

LEAP

Space Logistics
Technologies

BIGHORN PAYLOAD USER GUIDE

October 2026 // Version 1.0



SPACE SHOULD MOVE
AT THE SPEED OF
THE WORLD IT SERVICES,
WE BUILT LEAP AROUND
A SIMPLE IDEA: GETTING
YOUR PAYLOAD WHERE
IT NEEDS TO GO SHOULD
BE SIMPLE, RESPONSIVE,
AND REPEATABLE.

Chris Beckman

LEAP Chief Executive Officer

SPACE LOGISTICS, ON DEMAND

THE WORLD MOVES FAST.

A package crosses the planet in a day, on infrastructure so reliable we rarely question whether it will arrive. You get the cargo you want, where you want it, when you want it; the same should be true for space. Today, launch moves slow, with queues measured in months or years and vehicles built one at a time by specialized labor on specialized tooling resulting in the ride to orbit being the riskiest and least predictable part of most programs.

We started LEAP to modernize space logistics. Our vehicles and CONOPS are designed for execution at scale: one additively manufactured engine architecture across the vehicle family, stainless steel tanks mass produced in days instead of months, and orders of magnitude fewer parts than conventional vehicles. Bighorn brings that approach to orbit: a mass produced single-engine booster, built on low complexity, high-performance propulsion and inexpensive structures that is quick to transport, easy to integrate, and simple to launch. Bighorn is built to move cargo anywhere on Earth or to space in minutes, enabling responsive orbital delivery, point-to-point logistics, hypersonic testing and targets, and national security mission execution through a global logistics network unconstrained by distance.

Bighorn gives you a launch date you can plan against, standardized payload interfaces, short execution timelines, and a service ready for you rather than a waiting list for you to plan around. One contract and one dedicated mission manager cover integration, licensing, range coordination, launch, and delivery to your orbit. Your hardware moves when you need it to and the ride becomes the part of the mission you think about least.

This guide describes Bighorn, where it goes, what your cargo will experience, and how we work together from contract to deployment. Tell us when and where your cargo needs to be.

01/ INTRODUCTION



ABOUT LEAP

LEAP is a dual use launch and logistics company headquartered in Broomfield, Colorado. We design, build, and operate our own vehicles, engines, tanks, avionics, and launch infrastructure, that we use to provide space logistics services to defense, civil, research, and commercial customers.

Our team's expertise in the additive manufacturing of superalloys, fabricating metallic tank structures, and scaling production is what sets us apart from the rest of the industry. Where conventional vehicles depend on composite structures, complex turbomachinery, and specialized labor that cannot scale, LEAP builds with processes and designs chosen because they can be mass produced. The result is a vehicle family with fewer parts and higher reliability than conventional launch vehicles, produced on a production line rather than as one-off builds, and available when a customer's mission needs one.

REVISION HISTORY

This guide is provided for planning purposes and is superseded by mission-specific documents and any Statements of Work.

October 2026 // Version 1.0

* Specifications, performance figures, and other values in this document are provided for informational purposes only and may change in future product iterations.

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02/ BIGHORN

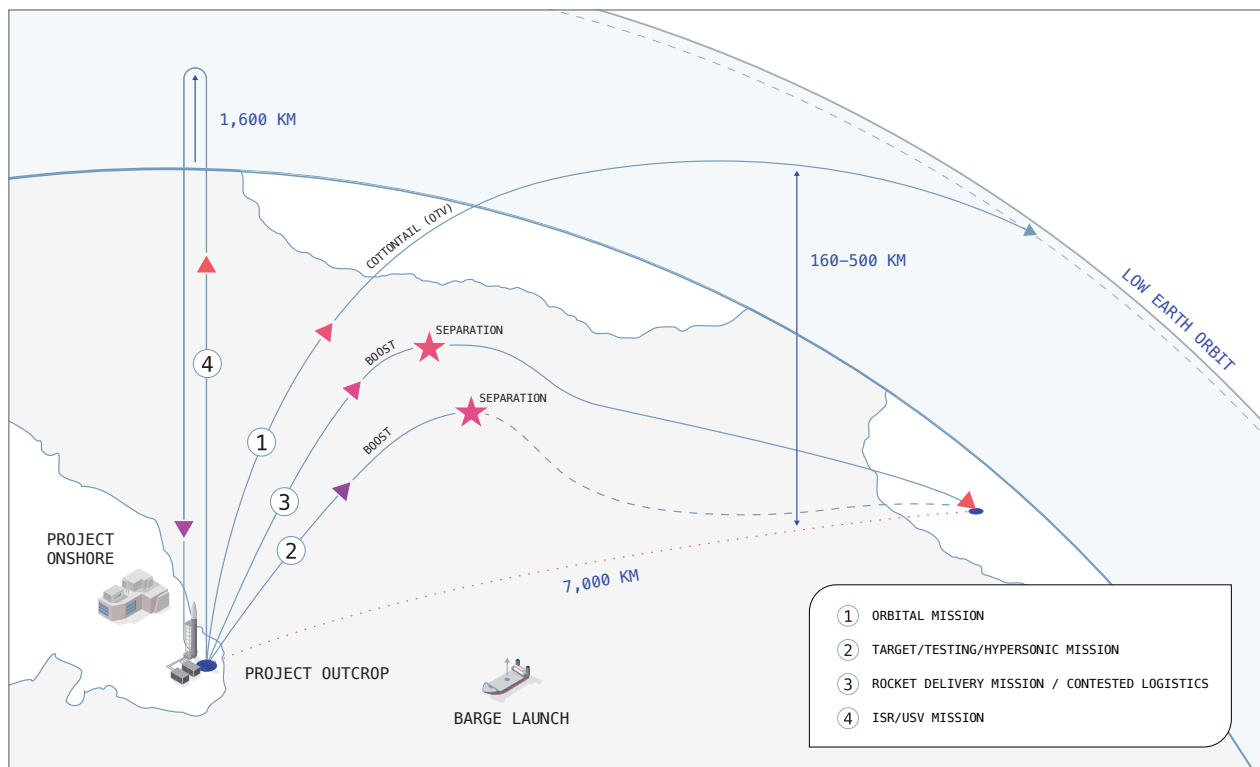


BIGHORN

VEHICLE

Bighorn is LEAP's multi-purpose, mass-produced launch vehicle. One engine, one stage, with the performance and flexibility to achieve multiple missions: targets, hypersonic testing, and when paired with last-mile delivery vehicles, point-to-point delivery and orbital insertion. Our multi-mode rocket engine means Bighorn gives spacecraft payloads one of the smoothest rides in small launch to LEO and SSO. Bighorn is inherently architected as quick to manufacture, with a foundation of process robustness, to come off multiple production lines at high rate.

Bighorn uses 90 percent fewer parts than conventional launch vehicles, making it straightforward to produce, enhances reliability with less failure points, and lowers manufacturing and operational costs. Production rate is 30 units per factory per year, scaling to 90 vehicles per year by 2030.



VEHICLE DESCRIPTION

BIGHORN BOOSTER

Type:	Single-Stage Booster
Length:	16 m (52.5 ft)
Diameter:	1.22 m (48 in)
GLOW:	8,165 kg (17,637 lb)
Structure:	Formed Stainless Steel
Safety:	Autonomous Flight Termination System (AFTS)
Control:	Gimbaled, cold-gas RCS

PROPULSION

Engine:	1 x Serrano Main Engine, 8 x RCS Thrusters
Thrust:	102 kN (23,000 lbf) SL, 51 kN (11,500 lbf) Vac
Propellant:	L0X / Ethane
Modes:	Boost / Vacuum, Deeply Throttleable
Isp:	233 SL, 334 Vac

COTTONTAIL KICK STAGE

Role:	Orbit Insertion, Plane Adjustment, Multi-Deployment, Depot/Payload Hosting, OTV
Propulsion:	4 x Poblano Engine
Propellant:	L0X / Ethane
Restarts:	4+

PAYLOAD

Payload to LEO:	Up to 205 kg – 28.5 deg, 400 km
Payload to SSO:	Up to 160 kg – 97 deg, 550 km
Booster to Payload Adapter:	985.8 mm (38.81 in) Bolt Circle 60x fasteners (M6 or 1/4-28)
Kick Stage to Payload Adapter:	ESPA Standard 381 mm (15 in) Bolt Circle 24x fasteners (M6 or 1/4-28)
Fairing Height:	2.1 m (82.7 in)
Fairing Width:	1.22 m (48 in), Tapering
Fairing Separation:	Non-Pyrotechnic
Separation Events:	Kick Stage, Fairing, and Payload Deployment Only
Max Acceleration:	< 6 g Axial, < 3 g Lateral

* All specifications are subject to change.



3D printed
superalloy thrust chamber
for Serrano engine

ENGINE

SERRANO

Serrano is the single engine that powers Bighorn. It burns liquid oxygen and liquid ethane fed by electric pumps, to produce 102 kN of thrust at liftoff, 51 kN in vacuum using a full-sized vacuum nozzle from the ground. Its simplified, yet high performing cycle replaces unforgiving systems found on full-flow and staged combustion cycles while removing the complexity and failure modes that come along with them.

The two thrust figures represent Serrano operating in two modes over the course of flight. It lifts off in boost mode, where the full 102 kN of thrust is available, then transitions to vacuum operation once the vehicle is through the lower atmosphere. The engine throttles down over a wide range, which allows a single stage to fly an overall more efficient mission trajectory, all the way to its target end point. One engine does the work of multiple, staged boosters and because the mode change happens within the engine itself, Bighorn carries no interstage and performs no jettison event during ascent through the atmosphere.

Single-print thrust chamber, injector, and other primary components drastically simplify the production process and are additively manufactured at LEAP's facilities using high strength superalloys, sharing their combustion architecture with the other vehicles in our development lineup. One engine design serves the vehicle family, which keeps production and testing streamlined and flight heritage accumulating on a single architecture. Every Bighorn flight is powered by an engine, tanks, avionics, and subsystems built, tested, and qualified in house.

03/ ORBITAL DEPLOYMENT



VEHICLES

Bighorn delivers up to 205 kg to low Earth orbit and 160 kg to sun-synchronous orbit using LEAP's Cottontail kick stage to circularize and insert the payload. The figures in this section are reference performance; mission-specific values are established in the trajectory and performance assessment prepared for each customer for their explicit mission.

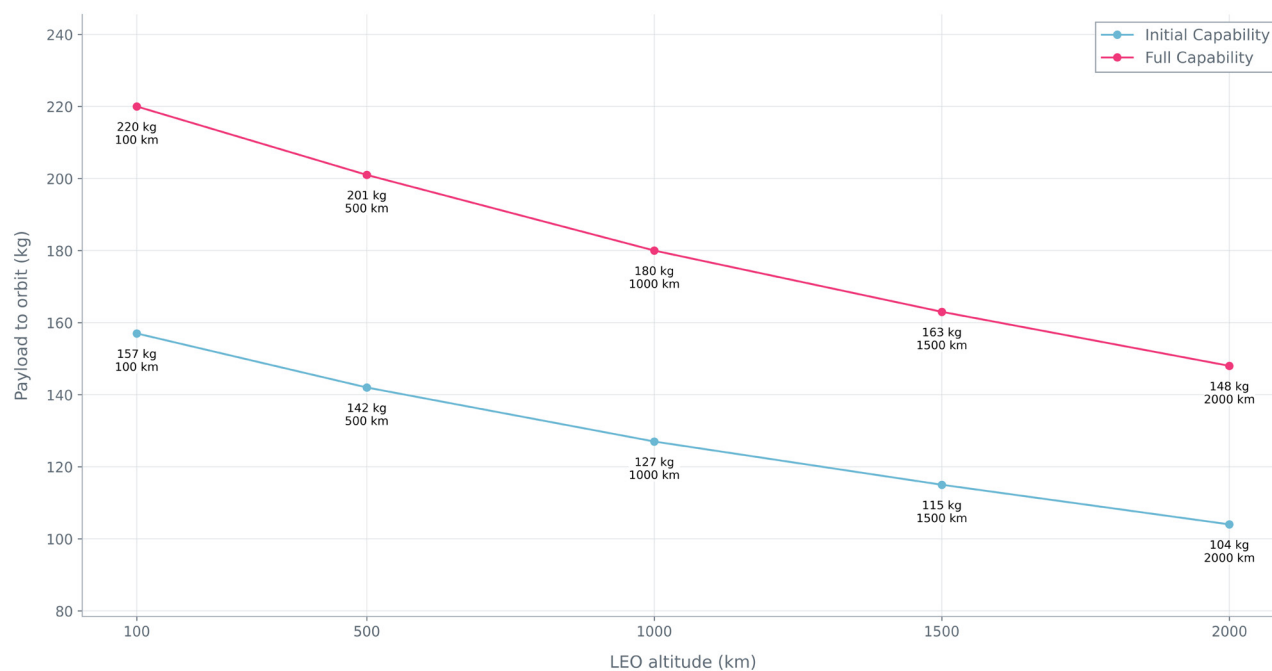
ORBITAL FLIGHT PROFILE

An orbital mission has one boost phase and no staging during ascent, this unique characteristic opens up sovereign and inland launch not possible before. The engine ignites in boost mode and carries the vehicle off the pad, transitioning to vacuum operation as the vehicle climbs through the remainder of ascent to cutoff altitude. The fairing jettisons once free molecular heating falls below acceptable thresholds, followed by the Cottontail kick stage separation from the booster. The kick stage performs insertion and circularization burns before deploying the spacecraft to the intended orbit. On multi-spacecraft missions the kick stage restarts between deployments to place each spacecraft in its separate orbit or LTAN, as required. After final asset deployment, the kick stage performs its disposal maneuver and burns up on reentry.

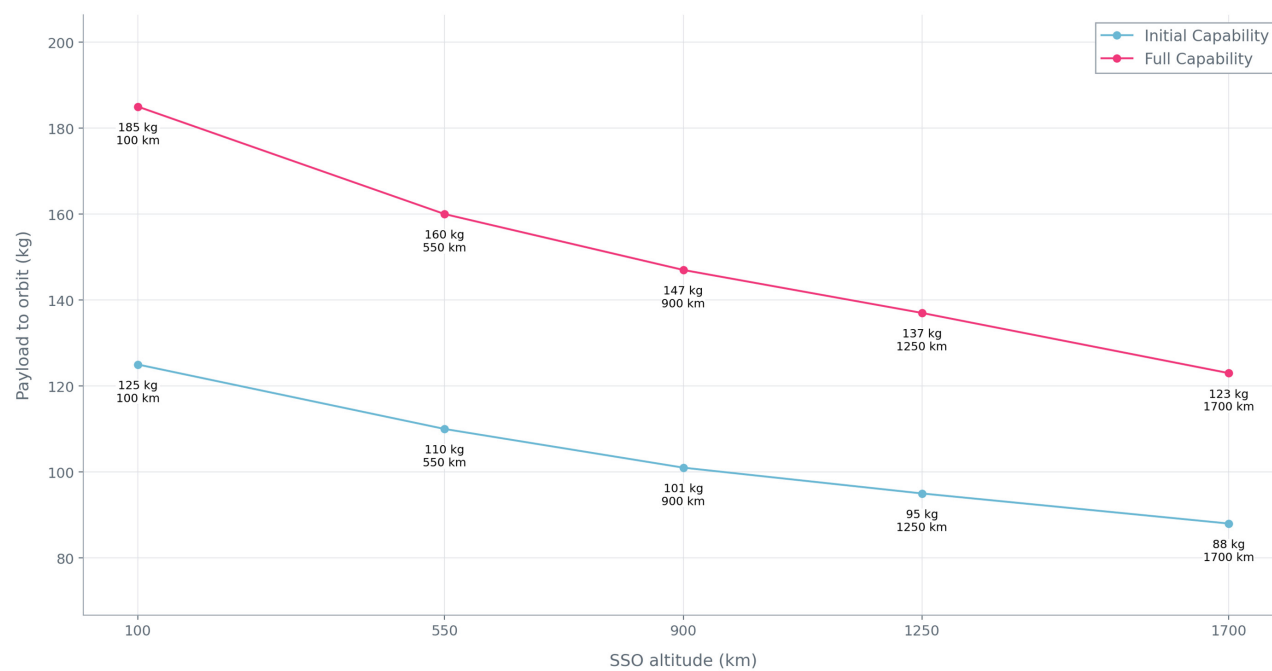
PAYLOAD MASS VS ALTITUDE

Reference performance is 205 kg to a 400 km circular orbit at 28.5 deg inclination and 160 kg to a 550 km 97 deg sun-synchronous orbit. Performance across circular altitudes is shown below for representative inclinations. Elliptical and non-standard orbits are supported and quoted per mission. The charts below show performance curves per inclination and planned vehicle upgraded capability.

LEO CAPABILITY (28.5°)



SSO CAPABILITY (97°)



ORBIT INJECTION ACCURACY

The kick stage performs a guided insertion with 11 DOF GNSS-aided navigation, giving injection accuracy independent of booster cutoff conditions. Mission-specific accuracies are calculated during analysis and verified against post flight tracking. Target accuracies for a standard mission are:

ORBITAL PARAMETER	VALUE
Inclination	+/- 0.25 deg
Perigee	+/- 15 km
Apogee	+/- 15 km
RAAN	+/- 0.25 deg

ATTITUDE DEPLOYMENT CONDITIONS

Cottontail holds spacecraft in its commanded release orientation to within 8 degrees, in any attitude the mission requires: along the velocity vector, sun-pointed, or as specified by the customer. Residual body rates at release are below 3 degrees per second per axis, allowing the spacecraft to begin commissioning without an extended detumble. These values cover Cottontail's contribution; tip-off imparted by the spacecraft's own separation system is characterized with the customer during mission planning and reviewed at the fit check. Mission-specific deployment conditions are confirmed in the flight reports.

PARAMETER	VALUE
Deployment attitude accuracy	+/- 8 deg
Deployment body rates	8 deg/s

MULTI-ORBIT DEPLOYMENT

On rideshare and constellation missions the kick stage restarts between deployments to change altitude or plane, placing each spacecraft in its own orbit on a single launch. 4+ restarts are available per mission. Staggered deployment along one plane, altitude splits between customers, and drop-offs at specific plane spacing are mission options; larger plane changes are quoted per mission against available stage propellant. A state vector for each spacecraft is delivered to the customer post deployment.

04/ COTTONTAIL



COTTONTAIL

SPECIFICATIONS

Every Bighorn orbital mission uses LEAP's Cottontail kick stage. The booster performs ascent; the kick stage performs orbit insertion, circularization, and deployment, and can raise orbits, adjust planes, and deploy multiple spacecraft to separate orbits on a single mission. For customers this means precise insertion and deployment flexibility. Cottontail is restartable and a refuelable OTV, allowing the same vehicle that deploys a payload to carry it to a higher orbit, adjust its plane, host it through an extended mission, or move it again later.

VEHICLE

Design Life on Orbit:	30 days
Communications:	Up/downlink supported as non-standard

PROPULSION

Engine:	4 x Poblano Engines
Thrust per:	2.5 kN
Propellant:	LOX / Ethane
Restarts:	4+ per mission
Burn Life:	9 minutes

PAYLOAD

Payload Adapter:	ESPA Standard 381 mm (15 in) Bolt Circle 24x fasteners (M6 or 1/4-28)
Electrical to Payload:	Supported
Electrical Interface:	Supported
Max Payload Mass:	300 kg

* All specifications are subject to change.



KICK STAGE

On a standard delivery, Cottontail separates from the Bighorn booster after cutoff and performs the burns that place spacecraft in their orbit. Insertion is guided by the stage rather than fixed at booster cutoff, increasing injection accuracy across missions and independent of ascent dispersions.

ORBIT RAISING AND PLANE ADJUSTMENT

Beyond drop-off orbit, Cottontail can raise or lower altitude and adjust inclination or RAAN within its propellant budget. Options include circularization at customer-specified altitudes, plane changes, and phasing along a plane for constellation deployment.

MULTI-ORBIT DEPLOYMENT

On rideshare and constellation deployment missions, Cottontail restarts between separations to place each spacecraft in its own orbit on a single launch: altitude splits between customers, staggered deployment along one plane, and plane spacing per mission planning. Deployment order and orbit assignments are set at mission planning and each customer receives a state vector per deployment.

ADDITIONAL CAPABILITIES

Cottontail is available as a highly capable spacecraft. Additionally, it can be deployed on other launch vehicles. Missions of this type are quoted individually and include the list below:

- High Delta-V transfers
- Orbit raising beyond drop-off
- Multi-burn transfers
- Staggered deployment
- Hosting and extended life missions
- Refueling and long-term storability
- Higher Orbit class reach
- Depot operation

DISPOSAL

Every Cottontail mission ends with a disposal maneuver compliant with ODMSP & FCC 5-year debris mitigation requirements. Either a controlled deorbit or a perigee-lowering burn, begins reentry. Disposal is included in every mission and documented in the post-flight report.

05/ BEYOND ORBITAL DELIVERY

BEYOND ORBITAL DELIVERY

APPLICATIONS

The same production Bighorn vehicle that can place spacecraft in orbit serves a broader set of missions. Flying with or without the Cottontail kick stage, Bighorn delivers payloads to suborbital and exoatmospheric conditions shaped to the mission. Reconfiguring between mission types is a trajectory change: the payload interface, integration flow, and launch operations described in this guide apply across all mission sets.

TARGETS AND HYPERSONIC TESTING

Bighorn provides a threat-representative target and test conditions for sensor characterization, tracking exercises, intercept testing, and system stress testing, at a cost and cadence that lets test programs fly campaigns rather than single events and supports simultaneous multi-theater, multi-threat simulation. Because the same production vehicle serves orbital and target missions, target availability is set by the manifest without a separate development effort, flown on the next vehicle off the production line.

Serrano's deep throttle range allows depressed, lofted, minimum-energy, constant heating, and constant heat flux profiles from the same vehicle, supporting hypersonic test articles including air-breathing, reentry, and boost-glide payloads. Payload separation velocities, release attitudes, and rates can be tailored to the test objective. The vehicle provides truth data and telemetry relay through separation for correlation with range sensing.

RESPONSIVE LAUNCH

Bighorn is produced at rate and held in inventory rather than built against a manifest request, so a vehicle can be assigned to a mission on short notice. A standard payload interface means a pre-integrated spacecraft needs no mission-unique work at call-up, and the transportable launch system allows the departure point to be positioned for the mission. Three service tiers support operational timelines: On-Call Launch reserves a vehicle and launch window against a customer alert. Integration Ready adds storage of an integration ready payload at a LEAP facility. Stored-Ready Launch holds the customer's spacecraft integrated, encapsulated, and flight-ready under maintained purge until call-up.



TRANSPORTABLE LAUNCH

Bighorn's launcher, ground support equipment, propellant handling, and launch control are containerized and move by road, sea, or air. The same system operates at every launch site, so adding a location is a range coordination and licensing exercise rather than a construction project, and missions can fly from established ranges, austere sites, or customer-selected locations subject to regulatory approval. LEAP exercised this approach on the Bullfrog program, deploying a complete launch system to a remote site and launching within hours of arrival. The same architecture carries Bighorn. For missions where geometry matters, whether a target presentation the range cannot support, a delivery route, or launch from a specific sovereign region, the pad goes where the mission is.

POINT-TO-POINT DELIVERY

LEAP provides point-to-point cargo delivery services at intercontinental range. Bighorn boosts last-mile cargo delivery vehicle front ends up onto a suborbital trajectory, allowing them to reach anywhere in the world in under 45 minutes and launch from LEAP's transportable launch system with a baseline delivered payload of 1,000 kg. This time-critical resupply at intercontinental range is designed specifically for degraded, denied, or remote regions without conventional rapid access, ideal for critical contested and denied logistics as well as humanitarian disaster relief scenarios. LEAP's flight-tested packaging includes containers qualified for blood, medical supplies, and sensitive cargo. Point-to-point missions are developed individually with customers, including trajectory design, delivery vehicle selection, overflight and reentry coordination, and recovery operations.



SUPPLEMENT REQUEST

Mission-specific performance, trajectories, and detailed operational concepts for these missions are provided in the Bighorn Mission Supplement, available to qualified customers on request.

06/ INTEGRATION & LAUNCH OPERATIONS

INTEGRATION AND LAUNCH OPERATIONS

COORDINATE SYSTEM

Bighorn is defined by a right-hand coordinate system defined as +X along the forward axial direction away from the engine. For the purposes of individual payload integration and environments, the Y and Z directions are referred to interchangeably as the lateral direction.

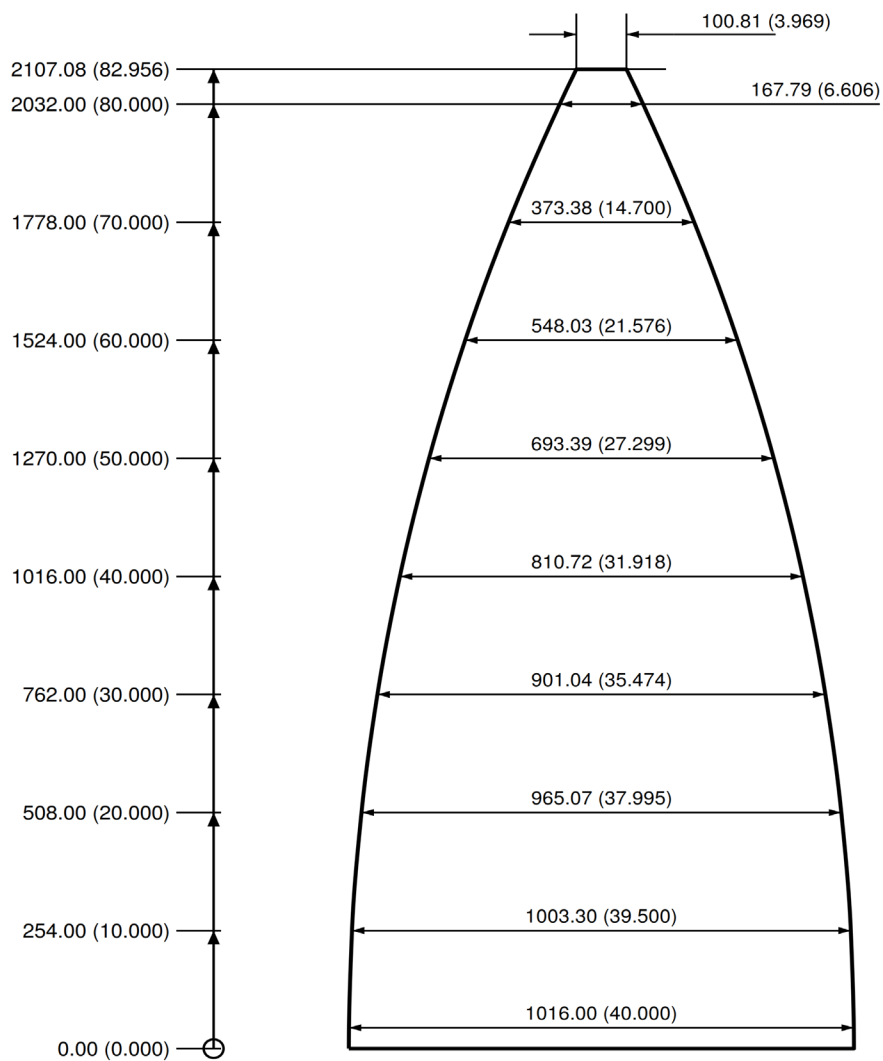


PAYLOAD VOLUME

Bighorn's payload fairing protects the spacecraft from encapsulation through ascent. The fairing has two usable payload envelopes shown below. Fairing separation occurs once free molecular heating falls below designated mission threshold. Acoustic protection is provided by blankets installed inside the fairing halves. Access doors support late operations after encapsulation. The fairing environment is controlled from encapsulation through liftoff with a continuous GN2 purge. Payload integration occurs horizontally, in the payload module at the launch site. There are two payload integration configurations based on mission set, orbital uses the Kick Stage configuration and payloads that do not need circularization, or that can provide their own, can utilize the extra space of the Booster Only configuration.

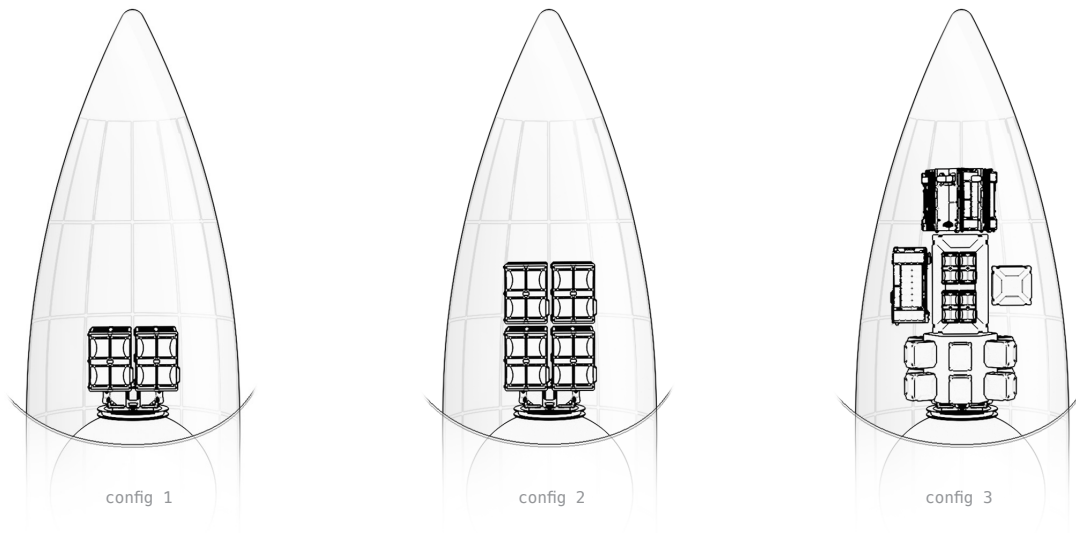
KICK STAGE CONFIGURATION

In our standard configuration with the Cottontail kick stage for orbital insertion and deployment, there is 2,107 mm of vertical payload volume, accounting for vibration margin. A standard 381 mm bolt circle is used for payload configuration attachment, adaptable by payload manifest.



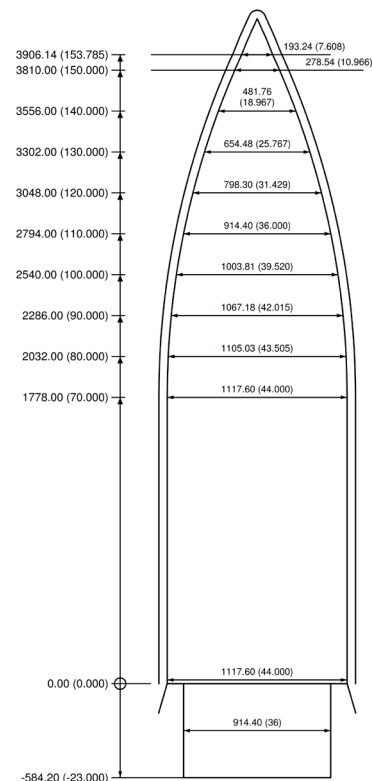
MULTI-ORBITAL PAYLOAD CONFIGURATIONS

The Kick Stage configuration supports single primary spacecraft, dual manifests, and rideshare missions from the same common payload interface. The 381 mm adapter ring provides a standard configuration for a variety of solutions to be built upon the same mechanical and electrical interface regardless of manifest, so a spacecraft designed for a dedicated flight can move to a rideshare position without redesign. Sample configurations are shown below; mission-specific layouts are established during mission planning.



BOOSTER ONLY CONFIGURATION

This configuration does not include the kick stage and needs its own solution to reach orbital velocity. It has a total of 4,490 mm of vertical height (including a negative space lower pocket) and interfaces at a 985.8 mm bolt circle.

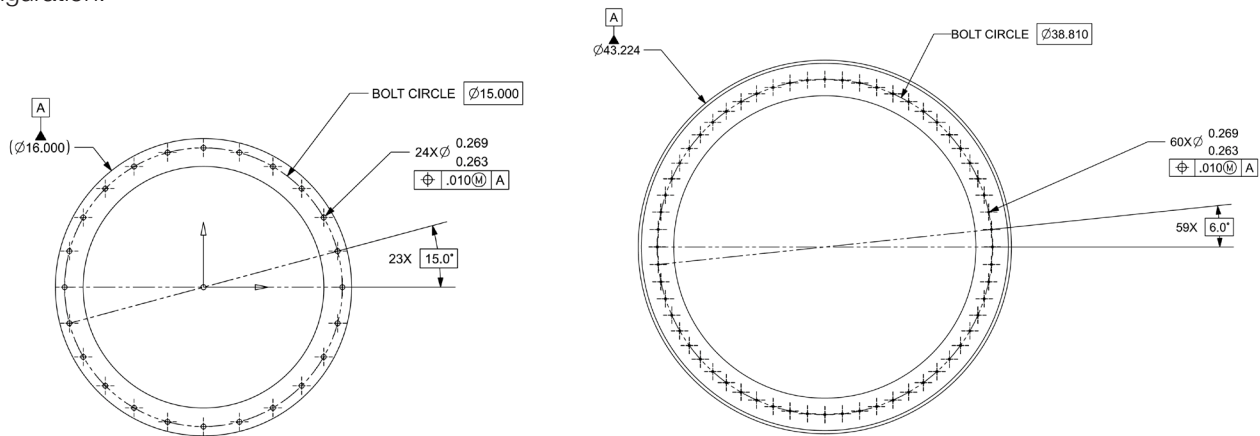


SEPARATION SYSTEMS

Customers may provide their own separation system or fly one provided by LEAP. The payload module is compatible with commercially available low-shock separation systems, including motorized band systems, and with CubeSat dispensers in rideshare positions. Separation systems are mechanically and electrically verified during the fit check, and separation velocity and tip-off are validated. Contact LEAP for list of provided and compatible systems.

MECHANICAL INTERFACE

The spacecraft mounts to one of two bolt circle adapter interfaces depending on the configuration. Spacecraft limits for mass, CG envelope, and minimum first modes (lateral and axial) are determined by a mission-specific coupled loads assessment. Alternative interfaces are approved on a case-by-case basis, as well as rideshare hostings in various configuration.



PAYLOAD ELECTRICAL INTERFACES

Bighorn provides a standard electrical interface at the separation plane through an Amphenol D38999 Series I LFT breakaway connector that disconnects passively at separation, with no lanyards or pyrotechnics. The standard interface provides 24 discrete digital input and output channels at 3.3 V or 5 V logic, one CAN-FD bus and one RS-485 bus for command and telemetry, and two +48 V power contacts with two returns rated 10 A total. The power bus is de-energized before separation. A separate 50 ohm SMP feed provides GNSS L1/L2 pass-through from a vehicle antenna, allowing the spacecraft receiver to track satellites while encapsulated.

A T-0 umbilical supports battery charging and spacecraft monitoring from encapsulation through liftoff, routed through ground equipment in the customer control room. Spacecraft separation is commanded by redundant discrete outputs, with loopback circuits on the vehicle side confirming separation to the flight computer.

TELEMETRY & DATA

Payload status is interleaved in Bighorn's S-band telemetry stream throughout flight and available at the customer console in real time. Downlinked payload data is limited on the standard service; higher rates and dedicated payload telemetry are available as an optional service. Following each deployment, LEAP delivers a state vector and a post-flight report containing trajectory, measured environments, separation confirmation, and imagery where available.

PAYLOAD ENVIRONMENT

The fairing volume is continuously purged with gaseous nitrogen from encapsulation through liftoff, maintaining a controlled temperature, humidity, and cleanliness environment around the spacecraft. Purge flow is monitored and logged, and the record is provided to the customer. For spacecraft that do not require purge, an unpurged configuration with conditioned air is available. Sensitive apertures may be served by dedicated purge lines as an optional service.

PAYLOAD INTEGRATION

Integration is horizontal, in the payload module at the launch site. The standard flow: spacecraft arrives at the processing facility before launch, completes customer checkout, and is mated to the separation system and adapter. Mass properties are measured, the module is closed out, the fairing is encapsulated with the purge established, and the encapsulated assembly is mated to the vehicle. Late access through the fairing doors is available as an optional service. Customers have facility access throughout integration.

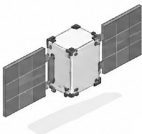
PAYLOAD PROCESSING WORKFLOW

Payload processing follows the same flow on every mission, with timing adjusted to the campaign type. Integration is horizontal throughout, and the customer has access to their spacecraft at each step until encapsulation.



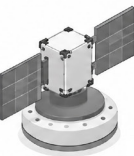
1/ Spacecraft delivery

The spacecraft and ground equipment arrive at the launch site processing facility before launch. LEAP receives, inspects, and unpacks with the customer team. Shipping requirements and customs handling for missions launching outside the United States are coordinated during mission planning.



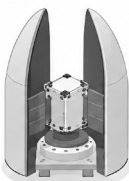
2/ Customer checkout

The customer completes independent verification of the spacecraft: functional tests, battery charging, software loads, and final closeouts, using the customer control room and the T-0 umbilical path for powered operations.



3/ Mate and mass properties

The spacecraft is mated to its separation system and the payload adapter, the electrical fit check is run with the flight harness, and mass and CG properties of the integrated assembly are measured and recorded against the expected values.



4/ Encapsulation

The payload module is closed out and the fairing is encapsulated with the nitrogen purge established. From this point the environment is monitored and logged continuously, and access is by the fairing doors only, as scheduled late-access operations.



5/ Vehicle mate and rollout

The encapsulated assembly is mated to the launch vehicle configuration horizontally, system-level interface checks are completed, and the vehicle rolls to the pad. Purge and umbilical services carry through rollout and terminate at liftoff.



6/ Launch and reporting

Following deployment, the customer receives a state vector and the post-flight report. For integration-ready responsive missions, the flow runs through step 4 and holds: the encapsulated spacecraft is stored flight-ready under maintained purge, and steps 5 and 6 execute on call-up.

PROPELLANT LOADING & PAD SUPPORT

Spacecraft may arrive fueled, or are fueled at the launch site processing facility as an optional service. Hazardous processing and fueling are approved and scheduled on a per-mission basis as well as timeline for mass validation, encapsulation, vehicle mate, rollout, and launch.

Time-sensitive payload elements can be installed or activated as late as day of launch and in some cases hours before launch can be scheduled as late-access operation. Late payload loading is coordinated during mission planning and overseen or performed by LEAP personnel.

Spacecraft propellant loading at the site is available as an optional service, with LEAP-provided equipment and trained personnel possible for certain operations and under the range safety process. Customers may also fuel with their own equipment and procedures, subject to safety review. Onboard fuels and fueling operations are approved with consideration of the total payload manifest.

ON-PAD SERVICES

Through the umbilical and ground systems, LEAP provides battery charging and spacecraft monitoring, nitrogen purge with logged environment, conditioned air options, customer console data at the control center, and pad power for customer ground equipment. Battery top-off, purge, and monitoring continue through the T-0 umbilical until liftoff. Additional pad services are quoted per mission.

INTERFACE CONTROL & VERIFICATION

Each mission is governed by an Interface Control Document covering the launch-vehicle-to-payload and launch-vehicle-to-range interfaces, delivered in draft at mission kickoff with a verification matrix assigning closure of every requirement to analysis, inspection, test, integration, launch, and schedule. Mechanical and electrical fit checks are performed before flight, and the matrix is closed at the Launch Readiness Review.

SPACECRAFT REQUIREMENTS & ALLOWABLES

All spacecraft shall meet the requirements before delivery for integration. Items marked for approval are closed before the Launch Readiness Review.

ITEM	REQUIREMENTS	NEEDS WRITTEN APPROVAL
Center of Mass	Spacecraft COM must be within specified limits, determined based on the location of the payload.	Outside of tolerance zone
Venting	Spacecraft venting during ground processing and flight must be declared, with vented species, rates, and locations. Venting of inert gases is standard; all other species by approval.	Non-inert venting, venting post liftoff
Batteries	All onboard power sources declared with chemistry, capacity, and protection circuitry. Charging after encapsulation is via the T-0 umbilical.	All chemistries and capacities
Propellants	Fueled spacecraft are accepted. Propellant type, quantity, and pressure vessel data must be declared in the safety data package and review with LEAP; Hypergolics and cryogenics by approval and mission-specific safety planning.	Hypergolic, cryogenic, or non-standard propellants; loaded pressure vessels
Pressure vessels	Declared with MEOP, proof and burst factors, pedigree, and any compliance to standards	Vessels not meeting existing standards (AIAA S-080, others)
Magnetics	Static field at the separation plane declared, with field map.	Fields above 0.5 gauss
RF	All transmit capability declared with frequency, power, and timing.	Any powered RF after encapsulation
Deployables	Anything that moves, releases, or changes configuration before separation.	All pre-separation mechanisms
Hazardous materials	Radioactive sources, lasers, biologicals, and toxic materials declared in the safety data package.	All items

MISSION MILESTONES

MILESTONE	LEAP DELIVERABLES	CUSTOMER DELIVERABLES
Mission kickoff	Draft ICD with verification matrix; payload module CAD; Trajectory and Performance Assessment initiated	Mission requirements; payload mass, CG, and geometry estimates; points of contact
Trajectory and Performance Assessment	TPA delivered: performance, insertion accuracy, environments basis for the mission	Orbit requirements confirmed
Materials and hazard data	Safety data package review; range safety submittals initiated	Materials list; SDS; batteries, pressure vessels, propellants, RF, and operations declarations
Final ICD and verification matrix	Final ICD issued; all verification items dispositioned to analysis, inspection, or test	ICD signature; open verification items closed
Spacecraft delivery	Receiving, inspection, cleanroom and control room access	Spacecraft and EGSE delivered with shipping documentation; measured mass and CG
Integration and fit check	Adapter and separation system mate; electrical fit check; mass properties measurement and verification against ICD	Spacecraft checkout complete; flight configuration declared
Encapsulation	Payload module closeout; fairing encapsulation; GN2 purge established and logged	Final closeout items; late-access requests identified
Launch Readiness Review	LRR conducted; range, vehicle, and payload readiness dispositioned	Customer flight readiness statement
Launch	Vehicle mate, rollout, propellant load, launch, and deployment to the contracted orbit	Console support as agreed
State vector	Post-deployment state vector for each spacecraft	
Post-flight report	Trajectory, measured environments, separation confirmation, and imagery where available	

STANDARD SERVICES

For every contracted flight, LEAP will:

- Assign a dedicated Mission Manager from contract start through post-flight data
- Deliver the Interface Control Documents, verification matrix, and CAD models at kickoff
- Perform trajectory and performance assessment tailored to the spacecraft and mission
- Complete mechanical and electrical interface, fit check, and mass properties measurement
- Lead launch licensing and range safety coordination, including flight safety analysis
- Integrate and encapsulate the spacecraft at the launch site
- Maintain the nitrogen purge and environmental control from encapsulation through liftoff
- Execute launch and deployment to the contracted orbit
- Deliver a post-deployment state vector and a post-flight report
- Hold regularly scheduled integration meetings with tracked actions

OPTIONAL SERVICES

Available on request and defined in the Statement of Work:

- Multi-orbit deployment, orbit raising, and plane adjustment via Cottontail
- Responsive launch tiers (on-call, integration ready, stored-ready)
- Dedicated or high-rate payload telemetry during flight
- Late access after encapsulation, and aperture-specific purge
- Powered payload services beyond the standard 48 V allocation
- Coupled loads, integrated thermal, and mission-specific analyses
- Separation system procurement and integration
- Mission assurance reviews and heritage documentation packages
- Spacecraft transport, storage, and processing beyond the standard flow
- Launch from customer-selected sites using LEAP's transportable launch system
- Customer PR and launch broadcast participation

07/ FLIGHT ENVIRONMENT



FLIGHT ENVIRONMENT

This section defines the mechanical, thermal, and electromagnetic environments a spacecraft will experience on a Bighorn mission, from liftoff through deployment. Levels are given at the payload separation plane and represent the maximum predicted environment without test margin; LEAP commits to providing customers environmental maximums below the specification limits in GSFC-STD-7000 for analysis at this time and will refine this data during every flight, to provide the most updated and accurate environment possible.

Bighorn has no pyrotechnic activities and only fairing separation and kick stage to booster separation, which removes the dominant shock sources found on multi-stage vehicles. Because a single deeply throttling engine flies the whole ascent, axial acceleration builds smoothly and remains below 6 g.

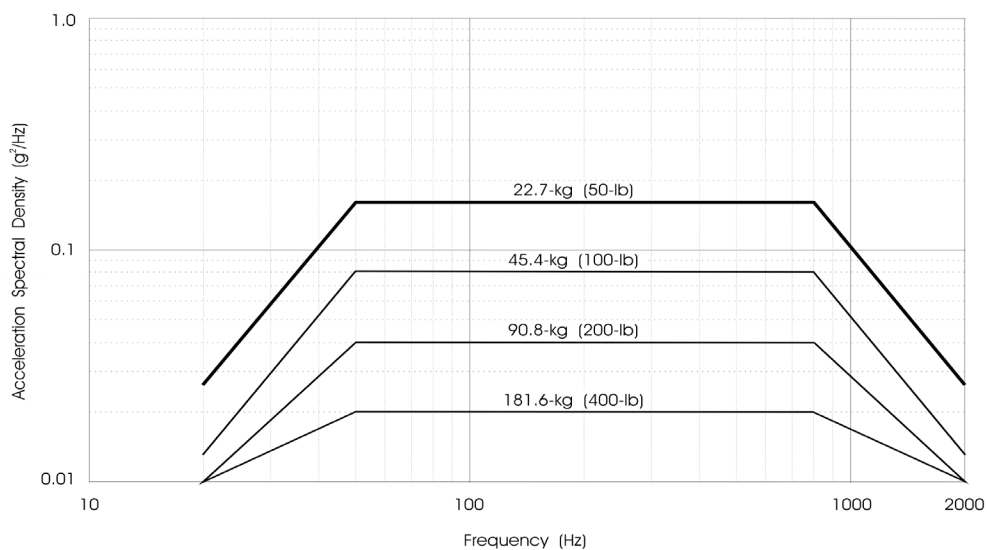
ACCELERATION LOADS

The spacecraft is subjected to combined axial and lateral accelerations during flight. Maximum predicted load factors fall within the envelope below, which covers static and dynamic contributions. Peak axial acceleration is below 6 g, peak lateral is 3 g. Mission-specific accelerations are determined by coupled loads analysis, available as an optional service. Transportation loads are dependent and provided per launch site.

DIRECTION	VALUE
Axial (X) Deployment	6 g
Lateral (Y,Z)	3 g

RANDOM VIBRATION

Bighorn's random vibration environment at the separation plane will not exceed the acceptance-level envelope of NASA's General Environmental Verification Standard (GSFC-STD-7000A), the environmental test baseline used across NASA and much of the small satellite industry. The envelope is shown in the figure below with its breakpoints and overall level of 10.0 grms; for spacecraft above 22.7 kg, the GEVS mass reduction applies and the enveloping level decreases with spacecraft mass. A spacecraft tested to GEVS acceptance levels is enveloped for a Bighorn flight without additional random vibration qualification. Measured flight environments from Bighorn characterization flights will replace this envelope in a future revision. Customer test levels and any notching strategy are agreed upon with LEAP on a mission-specific basis.



SINUSOIDAL VIBRATION

Bighorn defines no separate sinusoidal vibration environment. The vehicle's low-frequency transient set is limited to engine start, mode transition, engine cutoff, fairing separation, and kick stage separation (if applicable). These are captured in the coupled loads analysis rather than enveloped by a sine sweep. Spacecraft low-frequency loads are provided through the mission coupled loads analysis.

SHOCK

Bighorn has no booster staging or pyrotechnic separations in the payload load path, which removes the dominant shock sources found on multi-stage vehicles. Shock at the separation plane is governed by fairing separation, kick stage separation (if applicable), and by the customer's own separation system. Vehicle-source shock is expected to be enveloped by the shock environment of the spacecraft's separation system itself, and the vehicle-source shock response spectrum is provided; it will be published in this guide following characterization flights. Shock generated by the spacecraft separation system is the customer's to characterize and is reviewed during the fit check.

ACCOUSTICS

The acoustic environment inside the fairing peaks at liftoff and during transonic flight and is moderated by Bighorn's small fairing diameter and standard acoustic treatment. The overall sound pressure level is expected to fall below the 138 dB minimum acoustic test level of GSFC-STD-7000A, meaning a spacecraft that has completed a standard GEVS acoustic test is expected to be enveloped for a Bighorn flight; the predicted one-third octave spectrum is provided in the mission plan and will be confirmed with flight data.

VENTING

The fairing compartment vents to ambient during ascent, from launch-site inert gas pressure to near vacuum, but still positive pressure, by fairing separation. Bighorn's ascent produces a gradual pressure decay typical of small launch vehicles, with the highest depressurization rate occurring briefly during transonic flight; the depressurization profile is provided in the mission plan and will be published in this guide following characterization flights. Spacecraft with sealed volumes, shrouded cavities, or venting-sensitive components should confirm vent sizing against the profile during mission analysis, and sealed volumes should be designed for a full pressure cycle from ambient to vacuum.

THERMAL & HUMIDITY

The fairing environment is temperature and humidity controlled from encapsulation through liftoff by the nitrogen purge. In flight, fairing inner surface temperature remains controlled through insulation and the fairing is retained until free molecular heating falls below acceptable limits. A mission-specific thermal analysis from rollout through deployment is available as an optional service.

RADIO FREQUENCY

Bighorn transmits telemetry on S-band and receives GNSS throughout flight, and carries a flight termination receiver on a range-assigned frequency; specific assignments at each launch site are made through range coordination and confirmed with the customer before flight. The maximum radiated field is expected to be within the radiated susceptibility levels of a standard GEVS electromagnetic compatibility test program. Spacecraft transmitters are inhibited from encapsulation through separation; the GNSS pass-through allows receiver tracking while encapsulated without radiating. Payload RF operation during flight requires coordination.

NATURAL FREQUENCIES

To remain within the environments in this section, the spacecraft fundamental frequency shall be above 25 Hz with approval for lower values, fixed at the separation plane. Spacecraft below these limits may be evaluated on a case-by-case basis with a mission-specific coupled loads analysis to verify loads, and may see environments exceeding those published here.

08/ FACILITIES & LAUNCH SITES

FACILITIES AND LAUNCH SITES

LAUNCH SITES

Launch services are available from sites across the globe: LEAP has active relationships with ranges in the United States, Australia, and the United Kingdom and is working additional partnerships for sea launch capabilities to remain fully flexible and unconstrained by potential infrastructure bottlenecks. Between them, Bighorn reaches inclinations from the high 30s through sun-synchronous, polar, and retrograde orbits. Vehicle production, pre-integration, and testing are based in Colorado, and the launch system itself is transportable, so site selection follows mission need.

SERVICEABLE INCLINATIONS BY SITE

Inclination bands are available upon request at this time and will be added as range agreements mature. Bighorn-achievable inclinations and performance at each site are established per mission. Additional inclinations may also be possible with dogleg trajectories.

HEADQUARTERS, PRODUCTION, INTEGRATION, AND TEST FACILITIES

Bighorn is built, integrated, and qualified in Colorado. Our 75,600 ft² Broomfield, CO facility has a production capability of 30 vehicles per year by 2028, with total operations scaling to 90 vehicle capability per year in 2030. Headquarters, engineering, and payload pre-integration are located here with engine hotfire and vehicle qualification occurring nearby. Spacecraft integration occurs at the launch site for all customers.

SAFETY & SECURITY

LEAP conducts launch operations under FAA Part 450 licensing with range safety adherence per site. Hazardous spacecraft or payload systems are identified by customer and reviewed through the safety data package process. All customer hardware is held in access-controlled ITAR and CMMC compliant facilities, and security measures, including escorted transport and controlled processing for sensitive payloads, are tailored to mission requirements. LEAP runs operations for CUI, Secret, and TS/SCI work, supported as requested.

PAYLOAD PROCESSING

Spacecraft processing for missions is performed in payload processing facilities at the launch site, with pre-integration testing and qualification available at LEAP's Broomfield facility.

The Colorado facilities provide:

- ISO 8 class cleanroom processing space with temperature and humidity control
- TVAC Testing
- Vibe & Shock Testing
- Payload Fit up and interface verification

The launch site facility provides:

- ISO 8 class cleanroom processing space with temperature and relative humidity control
- Shore power, compressed air, gaseous nitrogen, and helium if requested
- Hazardous processing area supporting fueling operations as requested
- Secure, access-controlled storage for spacecraft and ground equipment, including flight-ready encapsulated storage under maintained purge for stored-ready responsive missions
- Consumables, gowning, and LEAP integration support personnel throughout the customer campaign

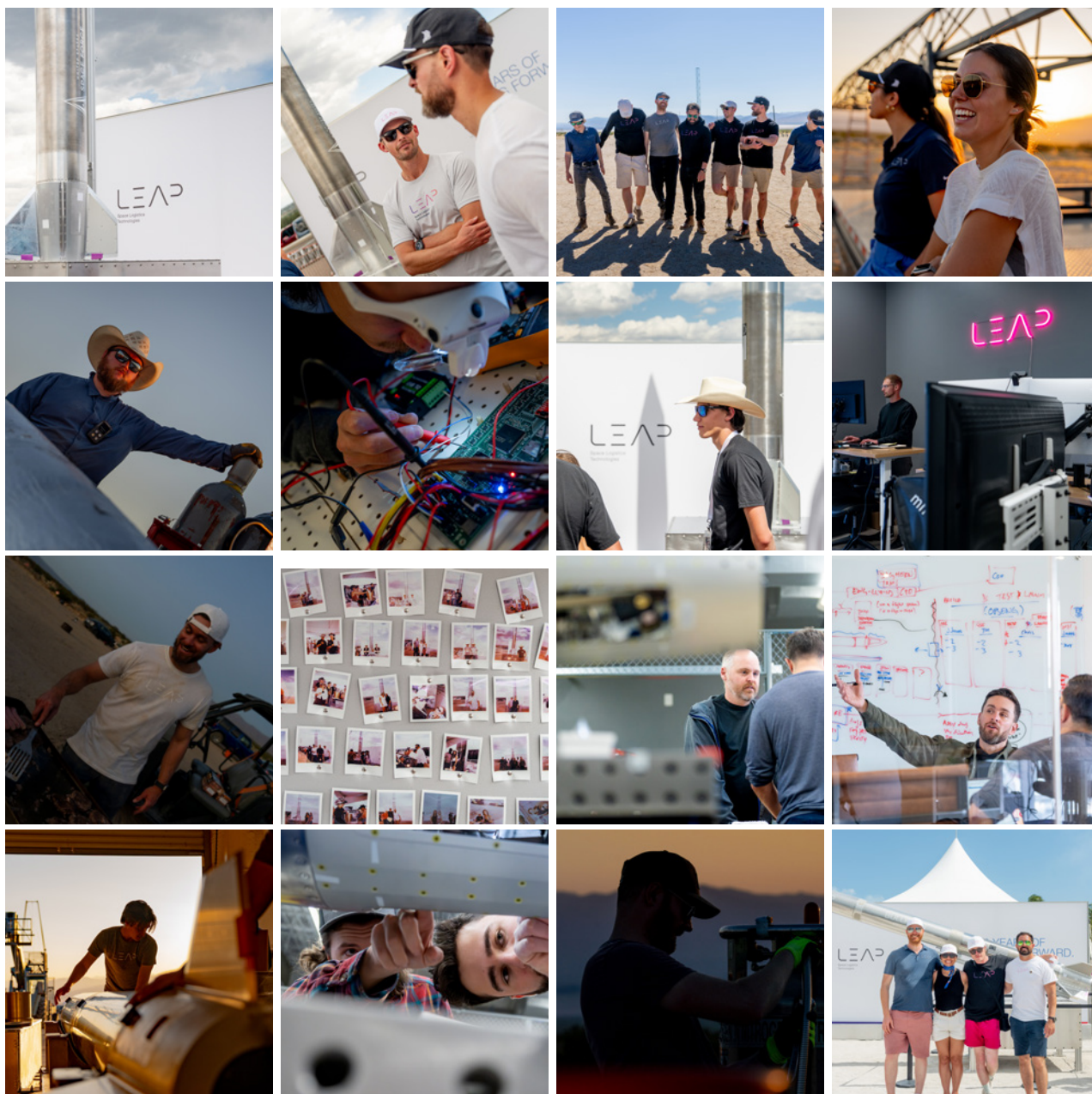
At launch sites, spacecraft processing may use site operator's facilities or LEAP's processing capability, with the same minimum ISO, environmental, and interface control. Explicit facility specifics for each site are provided during mission planning.

09/ THE LEAP TEAM



THIS IS LEAP

LEAP is built by engineers, operators, and entrepreneurs who share a single conviction: access to space must move at the cadence of modern innovation. Across propulsion, structures, avionics, and mission operations, our core staff brings together experience earned across over 30 rocket and launch vehicle programs.



ACRONYMS

AFTS	Autonomous Flight Termination System
CAN-FD	Controller Area Network with Flexible Data-rate
CG	Center of gravity
CLA	Coupled loads analysis
DOF	Degrees of freedom
EGSE	Electrical ground support equipment
EMC	Electromagnetic compatibility
ESPA	EELV Secondary Payload Adapter
FAA	Federal Aviation Administration
FTS	Flight termination system
GEVS	General Environmental Verification Standard
GN2	Gaseous nitrogen
GNC	Guidance, navigation, and control
GNSS	Global navigation satellite system
GSE	Ground support equipment
ICD	Interface Control Document
I/O	Input/output
ISO	International Organization for Standardization
Isp	Specific impulse
LEO	Low Earth orbit
LOX	Liquid oxygen
LRR	Launch Readiness Review
LTAN	Local time of ascending node
MEOP	Maximum expected operating pressure
MPE	Maximum predicted environment
OASPL	Overall sound pressure level
ODMSP	Orbital Debris Mitigation Standard Practices
OTV	Orbital transfer vehicle
PSD	Power spectral density
RAAN	Right ascension of the ascending node
RCS	Reaction control system
RF	Radio frequency
RH	Relative humidity
RS-485	Recommended Standard 485 serial data bus
SDS	Safety data sheet
SOW	Statement of Work
SRS	Shock response spectrum
SSO	Sun-synchronous orbit
TPA	Trajectory and Performance Assessment
TVC	Thrust vector control
USG	United States Government



Space Logistics
Technologies

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