The LMB is designed to provide high capability in a small volume compatible with small launch vehicles and secondary ride opportunities.

Payload Accommodation

**LMB Capabilities (Current Baseline)**

<table>
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<tr>
<th>Orbit:</th>
<th>400–900km, inclination 0–99deg</th>
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<tbody>
<tr>
<td>Mechanical:</td>
<td>Bus mass &lt; 90kg, Bus volume (min): 28 x 24 x 20 inches; Fits standard ESPA envelope for secondary launches</td>
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</table>
| Electrical: | Voltage = 28V ± 6V.  
Power:  
Nadir: 110W total; 68W available to payload (orbit averages)  
Sun pointing: 284W (instantaneous); 91W available to payload (orbit average) |
| TT&C: | Uplink rate: 64 kbps  
Downlink: rate = 10 Mbps, volume allocated to payload = 30+ MB/orbit |
| ADCS: | 3-axis stabilized; accuracy = 10 arc*sec, knowledge = 2 arc*sec, stability = 1 arc*sec |
| Payload: | 3+ interfaces, 60kg (dependent on launch vehicle capacity) |
| Design life: | 5+ years (Reliability 82% at 5 years; design includes selective redundancy) |
| Launch vehicles: | Compatible with Antares, Athena II, EELV (Atlas V & Delta IV), Falcon 9, Minotaur I&IV, Super Strypi |
The Laboratory for Atmospheric and Space Physics (LASP) combines all aspects of space exploration through our expertise in science, engineering, mission operations, and data management. As an institute at the University of Colorado Boulder, LASP includes students throughout our activities. Learn more at http://lasp.colorado.edu.

LASP Small Satellite Missions

- **Student Nitric Oxide Explorer** (SNOE, 1998–2004, LEO): a LASP managed NASA mission for which LASP designed, built, tested, and operated the instrument payload and spacecraft.
- **Solar Radiation and Climate Experiment** (SORCE, launched in 2003, LEO): a LASP managed NASA mission for which LASP designed, built, and tested the instrument payload and continues to operate the mission and manage science data distribution.
- **Aeronomy of Ice in the Mesosphere** (AIM, launched in 2007, LEO): a LASP managed NASA mission for which LASP designed, built, and tested two of three instruments provided mission systems engineering, and continues to operate AIM on-orbit.
- **Colorado Student Space Weather Experiment** (CCSWE, launched in 2012, LEO): nanosatellite funded by NSF’s Geoscience Cubesat program, student oversight by LASP technical experts for instrument and spacecraft development and test. LASP continues to operate CCSWE.
- **TSSI Operational Monitoring Constellation** (TOMC, 2014 proposed implementation for the TSIS-2 acquisition of the Total and Spectral Solar Irradiance (TSSI) Climate Data Record (CDR), LEO): keys to success of TOMC—the low cost of LMB, the Super Strypi launch vehicle, and a fully integrated mission design for the Total Irradiance Monitor (TIM) and Spectral Irradiance Monitor instruments.

LASP’s Small Satellite Experience

LASP’s experience encompasses all aspects of designing, analyzing, fabricating, testing, and operating satellites and space science instruments, including:

**Spacecraft Buses**
- Structures, Mechanisms, and Deployment Systems:
  - Aluminum and composite structures, one shot covers, bi-stable mechanisms, multi-axis pointing platforms, solar array deployment, antenna deployment
  - Electrical Power System (EPS): Power generation, storage, regulation and distribution
  - Command & Data Handling (C&DH): Microcontroller (Rad-hard, embedded FPGA and commercial options), real-time clock, memory (EEPROM, RAM, SD card), serial interfaces (RS232/422, SPI, I2C, and custom)
  - Flight Software: Time slice custom operating system, power control and monitoring, command/telemetry handling, instrument operations, fault detection and correction, mechanism control
  - Attitude Determination and Control System (ADCS): Sub arc-min 3-axis stabilized platform design scaled for small satellites in collaboration with CU’s CO Center for Astrodynamics Research (CCAR)
  - Communication (COMM): Use of commercially available solutions for X-band and S-band
  - Thermal Control Systems: Passive thermal control systems designed with on-site mission thermal system analysis and test capabilities

**Mission Operations**
- On-site mission operations experts and facilities implementing turn-key applications for commanding (OASIS-CC) and planning (OASIS-PS), on-site UHF ground station available for use

**Data Systems**
- Hosted data centers, data processing experts, and web-based interactive data tools developers

For more info on the LMB and small satellite missions, contact Pete Withnell (303-492-1326, pete.withnell@lasp.colorado.edu).