

Scalable High-Speed Mass Memory Units for ADHA and beyond

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Research & Development

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DSi Aerospace GmbH is a privately-owned SME headquartered in Bremen, Germany providing dependable electronics since 1997

DSi
Aerospace

Bremen &
Braunschweig

Payload Data
Handling Units

On-Board
Computers

Instrument
Control
Units

Data
Processing
Units

Ground
Support
Equipment

Currently with 100 employees.

DSi
Aerospace
Hungary

Subsidiary in Budapest established 03.2024

Dependable electronics – from LEO to deep space

Earth Observation

BIOMASS

Payload and Data Handling Unit
(Airbus, United Kingdom)

FLEX

Payload and Data Handling Unit
(Thales Alenia Space, France)

FORUM

Payload and Data Handling Unit
(Airbus, United Kingdom)

Science & Exploration

JUICE

Solid State Mass Memory
(Beyond Gravity, Sweden)

PLATO

Solid State Mass Memory
(Beyond Gravity, Sweden)

I-HAB

Mass Memory Storage
(Thales Alenia Space, France)

Space Safety

HERA

Mass Memory Unit
(Redwire Space, Belgium)

COMET-I

Mass Memory Unit
(OHB, Italy)

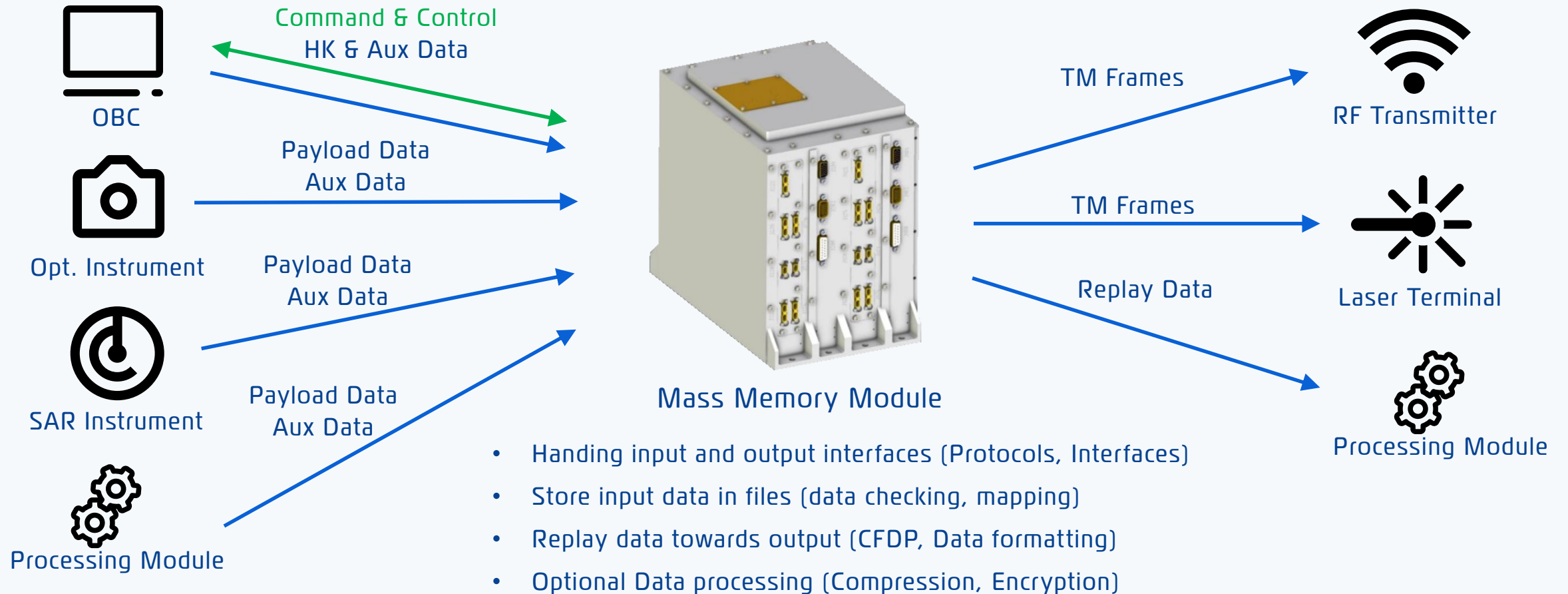
CLEARSPACE-1

On-Board Data Handling
(Clearspace, Switzerland)

Major Programs - Copernicus

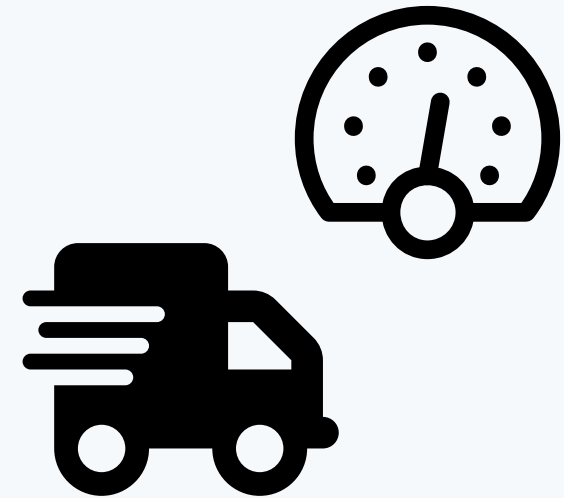


Mass Memory Units for Earth Observation



Trend to High Speeds

- Required Data rates (Interface Speeds & Throughput) are continuously increasing
- 3 Speed categories identified throughout various missions
 - Medium missions (e.g. Copernicus Expansion)
 - Up to 5 Gbps data throughput
 - SpW/WizardLink Data Interfaces
 - High-End missions (e.g. Sentinel NG)
 - 10 to 40 Gbps data throughput
 - SpW & SpFi Data Interfaces (incl. optical Links)
 - Next-Gen High-End Missions (e.g. national EO)
 - 40 to 120 Gbps data throughput
 - SerDes / SpFi based Interfaces (optical Links)
- Scalable Architectures cover wide throughput ranges for High-End or NG Missions
 - Units assembled from modular system up to standardized units
 - Standardized units with fixed HW speeding-up development time & reducing engineering risks



ADHA A3M System

A SCALABLE MASS MEMORY MODULE FOR ADHA



- Modular system scalable based on mission performance needs

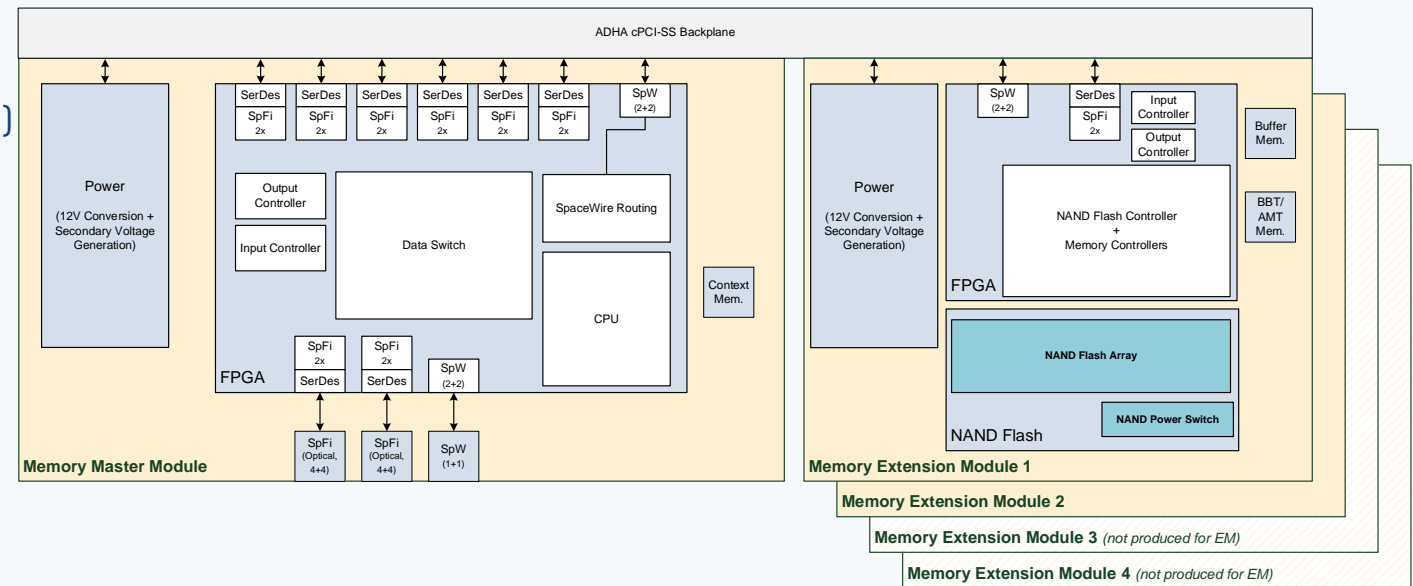
- Between 1-6 6U ADHA Modules
- Up to 40 Gbps data rates
- Up to 104 Tbit storage
- Redundancy with multiple modules (MMM)

- Memory Master Module (MMM)

- Controls multiple MEMs
- High speed interfacing

- Memory Extension Module (MEM)

- Add more MEMs for more performance
- Can be operated standalone by OBC

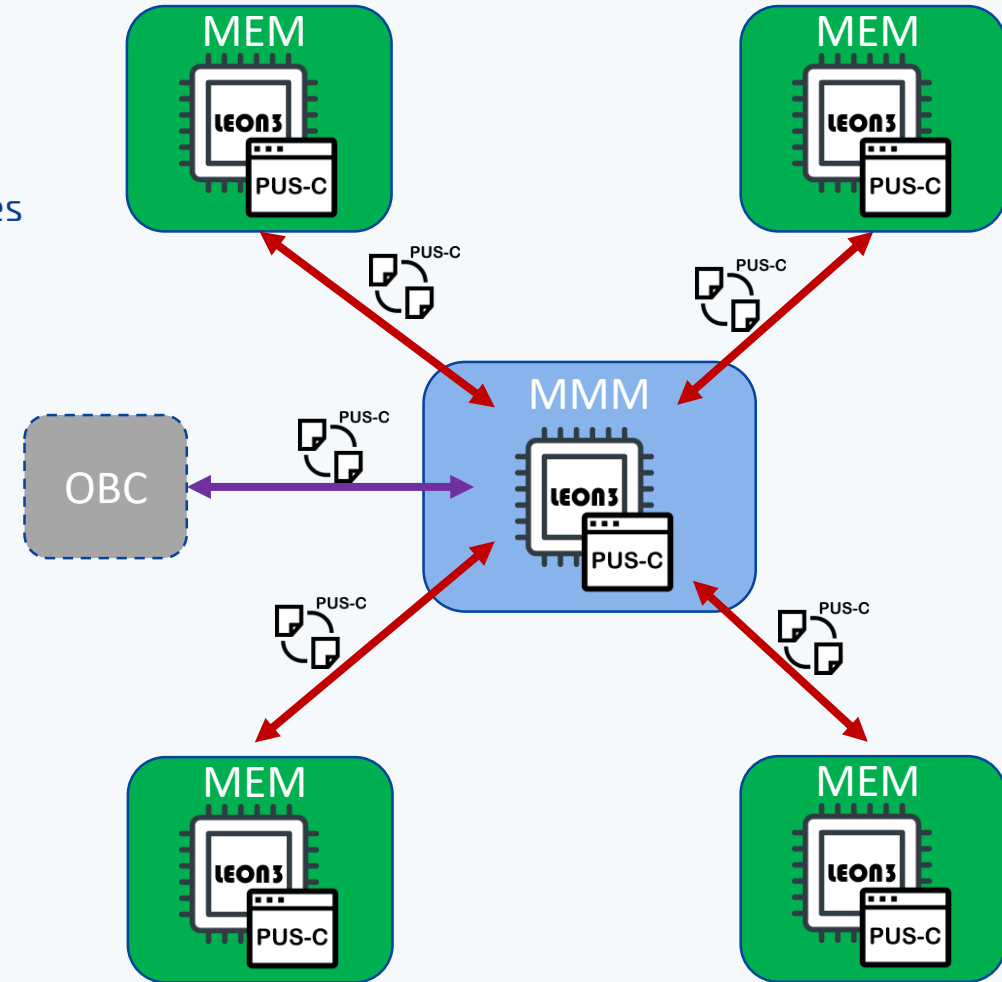


ADHA A3M System – System Concept



- Master Module - Supervising and Interfacing Unit
 - Interfacing module for external and internal high-speed data sources and sinks
 - Bridge between SpaceFibre and SpaceWire
 - Downlink Data Processing
 - High-Level File system*
 - Managing MEMs*
- Extension Module - Minimal Mass Memory Module
 - Data Acquisition from SpFi or SpW
 - Data Replay to SpFi or SpW
 - CFDP Entity for Data Replay
 - Flash File System*

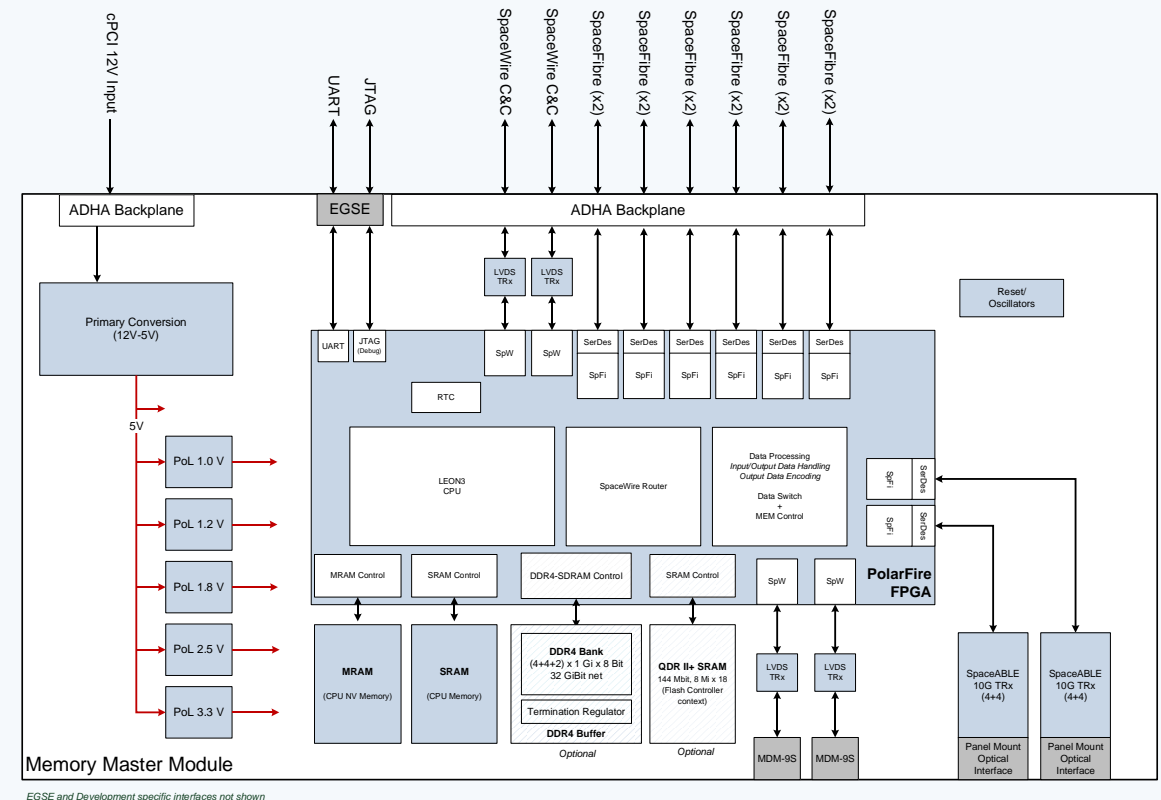
* A3M EM will contain only minimal SW on MMM and MEM but include PUS-C terminals



ADHA Memory Master Module



- 6U ADHA Memory Master Module
- Controls and routes data to/from up to 4 MEMs
- SpaceFibre/SpaceWire routing
- 4× MEM ADHA Backplane SpiFi interfaces
- 2× Generic ADHA Backplane SpiFi for other ADHA Modules
- 2× optical high speed front panel interfaces
- Soft CPU for monitoring and control of MMM and MEMs
- PUS-C TM/TC interface
- C&C via backplane SpaceWire to OBC
- TM Encoding of outgoing data

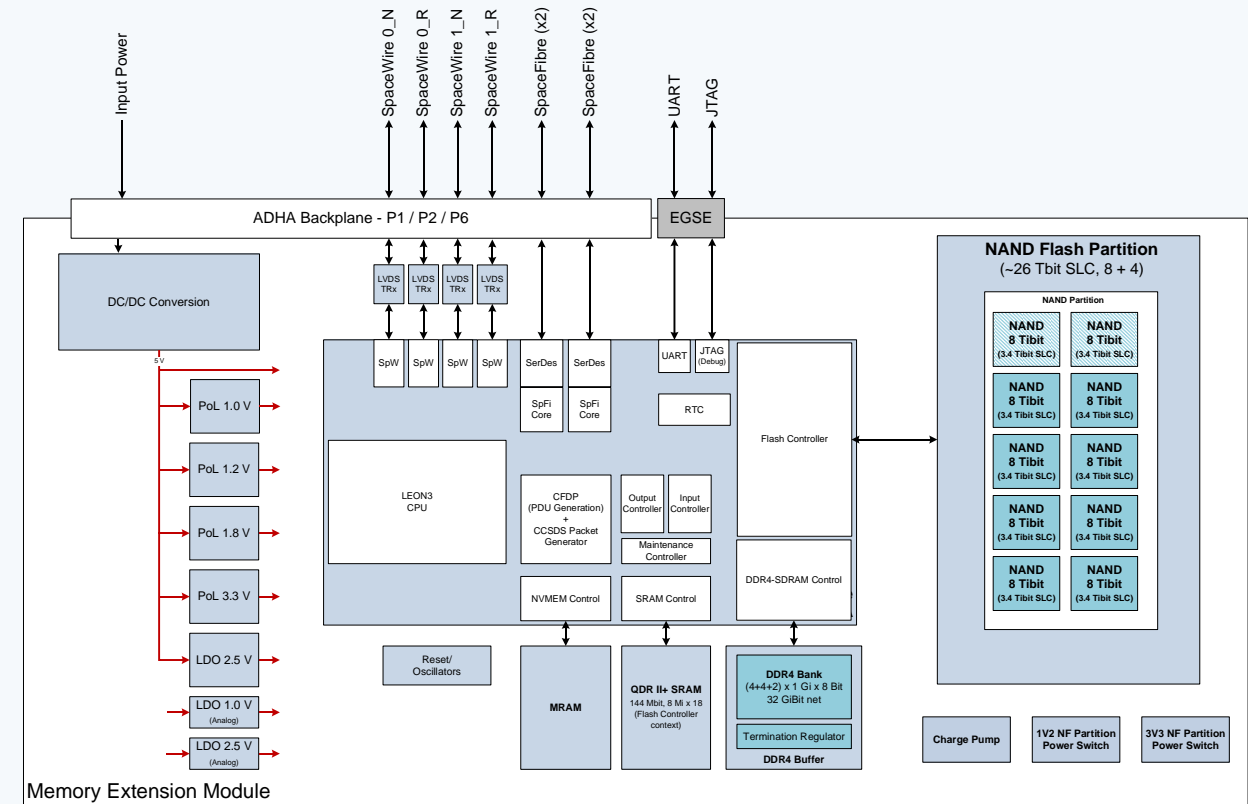


ADHA Memory Extension Module



- 6U ADHA Memory Extension Module
- Provides non-volatile mass storage to ADHA
- N+R MMM ADHA Backplane SpiFi interfaces
- 2× N+R 100 Mbps (via backplane SpW) to OBC*
- 26 Tbit NAND Flash user storage
- RT-PolarFire FPGA based design
- Soft CPU for local File System Management
- PUS-C TM/TC interface
- C&C via backplane SpaceFibre VCO from MMM
- C&C via backplane SpaceWire to OBC*
- CCSDS packet generation and CFDP PDU Generation

* In MEM stand alone configuration

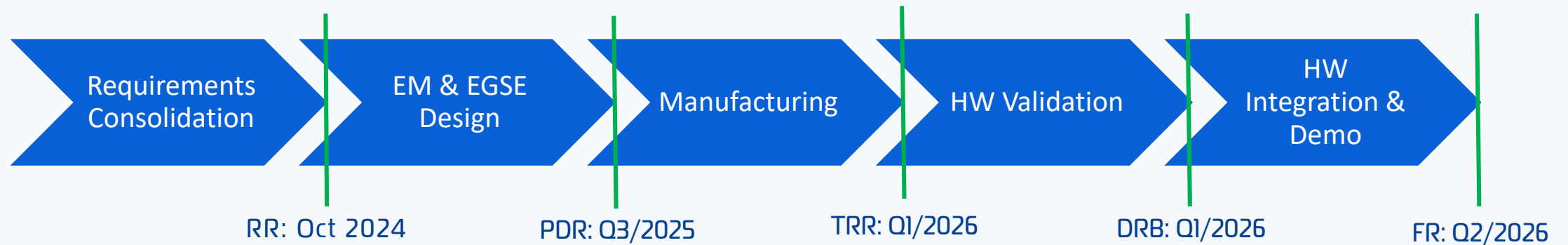


for a better space.

ADHA A3M System – State of Project



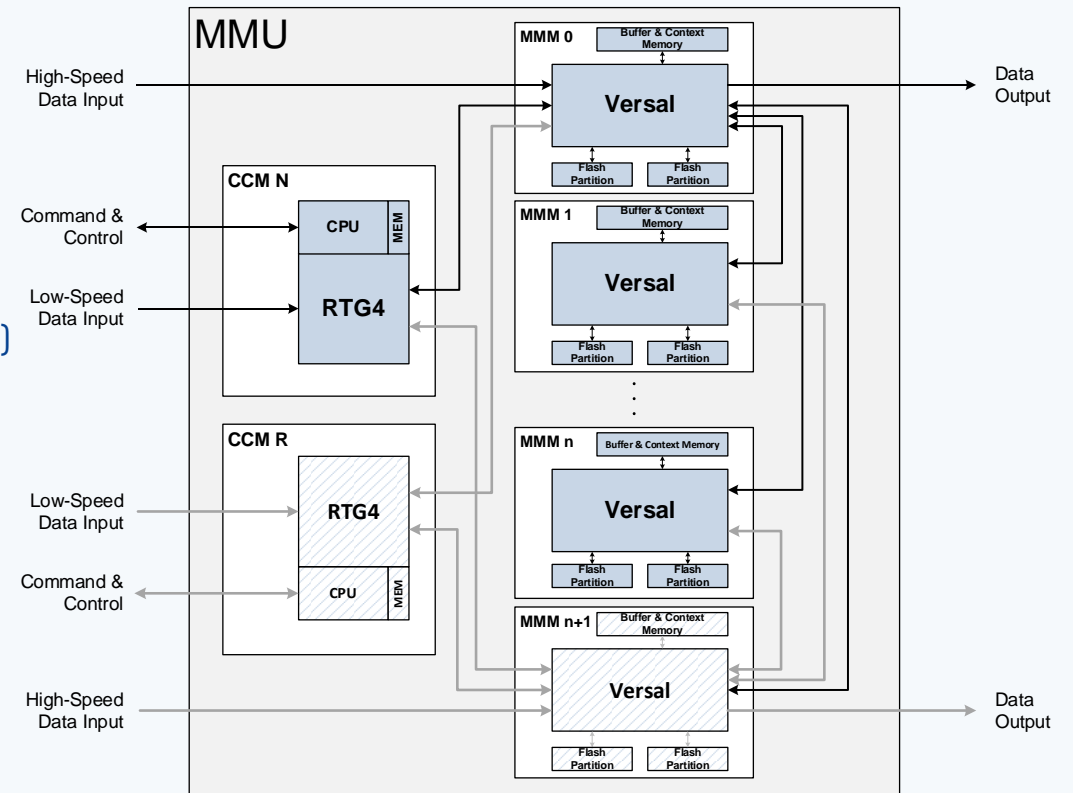
- Working towards Req. Review
- Schedule



MMU-NXT System

- Modular system scalable based on mission performance needs
 - Between 2-6 Modules
 - Module size $\sim 275 \times 60 \times 240 \text{mm}^3$
 - Up to 100 Gbps data rates*
 - Up to 192 Tbit storage*
 - Redundancy with multiple modules (2 CCMs, N of M MMMs)
- Command and Control Module (CCM)
 - CPU Managing File System & multiple MMMs
 - Low & Mid Speed interfacing (SpW/WzL)
 - Managing Observing SRAM FPGAs (MMM)
- Mass Memory Module (MMM)
 - Non-Volatile Memory & Buffer Memories
 - single or multiple MMMs for higher capacity / throughput
 - Data forwarding via high-speed MMM to MMM connection

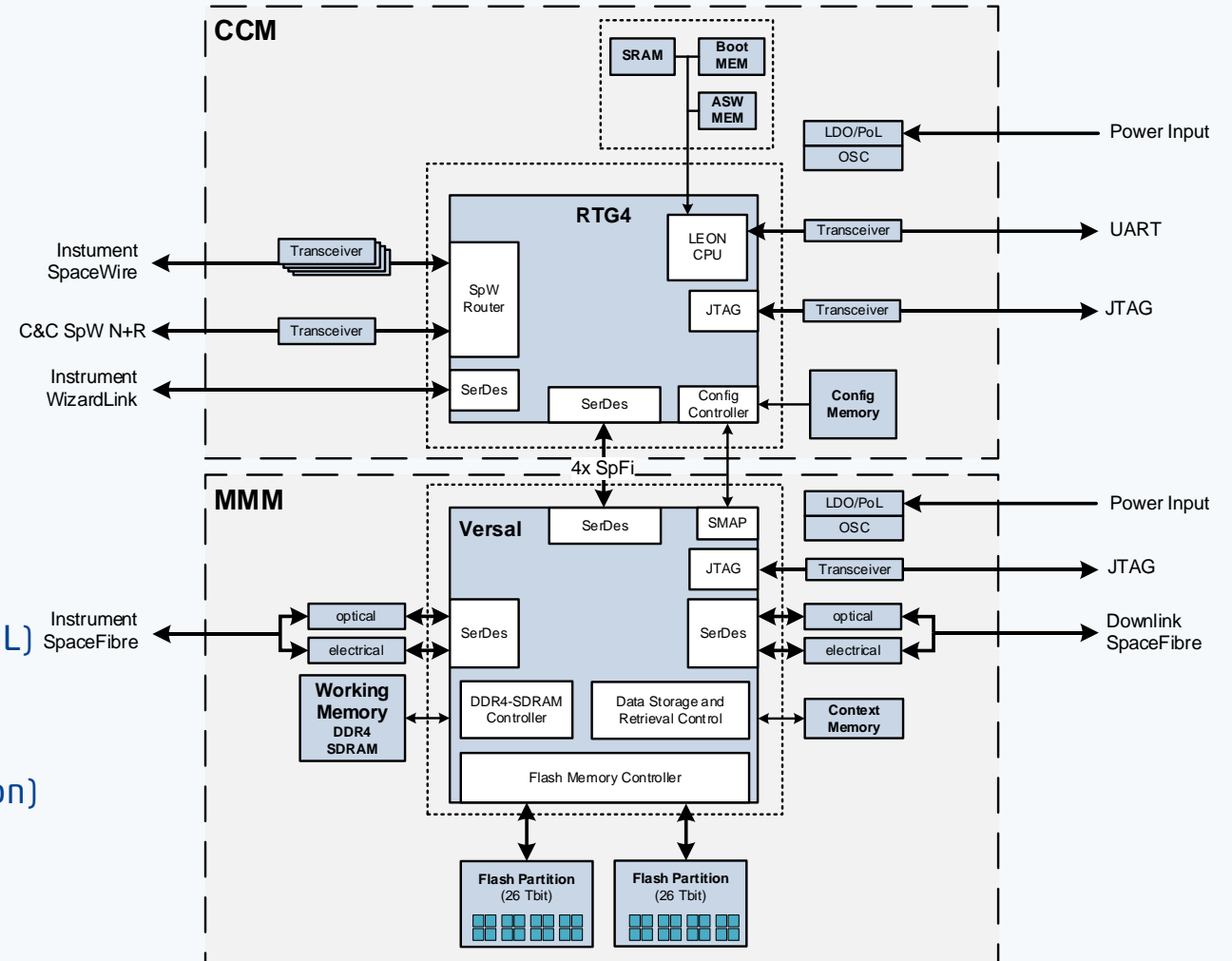
* 4 simultaneous active MMMs



MMU-NXT – EM/EM+ Design

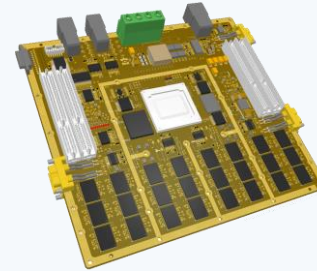
- Command and Control Module (CCM)
 - RTG4 FPGA including soft-IP CPU
 - TM/TC Handling
 - SpW & WizardLink Interfaces
 - Monitoring of MMM FPGA(s)
 - SerDes based CCM to MMM Interface

- Mass Memory Module (MMM)
 - Versal FPGA
 - Control of NAND Flash Partitions (2 × 26 TiBit BoL)
 - High-Speed SpFi (el / opt.) interfaces
 - Data Acquisition and Replay
 - Optional data processing (compression, encryption)

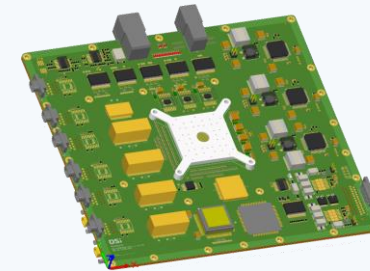


MMU-NXT – State of Project

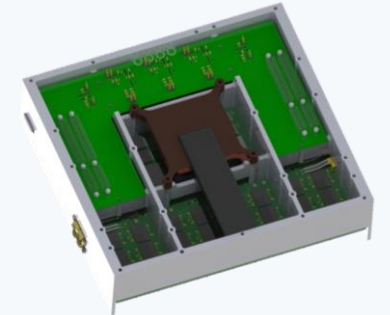
- Finalizing PCB Layouts & Preparing EM Manufacturing
- Optimizing mechanics (thermal analysis)
- Schedule



MMM



CCM

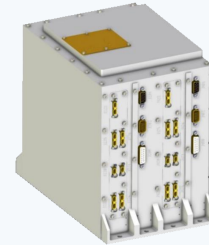


Mechanical Design



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Copernicus
Expansion
MMU

ADHA A3M

MMU-NXT

MMU-NXT

for a better space.



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Thank you for your attention!
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