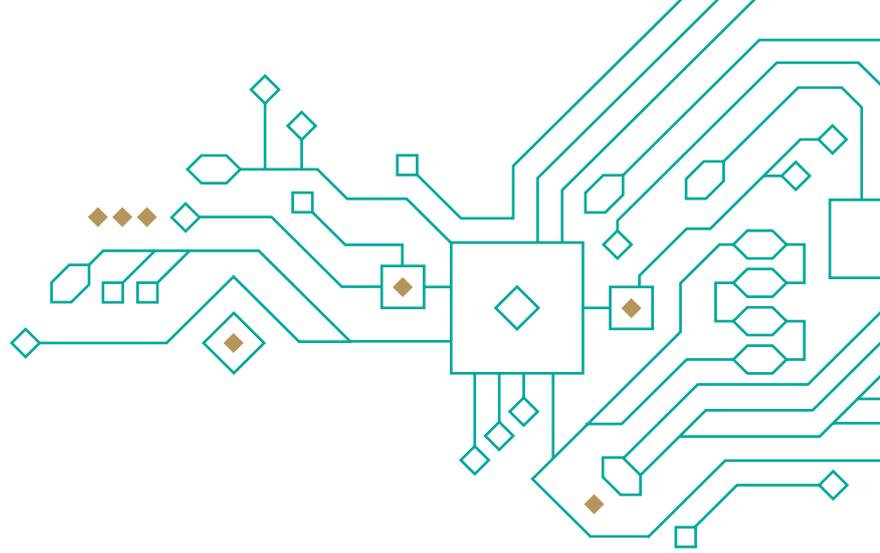


# LION DPU



## More AI power locked in the hardware

### ABOUT LION

Lion is a **data processing unit for advanced operations** with the use of artificial intelligence and on-board data processing. The Lion DPU is dedicated to micro and small satellites weighing **between 50 and 500kg**.

Lion is developed to process multi-dimensional and multi-sensor data in orbit and is composed of high-performance COTS components that satisfy the processing power, high reliability and memory bandwidth demands for a wide range of missions. Combined with **The Herd** (our library of AI-powered on-board data processing algorithms), this technology will connect the eyes (sensors) with the brain (DPU), thus enabling artificial intelligence to ensure **autonomous decision making in situ**.

It supports challenging activities allowing, for example, close-proximity operations through vision-based relative navigation between two spacecrafts for active debris removal or in-orbit servicing.

The Lion DPU hardware platform is composed of the Kintex Ultrascale FPGA with an accompanying external supervisor which provides **single-event effects (SEE) and single-event functional interrupt (SEFI) protections**, including configuration memory scrubbing and specialized watchdogs.

Thanks to the built-in bootloader, the external supervisor can update itself and reprogram the Kintex Ultrascale FPGA in-flight. Lion is also equipped with up to 8 GiB of DDR4, up to 16 SLC NAND Flash and up to 1 TiB of SSD storage. The developed thermal storage system can extend the on-orbit operation of the DPU to **at least five years**.

Lion is a part of **Smart Mission Ecosystem** – hardware, software and AI-powered algorithms designed to complete your mission.

### LION IS BUILT OUT OF 3 KEY ELEMENTS



#### Data Processing Unit

The DPU allows uninterrupted operation in orbit. Thanks to being equipped with specialised components it is **able to perform continuous and dynamic correction of errors** which may occur in space.



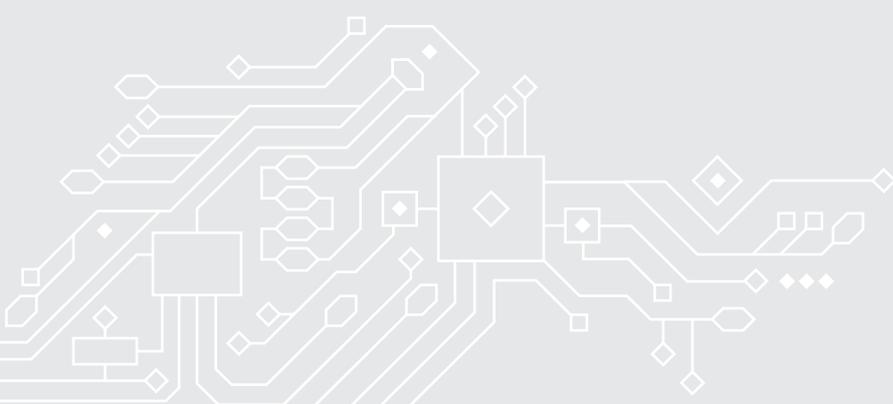
#### Thermal Accumulation System

The system **reduces the adverse effects of temperature cycling** on the risk of failure. The optional Phase Change Material-based TCS **enables the averaging of temperatures and thus prolongs lifetime**.



#### Customised DPU management software

The customised software delivers the following: smooth communication with other satellite subsystems; **telemetry data collection, monitoring and provision; the management and running of data processing algorithms** provided by the customers.



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## TECHNICAL SPECIFICATION

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### PROCESSING CORES

Xilinx Kintex Ultrascale FPGA

**KU035 | KU060 | KU095**

- ◆ Kintex Ultrascale FPGA for custom function implementation
- ◆ Optional Microblaze soft-core running on Kintex equipped with an external 4 MiB of MRAM in which the application software may be loaded by an external supervisor
- ◆ 3x64 MiB of NOR Flash to store FPGA bitstreams
- ◆ Multiple FPGA bitstreams can be stored and selected for in-flight loading

### MEMORY

- ◆ 2-8 GiB DDR4 providing with ECC
- ◆ 4-16 GiB SLC flash-based file system storage (EDAC)
- ◆ Up to 4x256 GiB of SLC flash-based data storage (possible redundancy)

### INTERFACES

- ◆ Exposed interfaces: CAN, LVDS, RS422/485, UART, GTH transceivers
- ◆ Additional customisable interfaces upon request: SpaceWire Lite, SpaceWire RMAP, Gigabit Ethernet
- ◆ LVDS/RS422 interfaces compatible with X/S-Band radios
- ◆ CCSDS-compatible IP-cores for X/S/Ku-Band radios upon request

### SPECIFICATIONS

- ◆ Up to 15W at the KU035 version with the option of scaling up for a more powerful FPGA
- ◆ TID resistance - minimum 20kRad
- ◆ Embedded SEU and SEFI mitigation techniques – MRAM-equipped supervisor, Kintex's CRAM scrubbing by external supervisor, SEFI detection, RAM scrubbing, etc.
- ◆ Thermal control system for SpaceVPX version heatsink with wedge locks that provide a thermal interface to a carrier box
- ◆ Client-driven customisation available upon request
- ◆ A PCM-based thermal control system available upon request

### SOFTWARE ECOSYSTEM

- ◆ Both Supervisor and Microblaze can run FreeRTOS (default) or RTEMS
- ◆ Linux support on Microblaze available upon request
- ◆ AI-based neural network engine running on Microblaze, accelerated by FPGA upon request
- ◆ OpenCV support available upon request
- ◆ Fully reconfigurable in orbit (Supervisor software and Kintex's bitstreams can be uploaded from the ground station)

### REDUNDANCY

- ◆ Possibility to introduce additional redundancy to each version

### FORM-FACTOR

- ◆ SpaceVPX 3U (mass up to 2.5 kg) or a custom form factor
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## ABOUT US

KP Labs is a NewSpace company based in Poland. We deliver AI computers and software to bring autonomy into demanding space missions. We are a team of more than 50 space enthusiasts who do not think that the sky is the limit.

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## SOUNDS GOOD?

Contact us at [sales@kplabs.pl](mailto:sales@kplabs.pl) to attain the benefits your organization deserves!

 **KP LABS** | KP Labs Sp. z o.o. | st. Konarskiego 18 C, 44-100 Gliwice, Poland | +48 32 461 22 99