LCC. The LCC has a maximum of 9 console stations with communications networks to the launch pad and down range surveillance personnel. Payload operators stations are also provided within the LCC to assist the launch crew during pre and post launch operations

Payload Processing Facility (PPF)

The PPF, located adjacent to the OCC is the central location for final payload integration activities prior to loading payloads into the SpaceLoft vehicle at the launch pad. Customers have access to power, ESD grounding, payload monitoring, and an optional tabletop clean room to complete payload preparations prior to launch. On the day of launch the PPF acts as an overflow for support payload personnel to monitor in-flight telemetry and support the launch crew in trouble shooting payload system anomalies during countdown operations.

Launch Pad and Final Assembly Building (FAB)

The launch pad and FAB are located 4,500 feet East of the LCC. Loading operations of the payloads are conducted with the launcher in the horizontal position, and the FAB rolled over the launcher and vehicle to providing an environmental shelter. During final countdown the FAB is rolled back and the launcher, is raised into the final firing position for launch as shown in the photograph to the left.