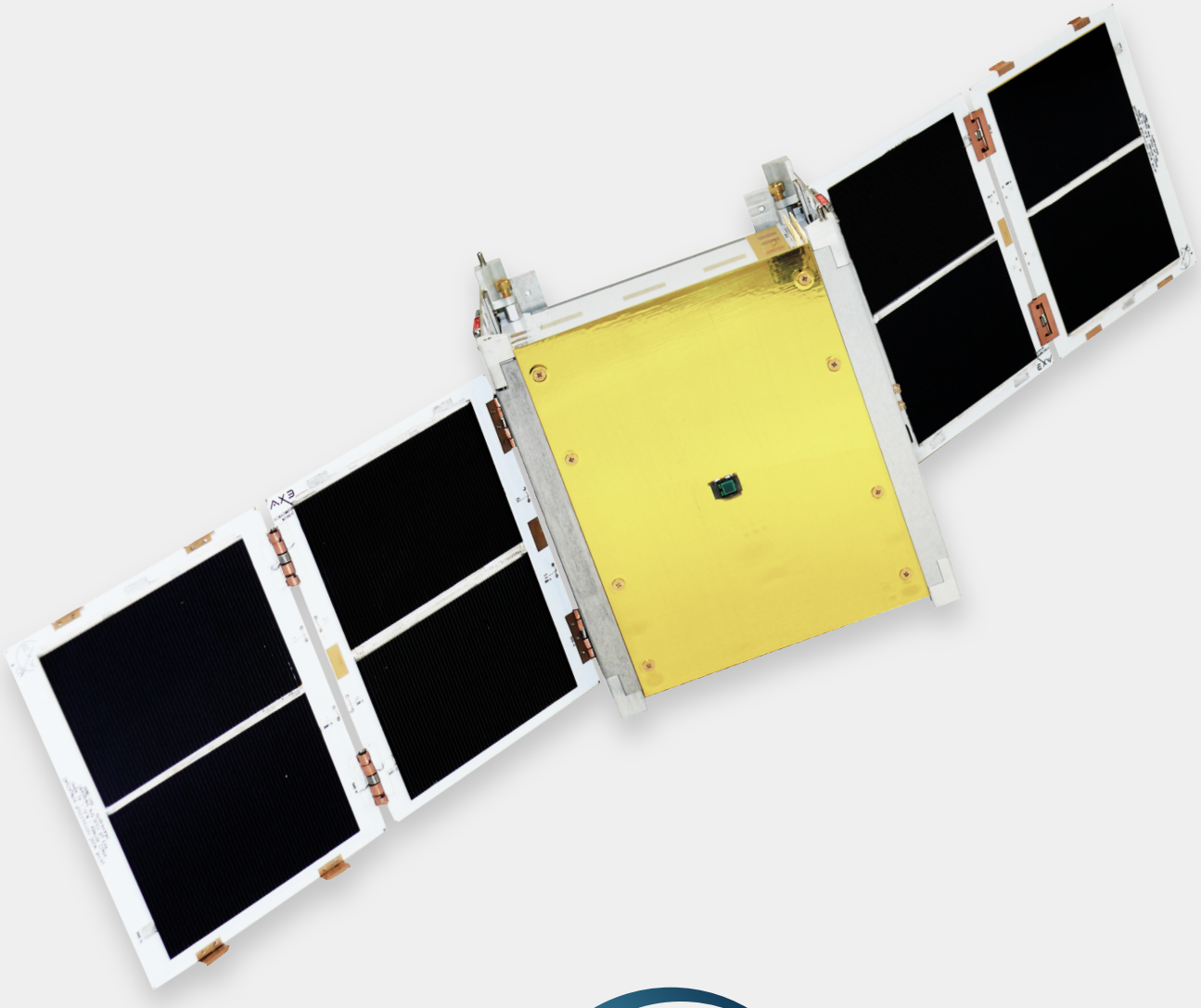
SERVICE SPECIFICATIONS

FullSat
SharedSat



ASTRALINTU
SPACE TECHNOLOGIES

May 2021, v1.2

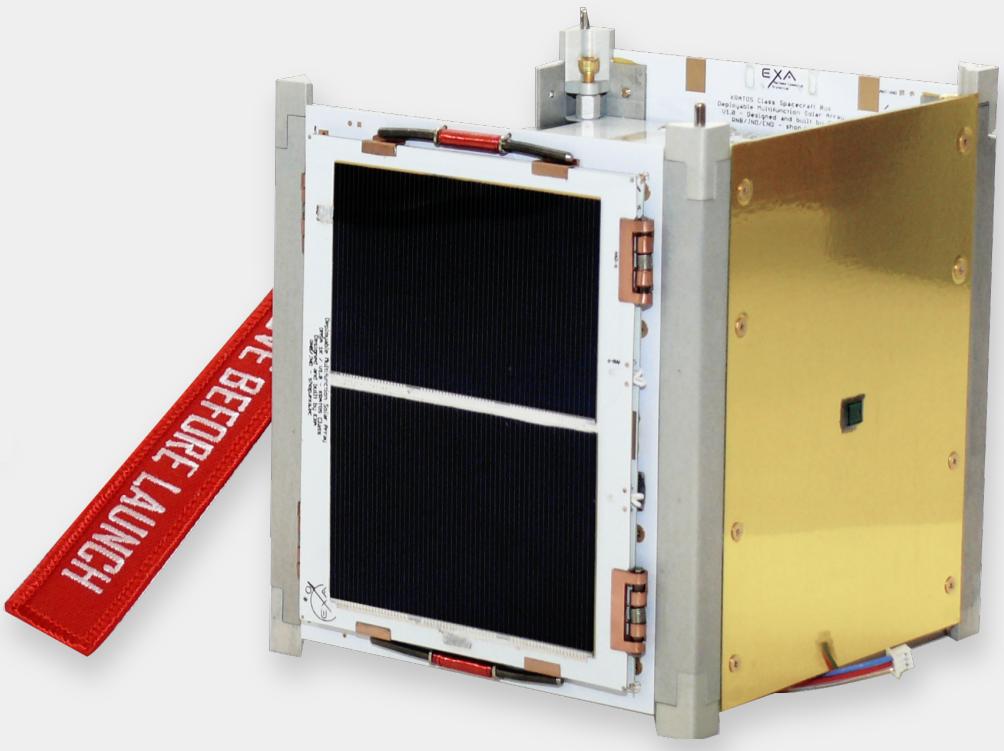
FullSat/SharedSat

With Astralintu's FullSat and SharedSat missions, we take your ideas to space with state-of-the-art technology and personalized support. On a dedicated FullSat or a shared SharedSat mission you focus on the payload; we take it to space.

Missions include planning, payload integration, testing, certification, launch procurement, frequency allocation, and more. Our engineering team will be with you all the way to orbit and assist you during it. We support technology demonstrations, educational missions, earth observation, scientific experiments, communications, constellations, and more.

Fly payloads built from commercial off-the-shelf components in the EXA KRATOS radiation proven, no thermal cycle spacecraft. No need to build rad-hard space-grade payloads: experience a radiation-free constant 10°C inside the spacecraft throughout LEO orbit.

Complement your FullSat or SharedSat mission with Astralintu's mission control, ground segment and secure data delivery services.



EXA KRATOS Spacecraft Bus 1U

The EXA KRATOS 1U Spacecraft Bus is a single-step CubeSat solution that allows developers to focus on the payload. The Spacecraft comes fully equipped and VTV tested, allowing Astralintu to integrate the user's payload and to prepare it to fly.

The EXA KRATOS 1U Spacecraft Bus is completely adjustable to various payload sizes and power requirements. Even with a compact 1U configuration, it has enough space to host up to 6 standard payload boards and 3 cameras while delivering up to 25 W of power.

The EXA KRATOS 1U Spacecraft Bus has everything needed to fly. The Spacecraft includes: onboard computer with preinstalled libraries, SDR Radio with integrated power amplifiers, powerful EPS with 4 power rails, UMPPT Solar Management coupled with a fast battery charger, Deployable Multifunction Solar Arrays, automated deploy/release control to up to 4 devices, embedded monopole and dipole antennas from VHF to L band, embedded magnetorquers, temperature and sun sensors in all walls, ADCS control with integrated Z axis magnetorquer, high power batteries, radiation hardened SSD storage and LASER communications at 10 Mbps minimum (add-on).

FullSat/SharedSat Configurations

FullSat gives you access to the entire spacecraft for your mission. SharedSat configurations allocate some of the KRATOS 1U Spacecraft Bus features for each payload slot. Other specified spacecraft bus features are fully available for the allocated daily time of operation for the corresponding slots (e.g. Tx/Rx time).

FullSat

Model	Description	Price
Alpha α	0.8U payload volume, 7 W solar arrays, 25 W·hr battery, basic ICEPS with OBC and SDR, basic antennas, basic ADCS, 20 hrs/day operation time.	Starting at **€ 130.000**
Beta β	0.8U payload volume, 10 W solar arrays, 25 W·hr battery, basic ICEPS with OBC and SDR, basic antennas, basic ADCS, 20 hrs/day operation time.	
Gamma ɣ	0.8U payload volume, 14 W solar arrays, 50 W·hr battery, ICEPS with OBC and SDR, S-Band Patch antenna, basic ADCS, 20 hrs/day operation time.	

* All Models have the option to add EXA-NEMEA Shielding (to operate with Earth standards components in the space).

SharedSat

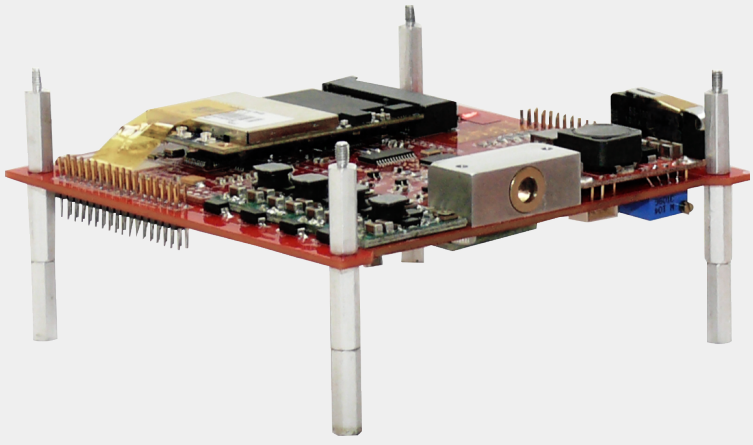
Slots Quantity	Description	Price
One Slot	0.13U Volume, 115 grams Mass, 4W Power, 2 hrs/day operation time.	Starting at **€ 22.000**
Two Slots	0.25U Volume, 230 grams Mass, 8W Power, 5 hrs/day operation.	
Three Slots	0.375U Volume, 345 grams Mass, 12W Power, 8 hrs/day operation time.	
Four Slots	0.50U Volume, 460 grams Mass, 16W Power, 11 hrs/day operation time.	

* All Slots have the option to add EXA-NEMEA Shielding (to operate with Earth standards components in space).

FullSat/SharedSat Features

Included in Base Configuration
Room for 6 standard payload boards and 3 cameras
USB 2.0 and I2C bus as standard
Embedded antennas, magnetorquers, temperature and sun sensors
Includes ICEPS all-in-one OBC, EPS, SDR radio and ADCS systems
Battery has temperature sensors, passive heater and optional active heaters
Designed for LEO missions and requirements
Manufactured according to NASA and ESA space standards and materials
Functional, performance, thermal bake out and vibration tests provided with documentation
Compatible and compliant with standard deployers and CubeSat Standard

Add-Ons/Upgrades
Room to control 2 more deployable devices as an add-on
LASER communications at 10 Mbps available as an add-on.
EXA NEMEA thermal cycling and radiation shielding.
L-band / S-band patch antenna (1000-3000 MHz)



Spacecraft Performance

Electric Power System (EPS)

Available power to each payload is allocated per slot. The following EPS specifications represent the full bus characteristics.

- 100 W max effective delivered power
- 1U Payload power available from 20 W (minimum) to 95 W (maximum)
- 4 Power Rails: 5 V at 25 W, 3 V at 25 W, 12 V at 50 W and 1 unregulated power rail
- 1 APU connection available
- UMPPT 4-channel, 2 A each, Solar power manager
- Fast 2 A dual Li-poly charger onboard
- Solar array power from 3.75 W minimum to 16 W maximum
- Solar Cell Efficiency: 28% (High power) or 19% (low cost)
- Battery: BA03/S slim high energy density array, from 25 W·hr (minimum) to 100 W·hr (maximum), embedded temperature sensor, standard graphene passive heater, optional active heater

Attitude Determination and Control System (ADCS)

ADCS capability is fully available for each payload during the daily allocated time per slot. Pointing libraries can be implemented to automatically position the spacecraft during the allocated time for each slot.

- 6 sun sensors input from all walls
- Integrated IMU o Optional Novatel GPS with antenna
- Detumbling and B dot libraries included
- Embedded Magnetorquers MT02
    - Nominal Magnetic moment: >0.14 A·m2
    - Saturation Magnetic moment: >0.48 A·m2
    - Linearity: +/- 4% across operating design range
    - Residual moment: <0.0075 A·m2
    - Torque: 3.66 μN·m @ 3.2 mTesla (1U mass)
    - Angular acceleration
        - 1.75 Rad/s2 (1U mass)
        - B-center = 3.0 Gauss
        - B-corners = 3.1 Gauss

- Z Magnetorquer MT01
  - Nominal Magnetic moment: >0.19 A·m2
  - Saturation Magnetic moment: >0.85 A·m2
  - Linearity: +/- 4% across operating design range
  - Residual moment: <0.0045 A·m2
  - Torque: 5.36 μNm @ 7.2-3 Tesla (1U mass)
  - Angular acceleration
    - 3.2-3 Rad/s2 (1U mass)
    - B-center = 8.9 Gauss
    - B-corners = 14.5 Gauss
  - Typical resistance: 4.1 to 4.7 Ohms @ 25°C,
  - Random Vibration: 16 G_{rms}
- Sun Sensor
  - Analog, GPIO, 5 V to 16 V
  - Linear response range from 0.2 V to 5 V
  - Working current: 50 mA
  - Working FOV: 65 degrees H/V

Software Defined Radio (SDR)

SDR Tx/Rx capability is fully available for each payload during the daily allocated time per slot. Communication frequency will be selected by Astralintu based on all users' mission requirements and be common to all payloads.

- Epiq Z2 ARM9 SDR
- SDR radio from 70 MHz to 6 GHz
- One Transceiver port and 2 Receive only ports
- Embedded Antennas
  - Band Range: VHF to L-band
  - Gain
    - Monopole configuration = 2.1 dB max,
    - Dipole configuration = 3.1 dB max,
    - Extended Monopole = 2.3 dB max
    - Lambda: from 1/4 to full wave
- Optional active S-band patch with 6 dBi gain, 120 degrees aperture (add-on)
- Optional active L-band patch with 6 dBi gain, 105 degrees aperture (add-on)

On Board Computer (OBC)

The OBC processing capability is fully available for each payload during the daily allocated time per slot. Flash memory, hard disk space, sensors and GPIO availability are allocated to each payload per slot. The following OBC specifications represent the full bus characteristics.

- Xilinx ARM9 dual core at 733 Mhz OBC
- Preinstalled Linux IIOS with full libraries
- 32 GB rad-hard storage (4GB available per slot, additional memory available as an add-on)
- 24 onboard sensors, 32 GPIO inputs (4 sensors and 5 GPIO inputs available per slot)
- USB and i2C concurrent buses (1 user device per slot, additional devices available as an add-on)
- 512 MB of DDR3L RAM
- 32 MB of QSPI flash storage for uboot bootloader Linux kernel, and root file system
- 480 Mbps bus speed (USB 2.0)

Shielding

As an add-on, users can select NEMEA temperature cycling and radiation shielding. This is a passive component available to all payload slots during in-orbit operation.

- SEAM/NEMEA A-class
- Regulates temperature to a comfortable and steady 10°C inside the spacecraft
- Stable and steady temperature through the complete thermal cycle o Deters and attenuates
- Alpha and beta particles, Gamma and X-rays and L-neutrons
- Can withstand 140°C on the outside while providing 20°C inside the spacecraft

Product Properties

The following properties correspond to the complete spacecraft and are common to all payloads.

Mass (exact mass depends on final configuration)	Alpha panel : 460 g minimum
	Beta panels: 500 g minimum
	Gamma panels: 540 g minimum
Al T6061 structure w/ 2 tunable pushers and 1 activation switch	
Solar panels thickness: (a) Folded: 1 panel/2 mm 2 panels/4 mm 3 panels/6.25 mm, (b) Unfolded: 1.5 mm	
Operating Temperature: -80°C to +140°C	
Radiation Tolerance: 4 years minimum in LEO MATERIALS	
Only TML and CVCM < 1% materials used (NASA and ESA approved)	
Contact sensors: Gold Deploy and Release	
Actuators: Deploy (spring operated), Release (EXA artificial muscles MDR/R1C, 50 grams max torque)	
Cell Material: GaAs (high power) or mono crystalline silicon (low cost)	
Cell Interconnector: Invar (silver plated)	
PTFE (Teflon) space grade cables, multi-strand, silver plated copper (AWG26, AWG24)	

Testing

Spacecraft is VTV tested before payload integration. After integration, the spacecraft undergoes another set of tests for launch certification.

- All panels are provided with tests reports regarding:
- Continuity isolation between cells and substrate
- No cracks warranty.
- Thermal Bake out (10E-5 mbar @ 50C for 72 hours)
- Full vibration test for Falcon 9, Electron, Soyuz, Dnepr and Long March 2D
- QT and AT are performed on the unit before payload integration

Add-ons / Upgrades

The following add-ons or upgrades can be acquired and implemented during mission operations or installed/allocated prior to deployment to orbit. If your mission requires additional capabilities aside from the ones presented, Astralintu can analyze any request.

Operations

- Additional daily operation time (in hours per day)
- Altitude raise from launch provider target SSO
- Additional integration, testing, and debugging
- In-orbit mission control and secure data delivery

Capacity

- Sets of 2W of additional battery power
- Sets of 4GB of additional rad-hard onboard storage
- L-band / S-band patch antenna (1000-3000 MHz)
- Additional Custom Power Rail
- Laser Optical Communications (up to 10 Mbps)
- NEMEA radiation and temperature cycling shielding
- Custom Deployment Capability (in addition to solar array deployment)
- Additional USB/I2C ports, GPIO inputs, and sensors

Contact Information

Eng Matías Campos MSc
CEO & Founder
matias.campos@astralintu.com

www.astralintu.com