

# Lynx - Performant and Flexible Processing Board

Eric Fornstedt

RUAG Space

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Together  
ahead. **RUAG**

# RUAG Space

EUR **328** million  
net sales in 2017

Products on **1'000**  
payloads delivered to space

**Preferred** partner for  
institutional & commercial  
customers

**Leading** independent  
supplier for space  
**products**

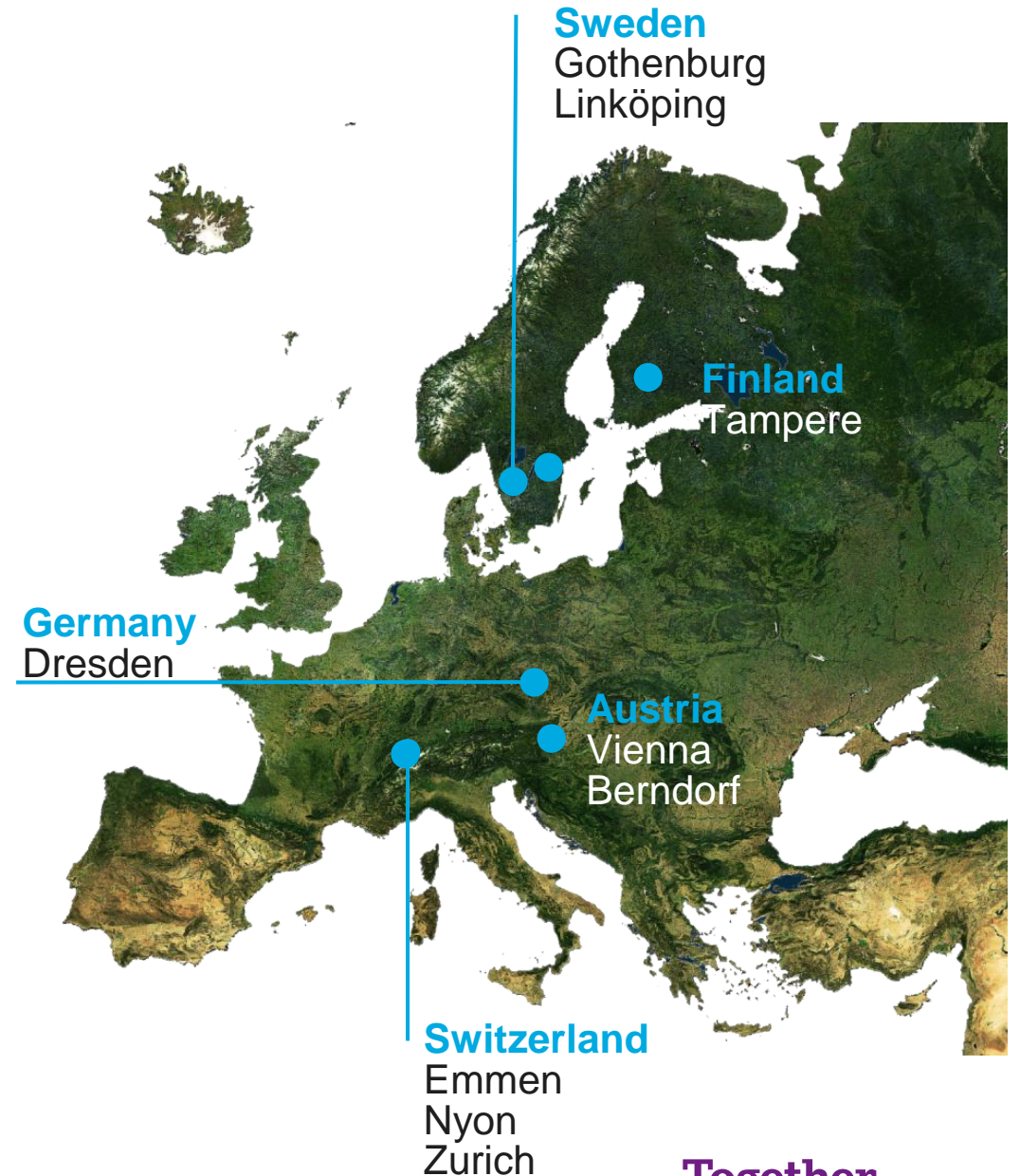
**100%**  
mission  
success

© image: ULA



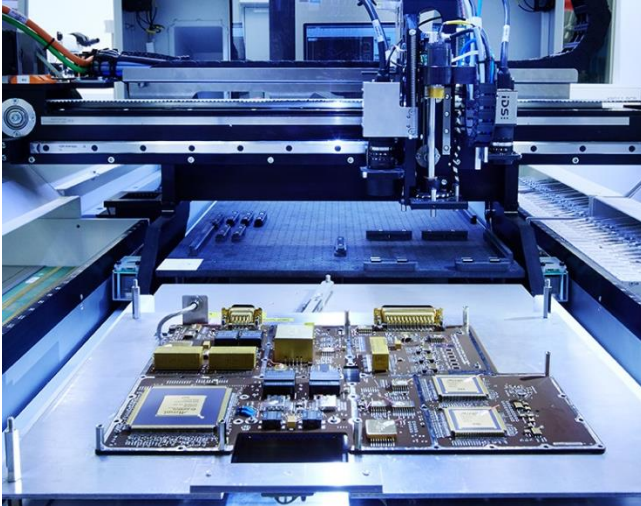
# RUAG Space on Earth

Close to our customers



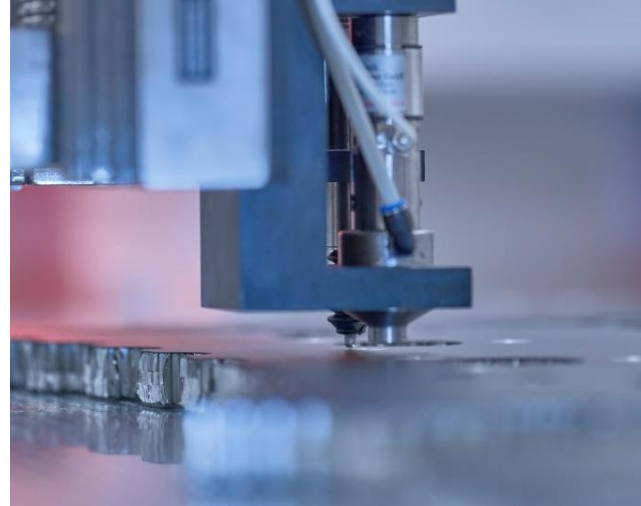
# Market leading portfolio

## Across three product groups



### Electronics

- Satellite and Launcher Computers
- Navigation Receivers & Signal Processing
- Power & Drive Electronics
- Microwave for Telecom
- Antennas



### Spacecraft

- Satellite Structures
- Satellite Mechanisms
- Mechanical Ground Support Equipment
- Thermal Systems
- Slip rings



### Launchers

- Launcher Fairings and Structures
- Adapters, Separation Systems, Dispensers
- Sounding Rocket Guidance Systems

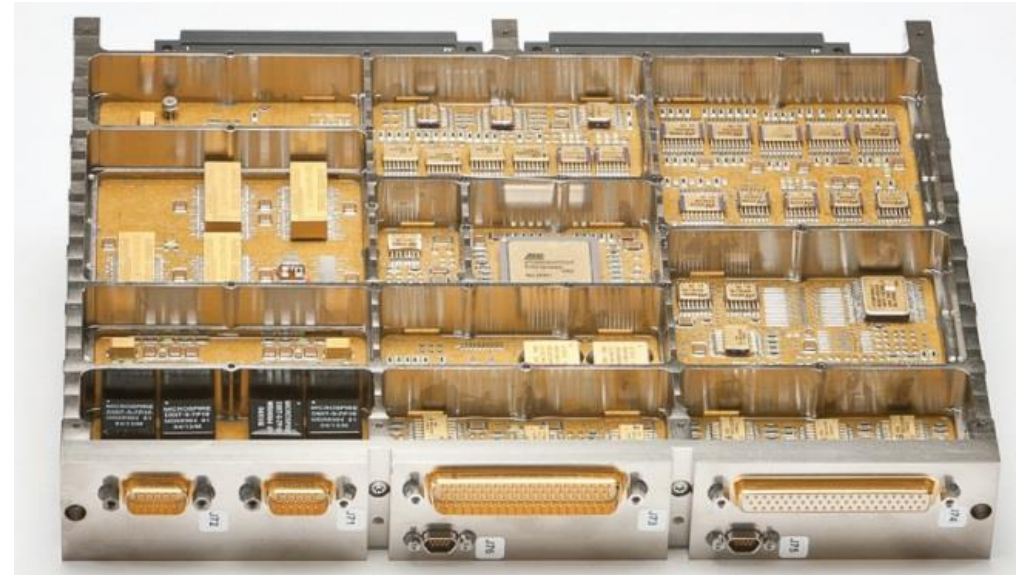


# Before Lynx

## Traditional Single Board Computers

High quality products build with a specific mission in mind.

- Performance of ~100 DMIPS
- Very reliable and durable
- Functionality and interfaces defined my hardware



# Modern On-Board Processing Challenges

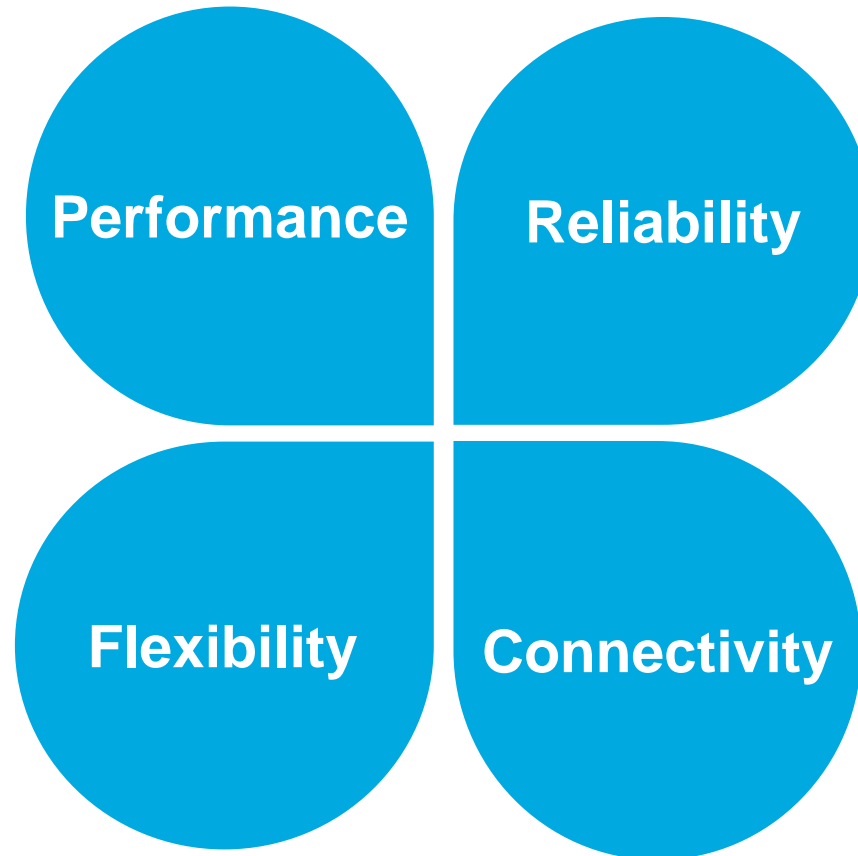
- Artificial intelligence – selection of data before downlinking
- Visual navigation and autonomous control
- Image and signal processing
- Software defined radio



- High performance processing modules in standard form factor

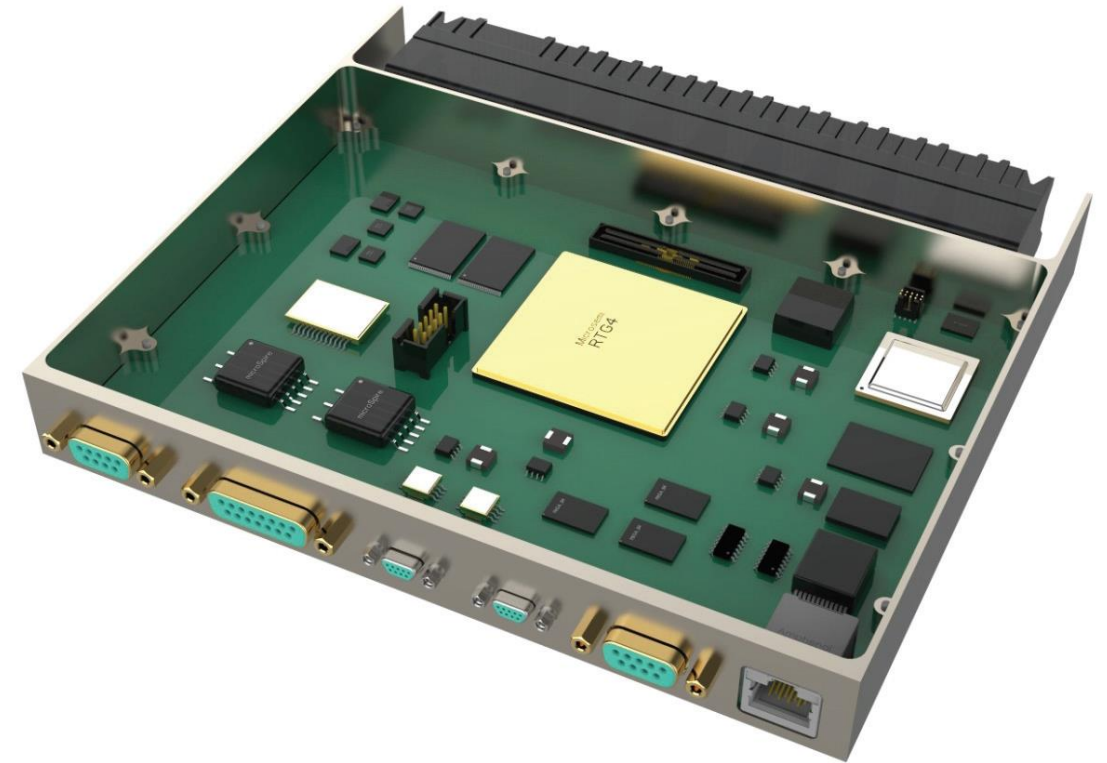


# Lynx Cornerstones



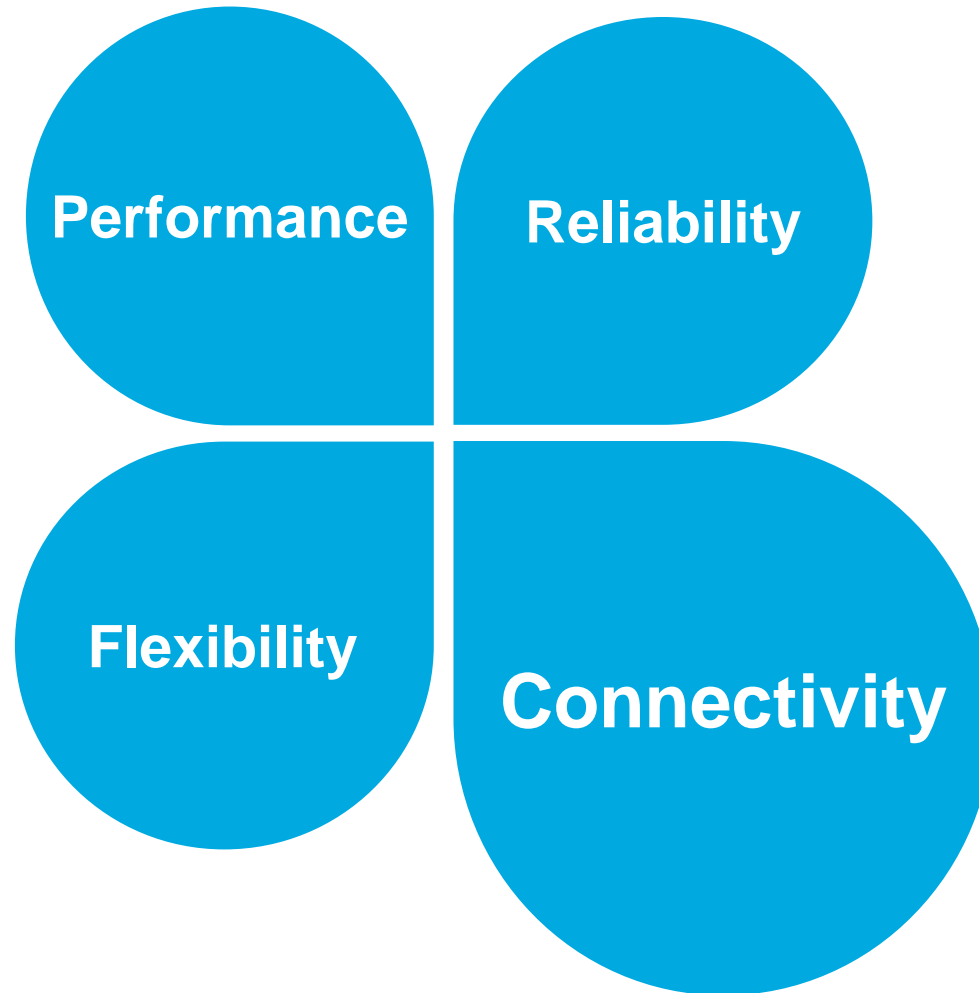
# Lynx Overview

- World leading processing performance, up to 10 000 DMIPS
- World leading high data communication bandwidth, up to 10 Gbps
- Flexibility
  - Software defined interfaces
  - Extension capabilities
  - Operating system or hypervisor of your choice
- Standard form factor easily integrated in your equipment





# Lynx Cornerstones



# Lynx Connectivity

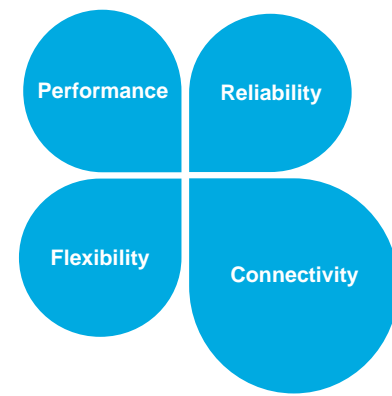
- Custom high-speed interfaces using SERDES and PCI-express to interface e.g. external high-speed DAC/ADC, GPU, DSP or FPGA.
- Traditional interfaces such as SpaceWire, M1553, CAN, GPIO and UART to interface other units.

## Front

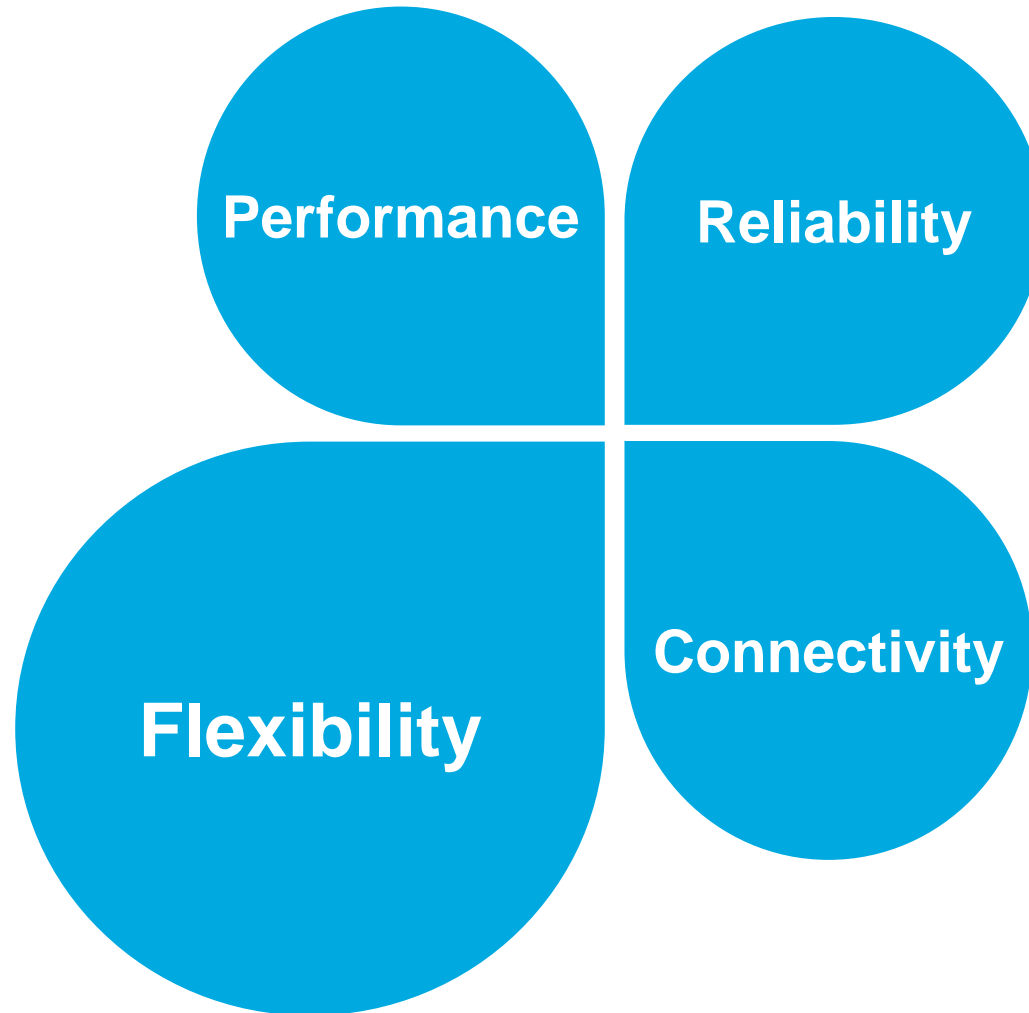
- 3 x SpaceWire (opt.)
- 2 x UART
- 2 x MIL-STD-1553B (opt.)
- 2 x CAN (opt.)
- 16 x GPIO (configurable)
- Test & debug
  - Gigabit Ethernet
  - UART

## Backplane

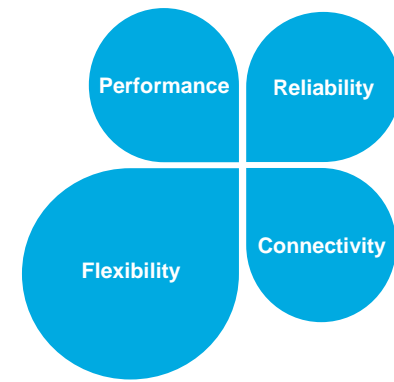
- 5 x HSSL (PCIe gen X) @ 3 Gbps
- 10 x SpaceWire
- 2 x I2C
- 6 x SPI
- 2 x UART
- 32 x GPIO
- Lynx cross-strapping
- Power supply



# Lynx Cornerstones



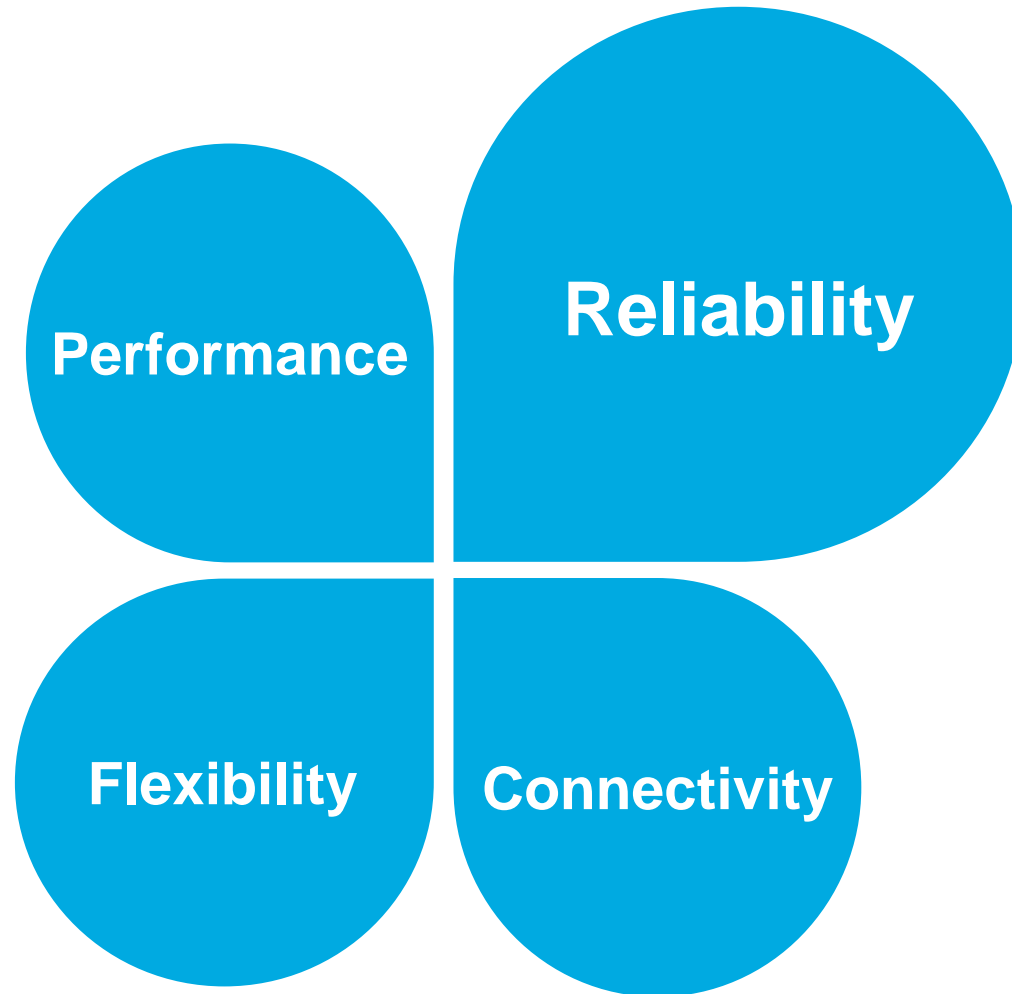
# Lynx Flexibility



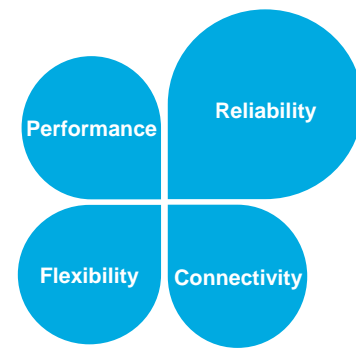
- Processor and FPGA can be selected independently for optimal balance between price, performance and reliability.
- Mezzanine connector allows extended functionality through daughter board extension.
- Several boards can be connected to increase performance or implement redundancy/voting mechanisms.
- Physical Interfaces are mounted only if they are necessary for the intended mission.



# Lynx Cornerstones

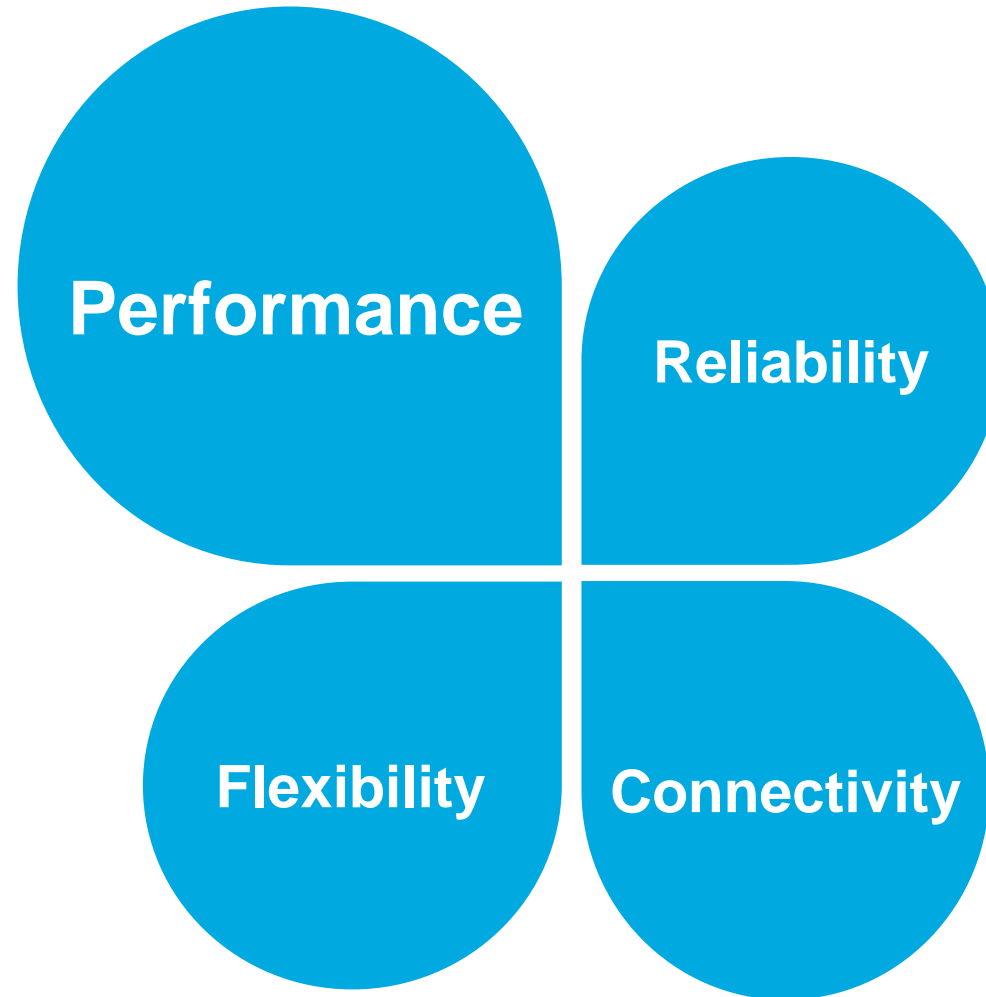


# Lynx Reliability



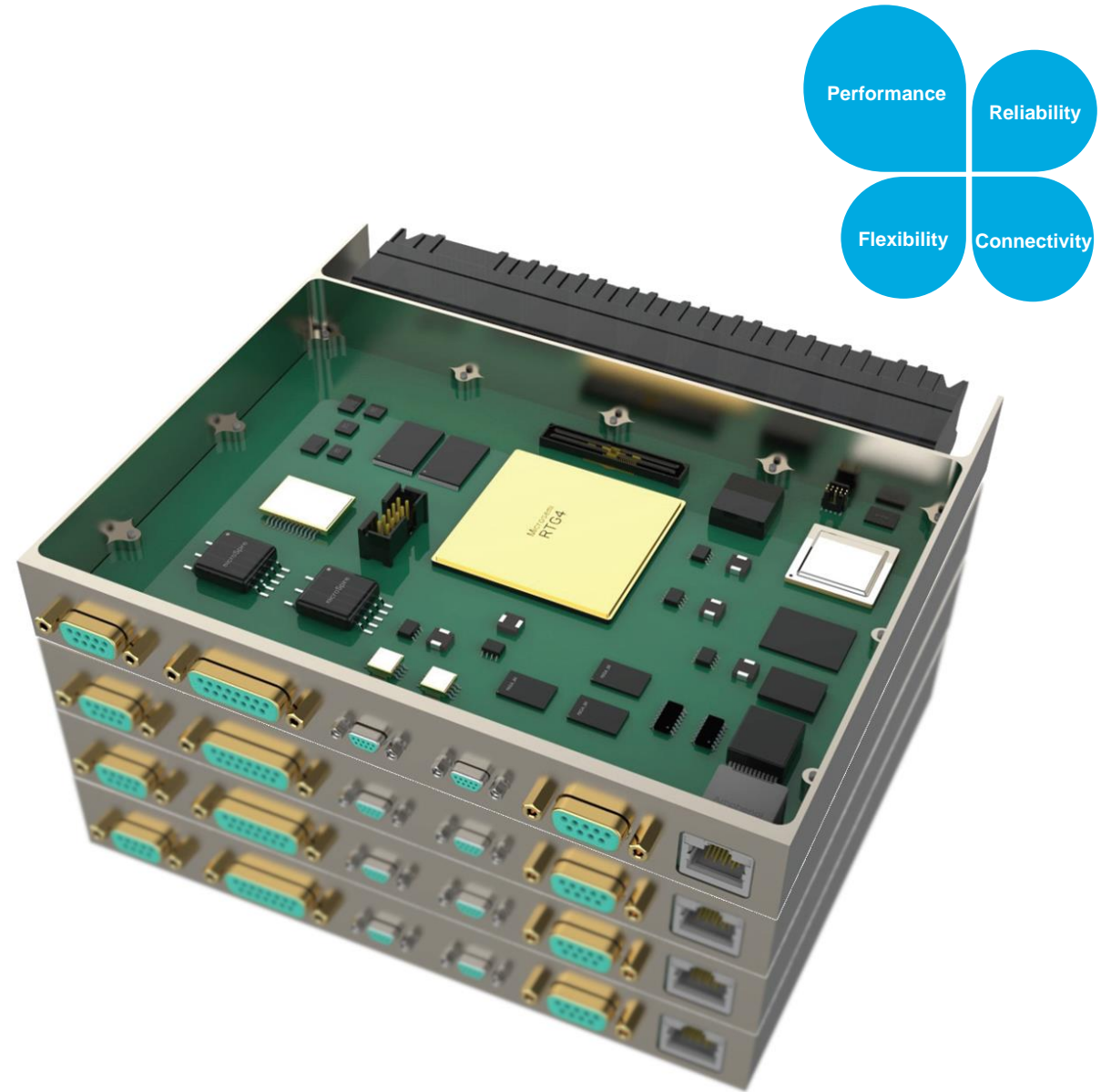
- State-of-the-art error detection and correction capabilities with ECC for processing, communication and non volatile memories.
- Radiation hardened FPGA, which includes TMR to further enhance reliability, can supervise a non-radiation hardened CPU.
- Radiation hardened alternatives are available also for the CPU for missions with very high availability/reliability requirements.
- Component latch-up protection by constant monitoring of current use.
- Hypervisor for isolation of independent software partitions.

# Lynx Cornerstones



# Lynx Performance

- PCI-express enables DMA data transfers between boards and fast communication between processors and FPGAs.
- Multi-core ARM CPU of more than 10 000 Dhrystone MIPS (DMIPS) in one board provides ample general purpose processing power.
- Modern FPGA for implementation of critical processing tasks.
- Mezzanine connector enable add-ons with additional FPGA, high-speed ADC/DAC, DSP or GPU etc.



Performance

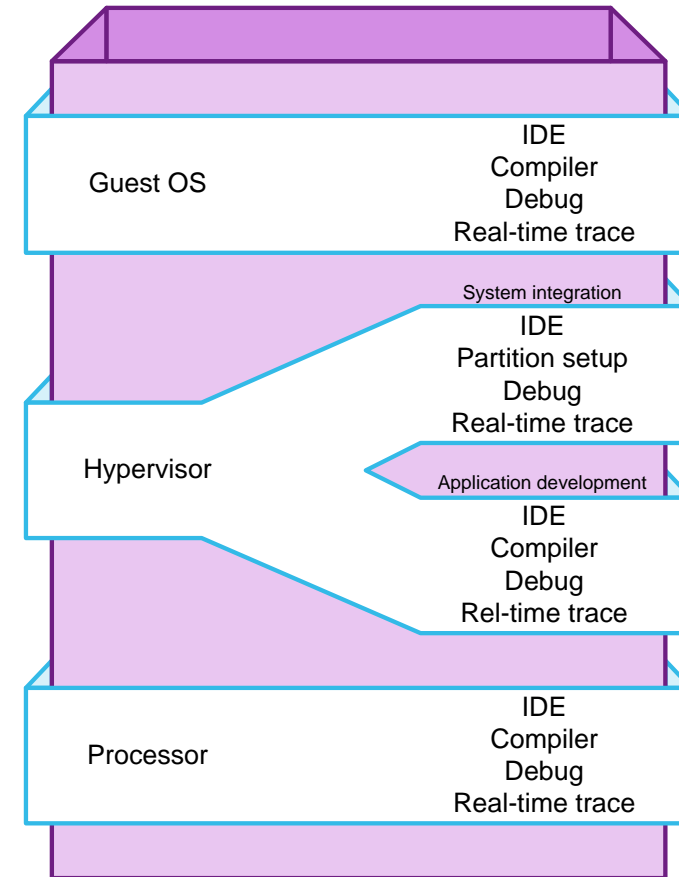
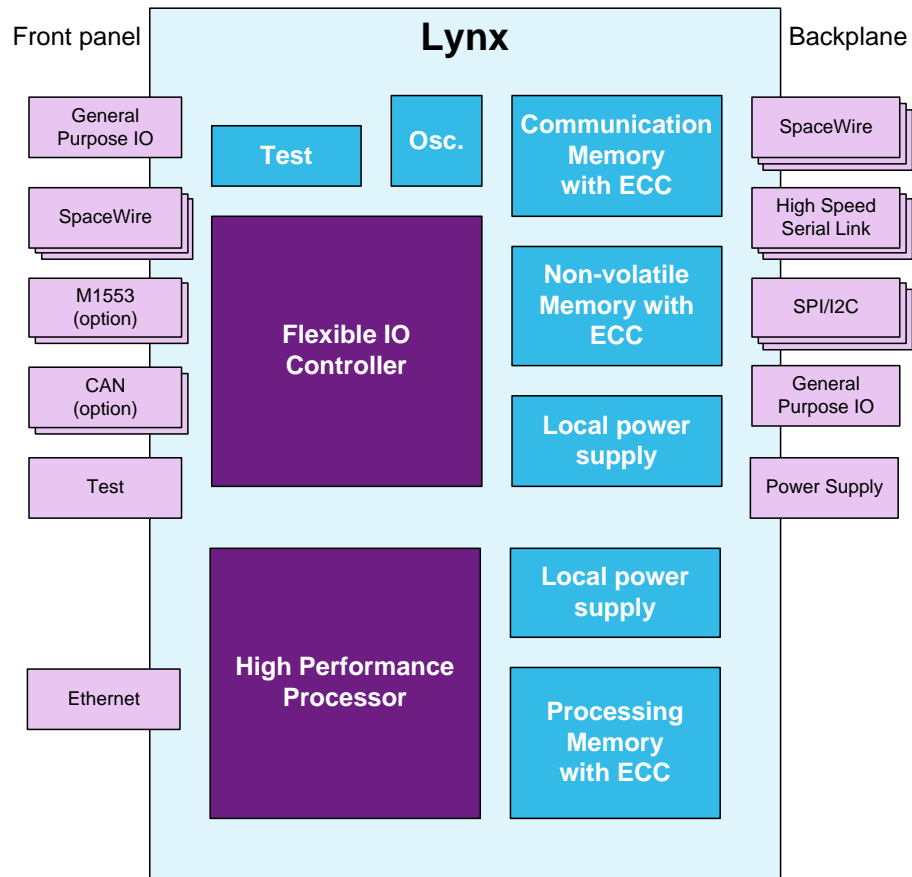
Reliability

Flexibility

Connectivity



# Lynx Details



# Lynx Details

## Key Features

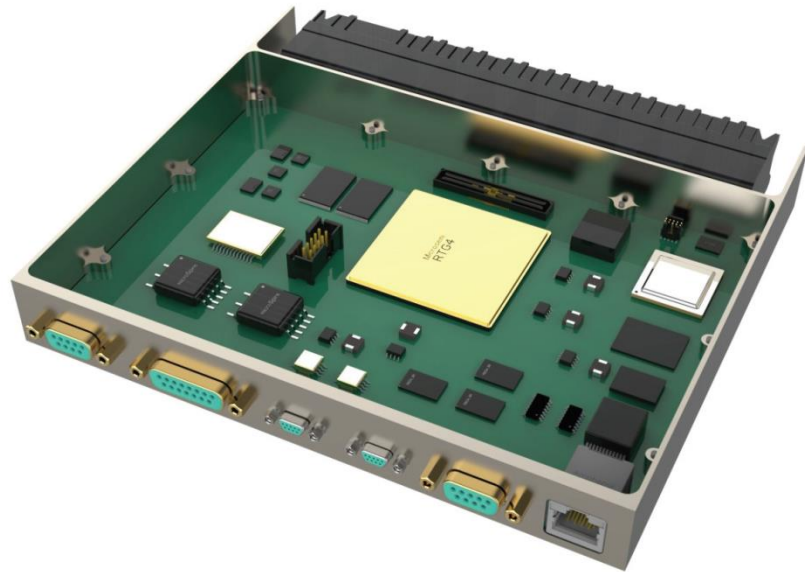
- 6U SpaceVPX Serial (optional)
- Mezzanine board (optional)
- ARM processor with 4 x CPU cores
- 32 KiB L1 instruction cache
- 32 KiB L1 data cache
- 2 MiB L2 cache
- Gigabit Ethernet Debug Link
- Real-Time Processor Trace Dump
- Hardware Driver Software

## Budgets

- Form factor 6U-160, 5 HP  
234 x 160 x 25.4 mm
- Power consumption 10-25 W
- Mass 1 kg incl. frame
- In-orbit life time 15 years
- Processing memory 4 / 8 GiByte
- Non-volatile storage 4 / 8 / 16 GiByte
- Communication memory 512 MiByte

# Lynx

## High Performance Single Board Computer



**We listen to make it right.  
We stay to make it real.  
A promise you can trust.**

### **RUAG Space Heritage**

- > 2900 failure free equipment years in orbit
- > 300 Launcher On-Board Computers
- > 120 Satellite Data Handling Systems