STELLAR
AEROSPACE

LIGHTNING

Payload User's Guide

Preliminary edition, November 2026



FULL CHAMELEON RACK
2,500 kg

SINGLE SATELLITE
2,750 kg

PRICE
$5,000/kg

LAUNCH DAYS
Tuesday and Thursday

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1. About This Guide

This guide is for satellite teams planning a future launch on Lightning, Stellar Aerospace's fully reusable launch vehicle. It explains what Lightning is designed to carry, how the service works and what we need from you to start planning a mission.

Lightning is in development. Every figure here is a design target. Stellar flies two vehicles first to retire the risk: The Guinea Pig (Phase 1), a suborbital test rocket planned for late 2027, and Spark (Phase 2), a 100 kg orbital demonstrator that carries no paying customers. Lightning is planned to be operational by late 2031 and flying every Tuesday and Thursday by 2032. Figures will be confirmed or revised as those flights produce data, and each revision of this guide is dated.

*Items marked **To be published** are not yet defined. We list them so you know what to ask for, and we will not quote numbers for them until testing supports them.*

2. Service at a Glance

Item	Design target
Payload to Low Earth Orbit	2,500 kg with the full Chameleon rack
Single large satellite	2,750 kg on the whole vehicle, rack spine removed
Shared flight price	$5,000 per kilogram, flat and published
Whole vehicle price	$13.75 million per flight, flat; you choose the orbit
Mass per customer on a shared flight	50 kg minimum (smaller payloads are billed at 50 kg), 2,450 kg maximum
Launch days	Every Tuesday and Thursday (about 104 flights a year)
Orbits	Mostly Low Earth Orbit. One sun-synchronous flight after every three to four Low Earth Orbit flights.
Sun-synchronous capacity	1,250 kg shared on Chameleon; 1,500 kg as a whole vehicle
Sun-synchronous price	$9,167 per kilogram shared; whole vehicle $13.75 million
Pad turnaround	48 hours, two pads sharing one hangar
Booking	Online booking portal, with an API for teams that schedule many launches
Payload interface	Fly Adapter (rack) or Dragonfly Adapter (Upper Stump or Heavy mode), fitted by the customer
Separation	Separation springs, no pyrotechnics

3. The Vehicle

Lightning is a two-stage rocket. Both stages and the fairing are recovered after every flight and flown again, so the cost of a launch is mostly propellant, inspection and labor.

Element	Description
Stage 1	Nine Phoenix engines. Liquid methane and liquid oxygen, electric pump-fed by battery-powered pumps, regeneratively cooled, 3D printed in Inconel 718.
Stage 2	Three vacuum-optimized Phoenix engines with larger nozzles. Custom PICA ablative heat shield on the windward side of the stage and fairing, swapped after each flight.
Fairing	Two halves hinged at the base of the stage. They open in orbit, close before reentry and land with the stage.
Stage 1 recovery	Boostback to the launch site, caught by arms on the launch tower.
Stage 2 recovery	Steerable parafoil to a recovery arena approachable from eight directions; the stage hooks a shock-absorbing arresting cable, releases the parafoil and drops into a net.
Engine thrust, Isp, vehicle height and mass	To be published

4. Payload Accommodation

Chameleon rack. Chameleon is the payload rack on the second stage. Each satellite or CubeSat dispenser arrives with a Fly or Dragonfly Adapter already fitted, and we click it onto the rack with over-center latches. The same rack carries up to 50 small satellites, a large primary with rideshare below it, or one satellite of up to 2,750 kg.

Separation and spacing. Separation springs push each payload off the rack, with no pyrotechnics. Satellites on the sides of the rack release first, and a primary on the top deck follows about 60 seconds later. Payloads booked with the cold gas layer get a small push of their own to clear the stage and make fine adjustments.

Rack configurations

Mode	Layout
Logistics	The full spine, with up to 50 small satellites and/or CubeSat dispensers mounted around it, each on a Fly Adapter. Up to 2,500 kg in total.
Hybrid	The Upper Stump sits partway up a shorter spine. A primary rides on top on a Dragonfly Adapter, with rideshare satellites below it on Fly Adapters.

Mode	Layout
Heavy	The spine comes off and one satellite of up to 2,750 kg rides on a Dragonfly Adapter. The customer buys the whole vehicle and picks the orbit.

Upper Stump capacity is the total payload mass for the flight minus the mass mounted below it. Up to 50 satellites and/or CubeSat dispensers fly per flight.

Fly-series adapters

Item	Description
Fly Adapter	The smaller ring, for satellites and CubeSat dispensers mounted on the sides of the rack.
Dragonfly Adapter	A larger, stronger version of the same ring, for payloads on the Upper Stump or on the base in Heavy mode.
Cold Gas Layer	An optional add-on you choose when you book. We fit it ourselves between the rack and your adapter, so you never handle it. It gives the satellite a small push to clear the stage and make fine adjustments. It is not for station-keeping or changing orbit.
Adapter and cold gas layer mass and price	To be published

The adapter is the only hardware we ship to you. Adapters and the cold gas layer are priced and billed separately from launch, and each leaves with its satellite. Adapter mass counts toward your billed payload mass. Adapters and cold gas layers are made in volume by Stellar at one fixed price each. A CubeSat dispenser is released as one unit into clear space and deploys its CubeSats on its own schedule. Flying CubeSats? We can also supply a CubeSat dispenser with the Fly Adapter already mounted, so you only ship us your CubeSats.

Chameleon is in design and no hardware exists yet. A small-scale version flies on The Guinea Pig and Spark before the full-size rack flies on Lightning. Diagrams of each mode: stellaraero.us/launch-system/chameleon/

Payload environments

Launch environments depend on flight data from Spark. Until then, the following are **To be published**:

Parameter	Status
Usable fairing volume and envelope drawing	To be published
Quasi-static and random vibration loads	To be published
Acoustic and shock environment	To be published
Thermal, humidity and cleanliness during integration	To be published
Orbit insertion accuracy	To be published

Parameter	Status
Adapter ring dimensions, bolt pattern and electrical interface	To be published

5. Mission Flow

Step	What happens
Book	Choose a date, mass and orbit in the booking portal. Published prices mean the quote is immediate.
Order	Order a Fly or Dragonfly Adapter from Stellar. Choose the optional cold gas layer at booking; Stellar handles that hardware.
Fit	We ship the adapter with an integration checklist. Your team mounts it on the satellite or CubeSat dispenser, and adds its published mass to your billed payload mass.
Ship	Ship the satellite, adapter mounted, to the Stellar integration site (location to be published).
Integrate	Stellar clicks it onto the Chameleon rack with over-center latches, with the cold gas layer fitted by Stellar between the rack and the adapter if booked. The adapter is the only hardware the customer handles.
Launch	Lightning flies on its fixed Tuesday or Thursday slot.
Deploy	In orbit the fairing swings open. Separation springs release the satellites on the sides of the rack first and a primary on the Upper Stump about 60 seconds later. The adapter and any cold gas layer leave with each satellite.
Recover	Both stages and the fairing return and are turned around within 48 hours for the next booking.

6. Pricing

Shared flights are priced by mass to Low Earth Orbit at a flat $5,000 per kilogram, from a minimum of 50 kg up to 2,450 kg per customer. A payload under 50 kg is billed at 50 kg. Payloads over 2,450 kg, single satellites and custom orbits buy the whole vehicle at a flat $13.75 million per flight, up to 2,750 kg. Sun-synchronous shared flights are $9,167 per kilogram, the whole-vehicle price spread over its 1,500 kg sun-synchronous capacity, with up to 1,250 kg shared per flight. Billed mass includes your adapter, which is priced separately. Examples to Low Earth Orbit at the target rate:

Payload mass	Launch price at the target rate
50 kg shared	$250,000
100 kg shared	$500,000
250 kg shared	$1,250,000
500 kg shared	$2,500,000
1,000 kg shared	$5,000,000
2,450 kg shared	$12,250,000
Whole vehicle, up to 2,750 kg	$13,750,000

The online estimator at stellaraero.us/launch-system/#price applies the same rules and checks your payload against the shared-flight and whole-vehicle limits for each orbit.

7. Starting a Mission

To start planning, send us the following. Rough numbers are fine at this stage.

Information	Why we need it
Payload mass and dimensions	Fit on the rack or as a single satellite, and price
Target orbit (altitude, inclination)	Low Earth or sun-synchronous flight assignment
Target launch window	Slot planning against the Tuesday and Thursday schedule
Propulsion and any hazardous materials	Integration and range safety planning
Number of satellites and deployment order	Rack position and separation sequence

Contact: **contact@stellaraero.us** or the launch enquiry form at stellaraero.us/customers/. Registering interest now helps shape the service. It does not create a reservation.