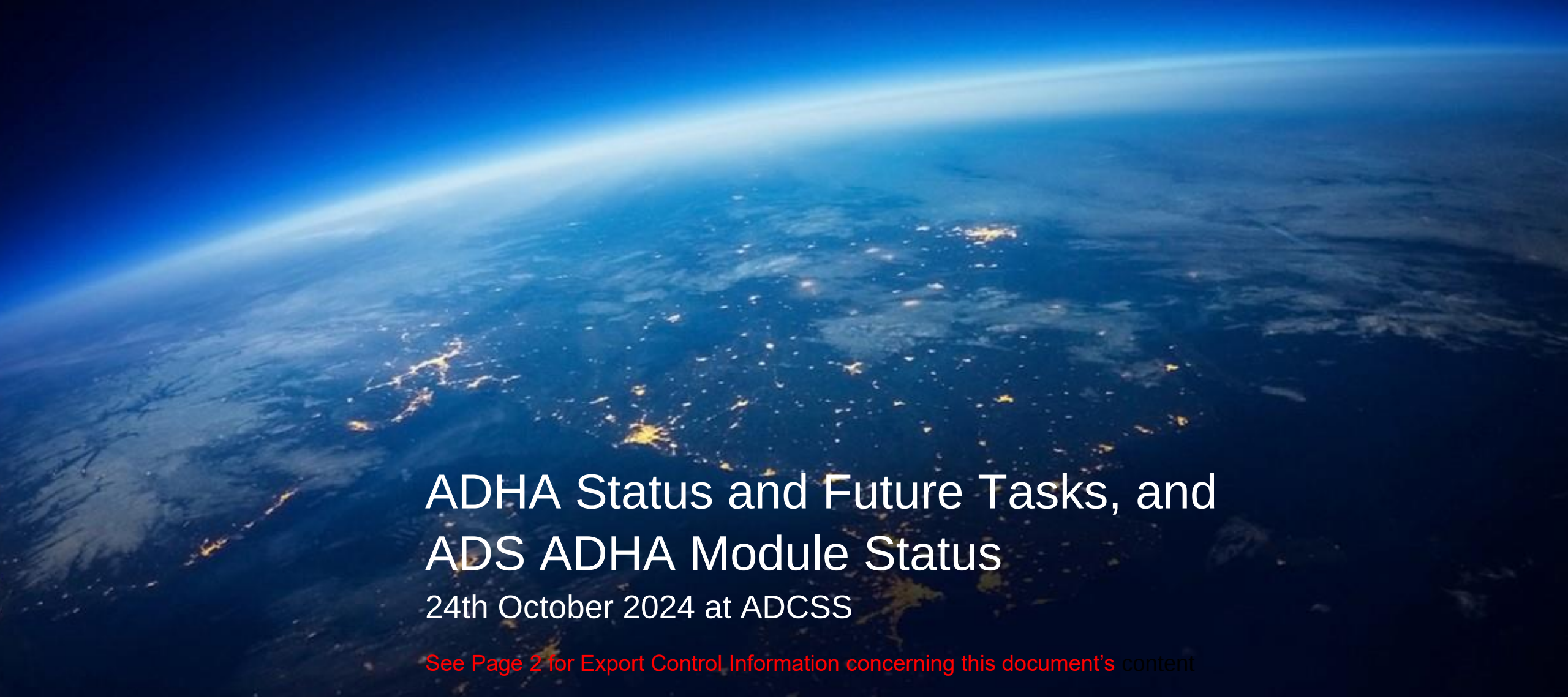

ADHA Status and Future Tasks, and ADS ADHA Module Status

24th October 2024 at ADCSS

See Page 2 for Export Control Information concerning this document's content

DEFENCE AND SPACE

Julian Bozler (julian.bozler@airbus.com)

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Export Control Information

Section 1 (Not applicable in France, please go to section 3)

This document contains Technical Information:	☒ **Yes**	☐ **No**

If No to section 1: please complete Section 2
If Yes to Section 1: please complete Section 3 as applicable

Section 2 (not applicable in France, please go to section 3)

I confirm the document does not contain Technical Information and is **"Not-Technical"**.	**Name:**	**Date:**

Section 3

3a. National and EU regulations Export Control Assessment

This document has been assessedagainst applicable export control regulations in:

☐ France ☒ Germany ☐ Spain ☐ UK ☐ other: [specify country]

☒ and does not contain Controlled Technology and is therefore « Not Listed / Not Controlled »

☐ And contains controlled technology with export control classification [insert classification number, e.g. ML22x, xExx, AMAx]

Note: Any transfer of this document in part or in whole must be made in accordance with the appropriate export control regulations. Prior to any transfer outside of the responsible legal entity, confirmation of an applicable export licence or authorisation must be obtained from the local Export Control Officer (ECO).

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☒ This document does not contain US origin Technical Data (Technology).

☐ This document contains "Technology" which is controlled by the U.S. government under [USML category number / ECCN] and which has been received by [legal entity] under the authority of [licence number / ITAR exemption / EAR licence exception / NLR].

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3c. Technical Rater Information

This document has been assessed by the following Technical Rater:

Assessed and classified by: Julian Bozler **Date classification completed: 18/10/2024**

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Agenda

- ADHA Module Development in Airbus
  - ADHA Power Module
  - Stream
  - NICE
- Status
- Future Tasks and challenges
- Conclusion

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Airbus Space Electronics (Elancourt):
ADHA Power Module: Project & Product Description

Project:

- Contractual framework: ESA TDE
- Objective: to develop an engineering model for a power module aimed meeting with ADHA requirements
- Project kicked-off in Oct 2023.

Generic power module with the following characteristics:

- Unregulated power bus 21V to 37V
- +5V / 5A (25W)
- +12V / 12.5A (150W)
- +28V / 1A (28W)
- Total power = 203W
- Nominal and Redundant module on the same board
- High Efficiency
- Dimensions = 6U cPCI that is 220mm x 233mm x 35mm

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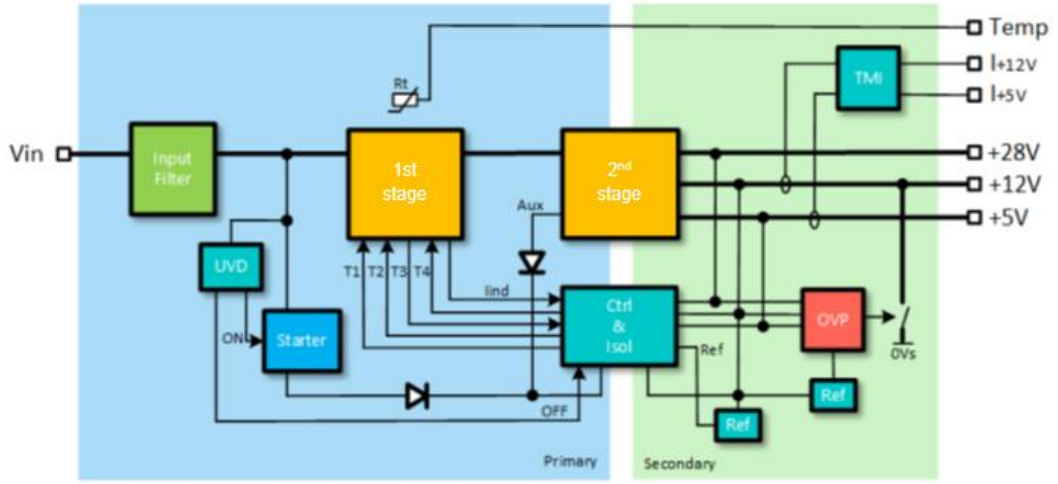
ADHA Power Module: Architecture

Solution

- Two stages solution:
  - 1st stage in charge of regulation
  - 2nd stage in charge of insulation and output voltages delivery
- Soft-switching solutions to achieve high efficiency
- Use of GaNFETs

Main features

- Barycentric Regulation at converter outputs.
- Overvoltage protection on all outputs with short circuit of the +12V to stop the converter.
- Current TM on +12V and +5V
- Automatic restart in case of converter malfunction



ADHA Power Module block diagram

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ADHA Power Module: Project status

Milestones and schedule:

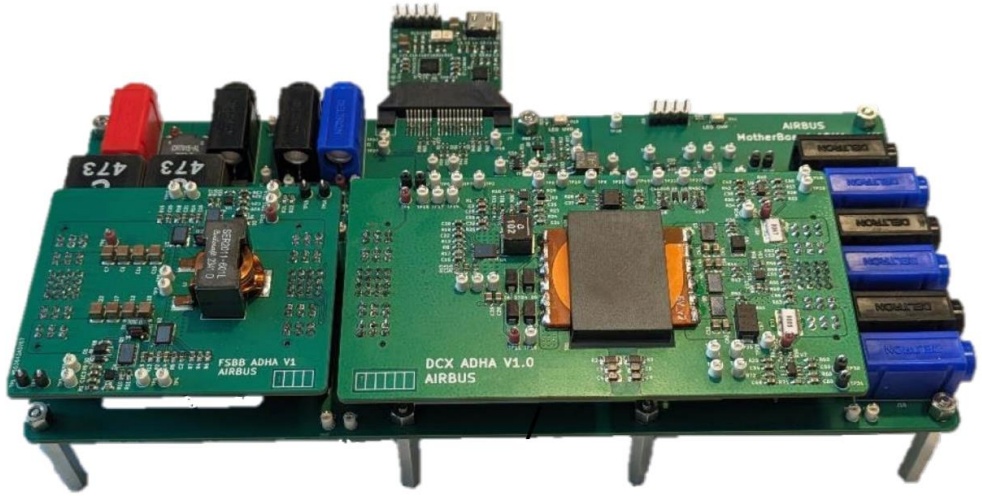
- System Requirements Review held in Nov 2023
- Conceptual Design Review held in June 2024
- Engineering Model Preliminary Design Review to be held end 2024-early 2025
- Final Review Q3 2025

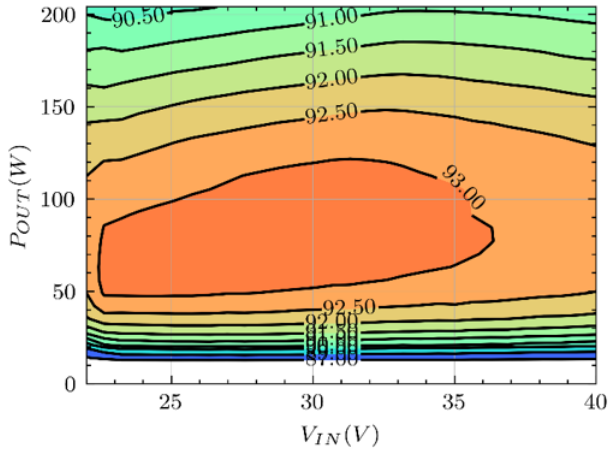
Progress overview

- Breadboarding & validation of all functions completed
- Peak efficiency is above 93%
- Optimization in progress to improve efficiency performances on the whole operating range

Way forward

- Thermal & mechanical design in progress
- Engineering Model layout





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Airbus CRISA: STREAM project

Scope of work

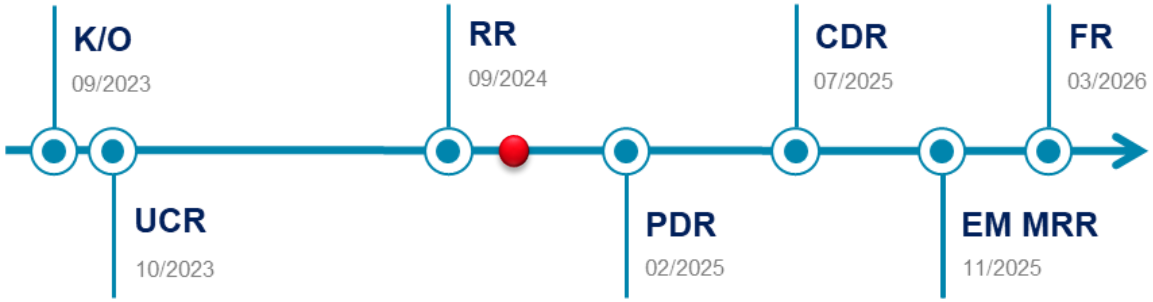
- Development of ADHA-compatible RIU / RTU modules: Standard I/Fs + AOCS I/Fs + Propulsion I/Fs
- Manufacturing, in EM quality, one board of each type

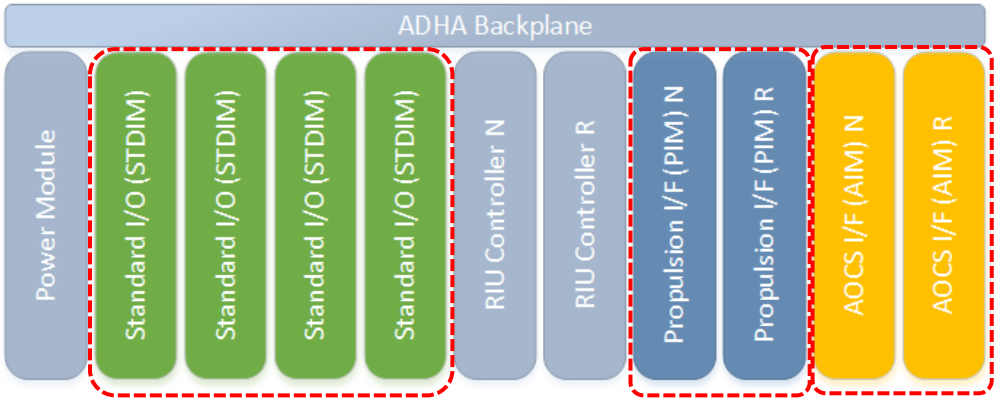
Targeted uses cases

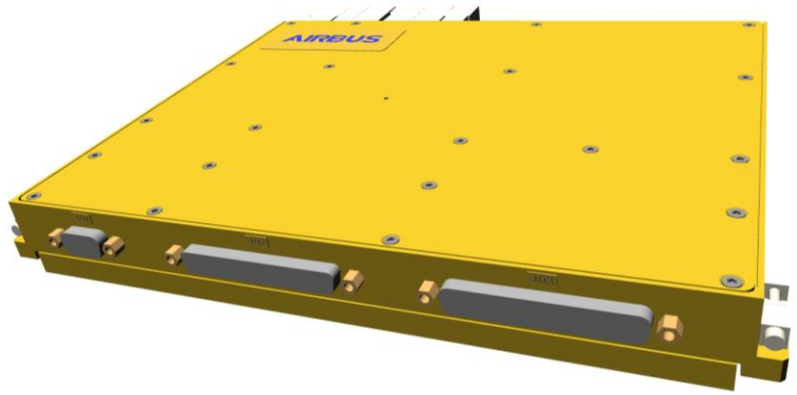
- Stand-alone RIU in a centralized architecture
- RIU boards integrated in a S/C management unit, together with the OBC

Features

- Board format: 6U, 220 mm depth, 6 HP
- High density of interfaces
- Possibility to configure standard interfaces, depending on the system's needs







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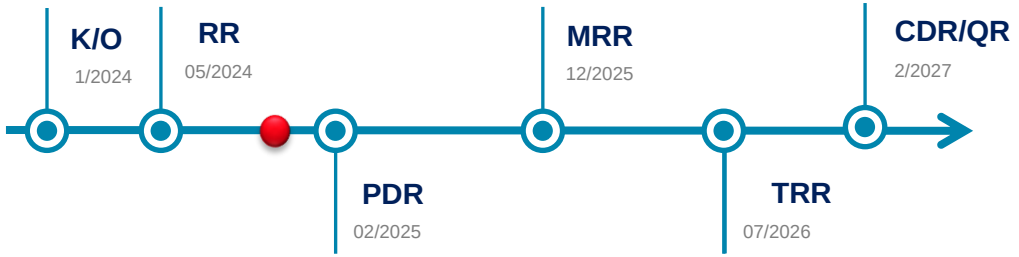
Airbus CRISA: GR40 PCM & NICE IncuBed project

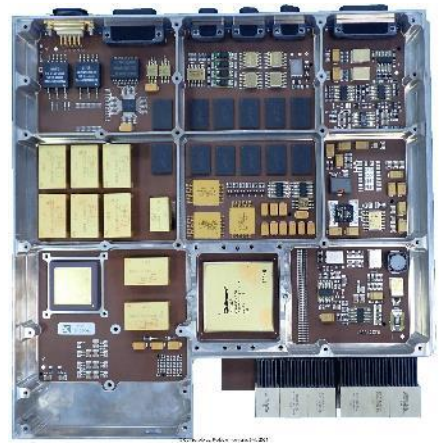
GR740 Payload Controller Module (PCM)

- General purpose Payload Controller Board for ADHA standard equipment
- High performance processing for Payload applications
- Optical links at rear side (SpaceFibre)
- 2x EMs manufactured and submitted to full characterization (TRL5 achieved)
- Thermal testing on an EM planned for 1Q25 (TRL6)

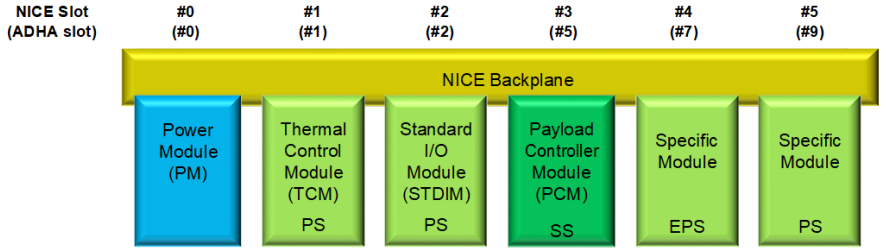
New Instrument Control Electronic (NICE)

- New Generation of Instrument Control Units AHDA compliant
- Single redundancy (redundancy achieved by two separated units)
- Implements the core functions of the Payload Control Units
  - C&C implemented by GR740 PCM (internal development)
  - TM/TC Standard interfaces implemented by STDIM (developed in STREAM)
  - Power Module (80W output power), non redundant
  - Thermal Control Module (out of scope of this activity)
- An EQM will be manufactured and will undergo qualification testing (TRL7 by 1Q27)





GR740 PCM EM model



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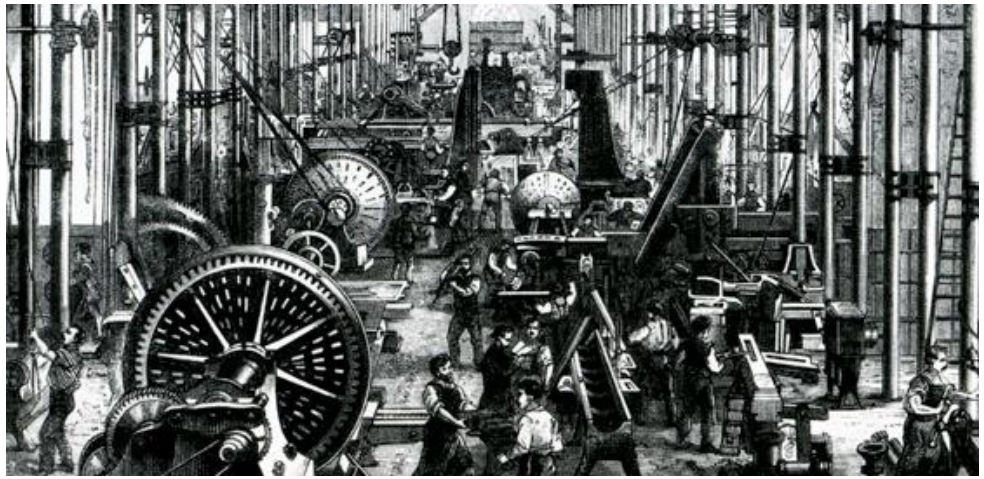
Status: how can ADHA improve a system?



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ADHA ease the Geo-Return:

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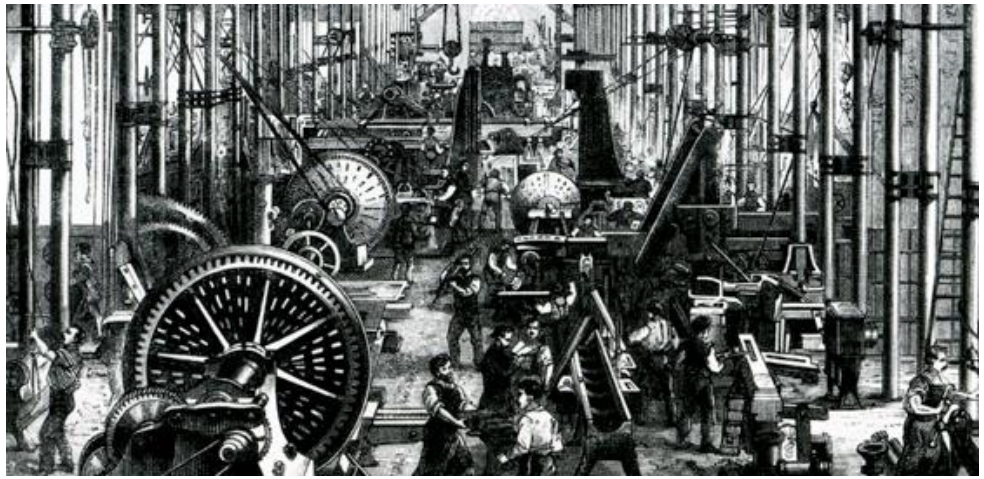

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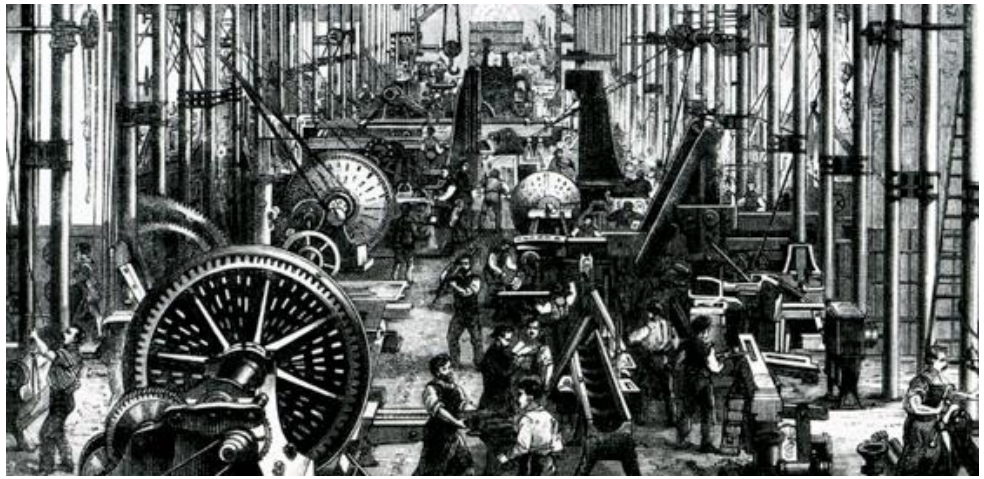
- By the lower granularity of modules compared to units, the reuse of modules is more likely as of today



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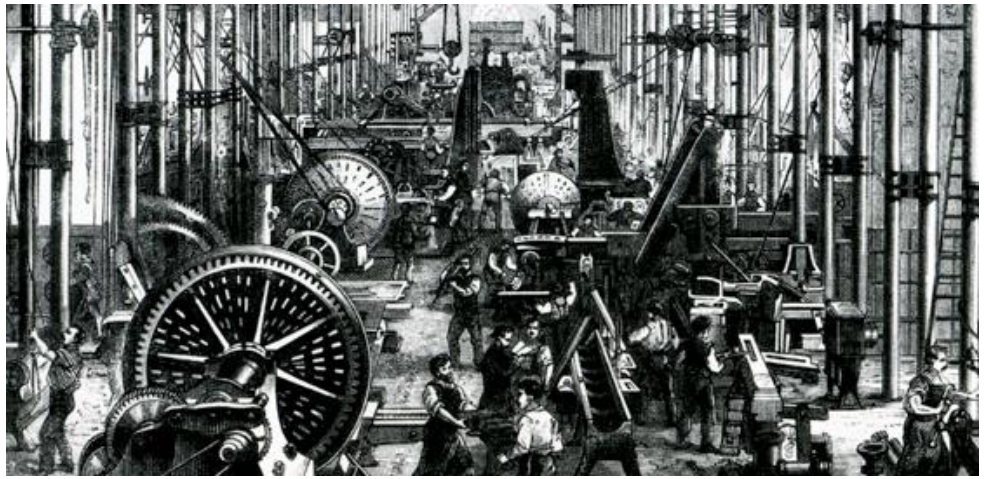
- Unit development time will be shorter because modules are reused more frequently
- Lower granularity of modules compared to units ensures that module supplier can focus on their development.
- Companies specialized on a specific domain will have less development effort on other domains.
  - ➢ This allows as well a faster adaptation to innovative technology



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Industrial benefits:

- ADHA ease for SMEs, newcomers and non-space companies to enter the market.
- ADHA ease integration of “payload of opportunities”.
- Late exchange of a module from one supplier to another possible.
- ADHA allows more competition which reduce the cost.

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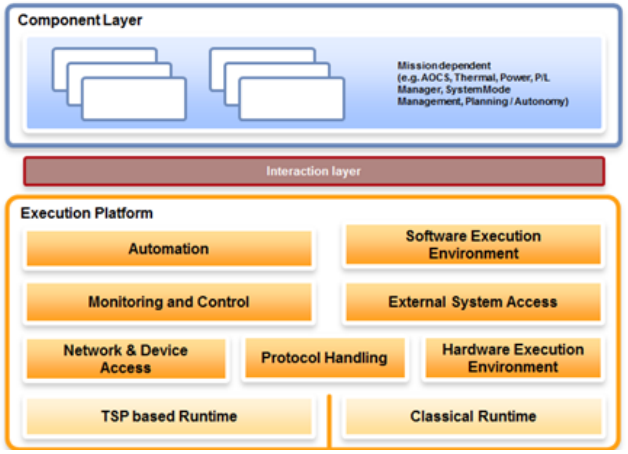
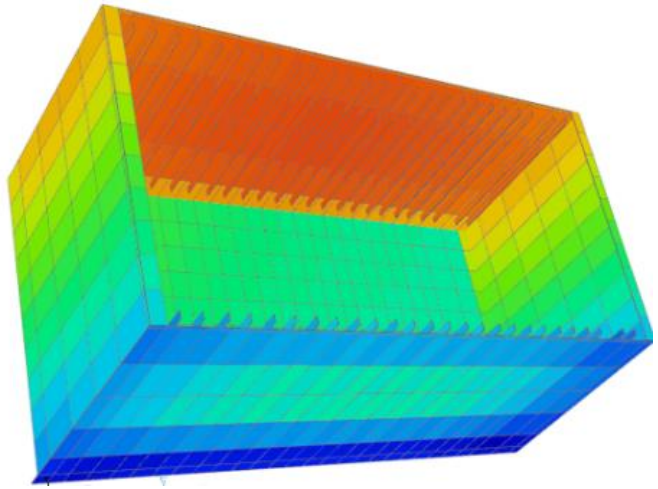
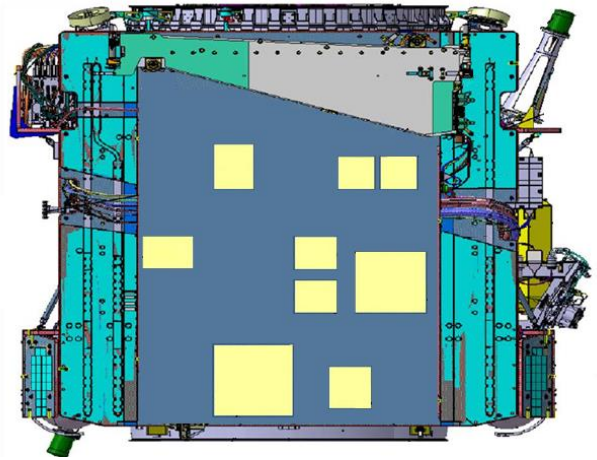
Future Tasks and challenges







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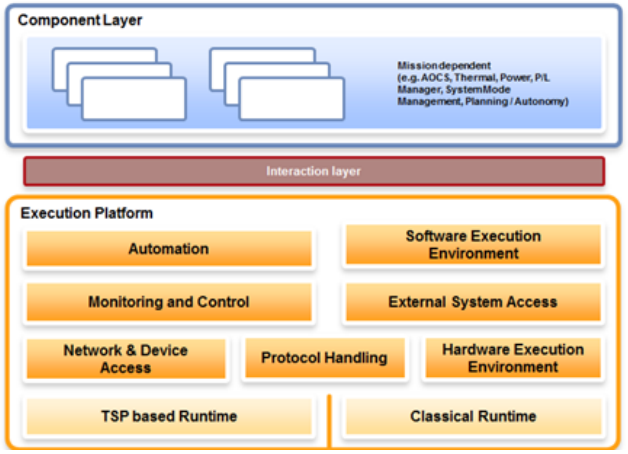
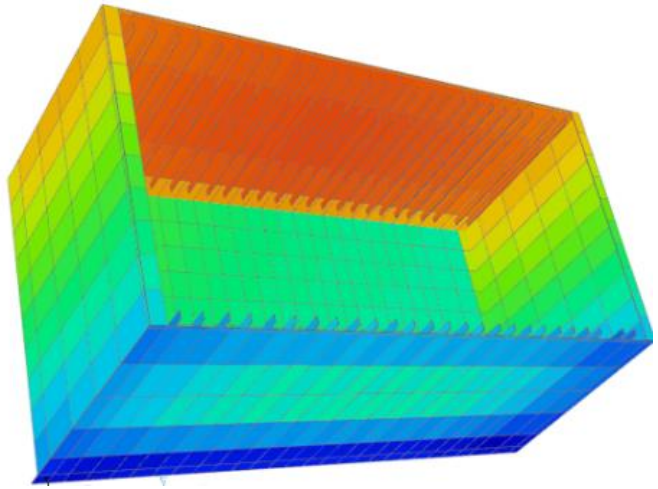
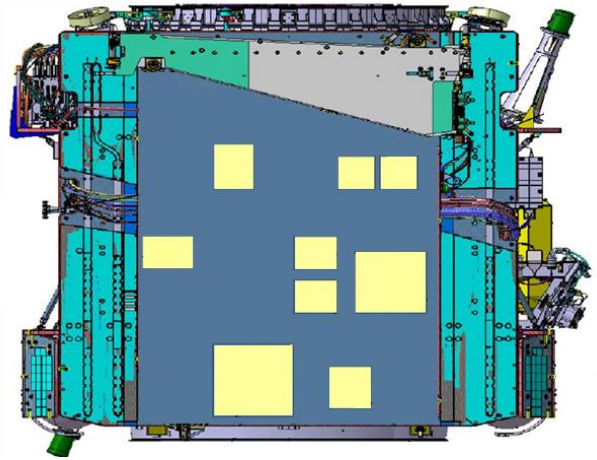
Future Tasks and challenges

Connector qualification

- ESA-activities running for the qualification of the cPCI-SS connector.







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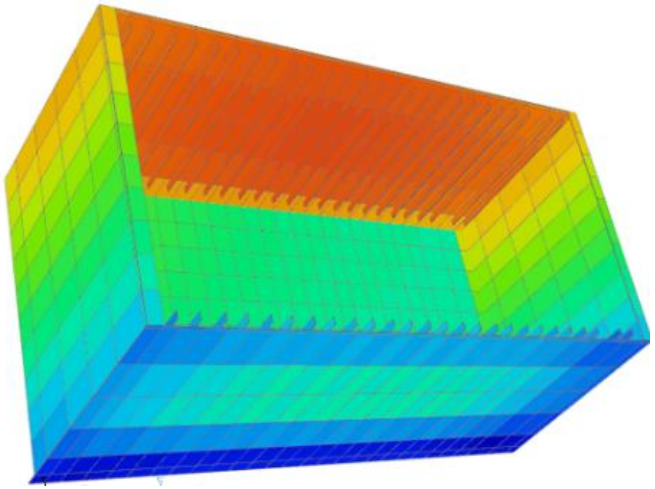
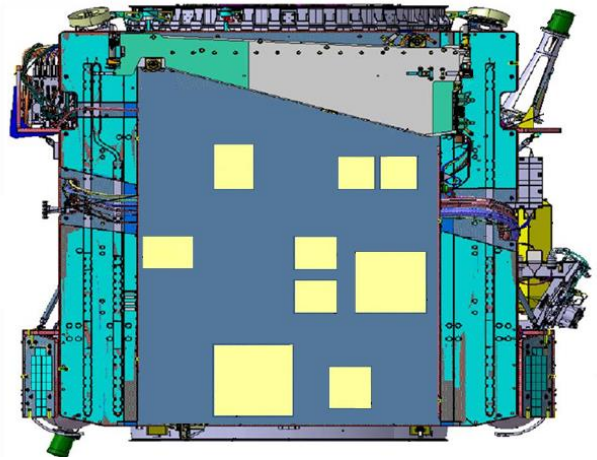
- Analyse the software components within the DHS system
- Define standard software protocols and services
- Define ADHA Software Architecture and Requirements Specification
- Implementation of ADHA-SW





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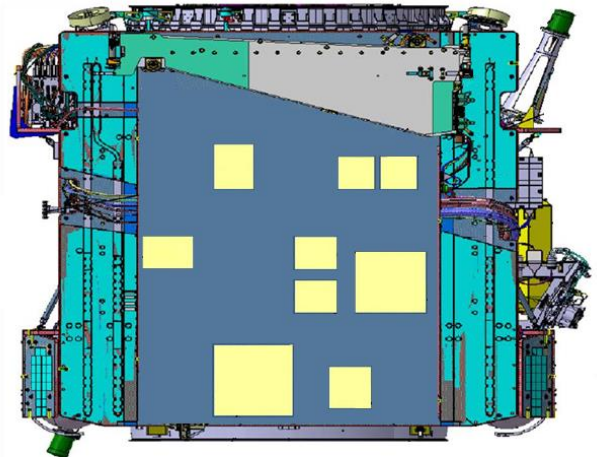
Standardization somehow prevent the thermal/mechanical optimization of the design for a specific function

- Units/modules will not be the optimum for thermal & mechanical design
- Most likely ADHA is an overdesign or underdesign for a specific function.
  - ➢ Improve thermal design.
  - ➢ Standardized active cooling will be investigated.



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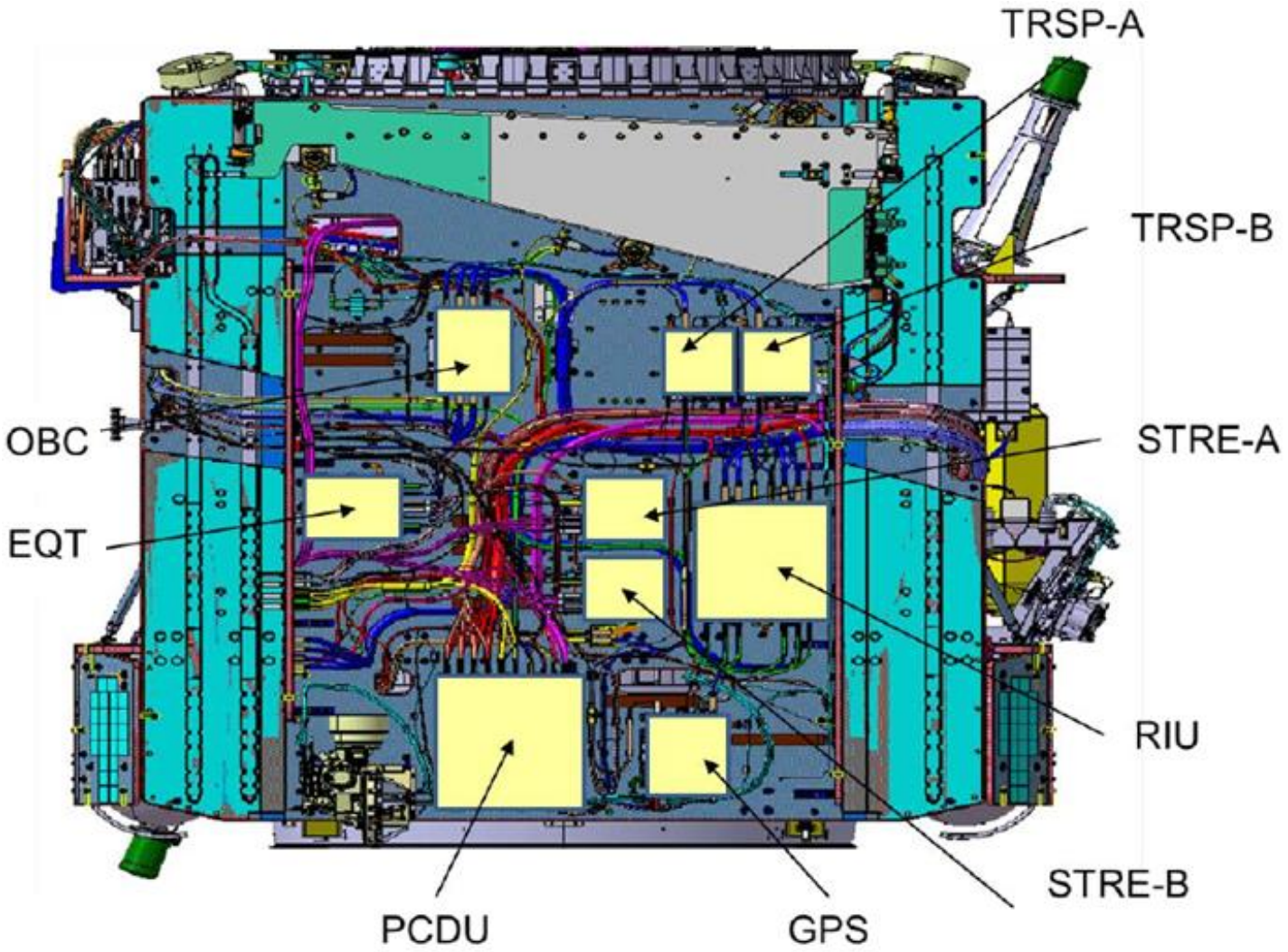
Standardization somehow prevent the optimization of the design for a specific function w.r.t. size and mass

- The form factor (6U extended or 3U extended) will not perfectly fit the function
- PCB surface not fully used or
- Function to be split over several modules
- Will ADHA add mass and size?
  - ➢ On unit level: yes, probably… but on system level…

Accomodation



~50% of the space is used for harness and AIT

⇒ With ADHA many links are integrated in the backplane!

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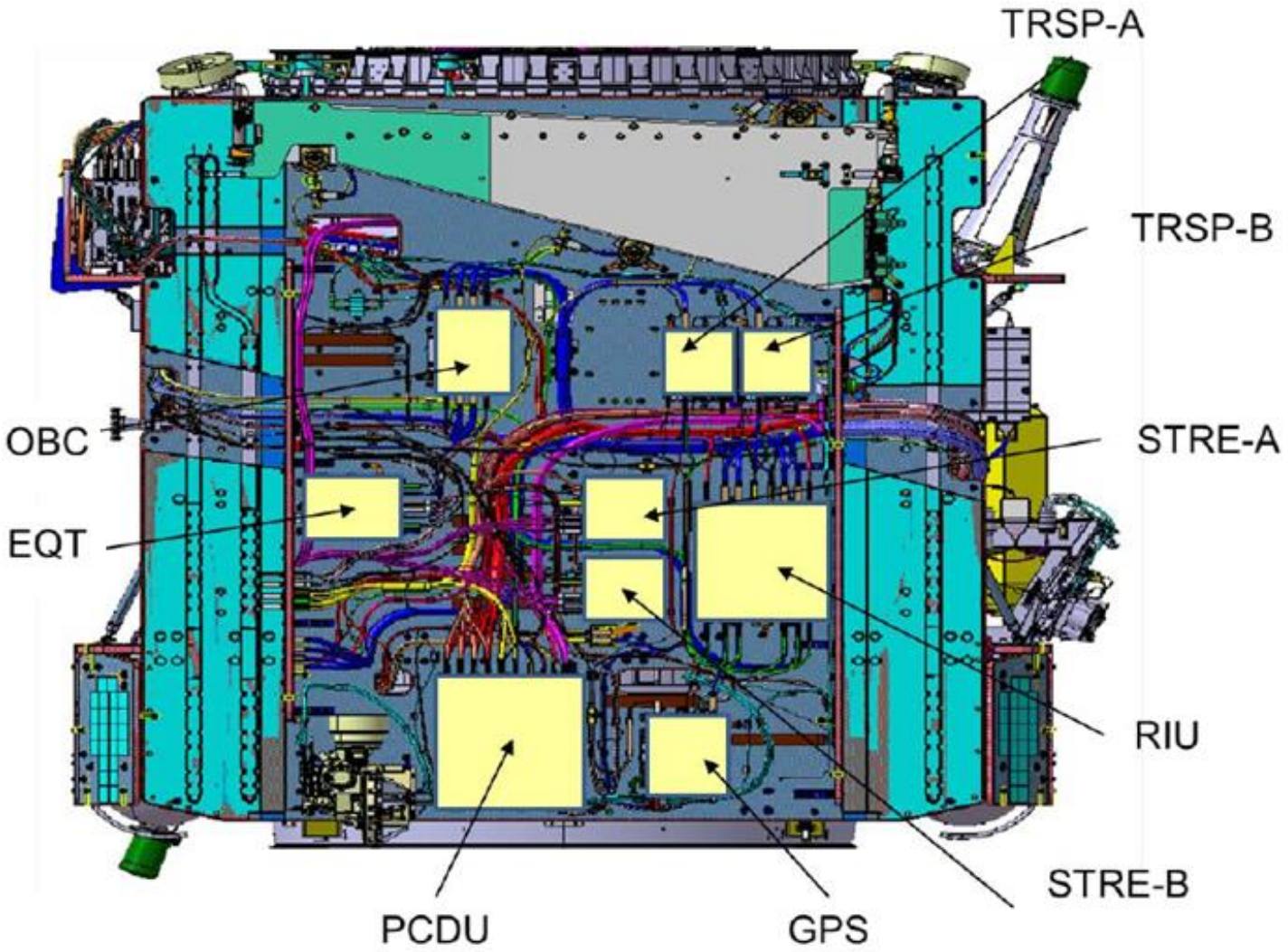
Accomodation



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⇒ In ADHA the length, width and height is standardized.

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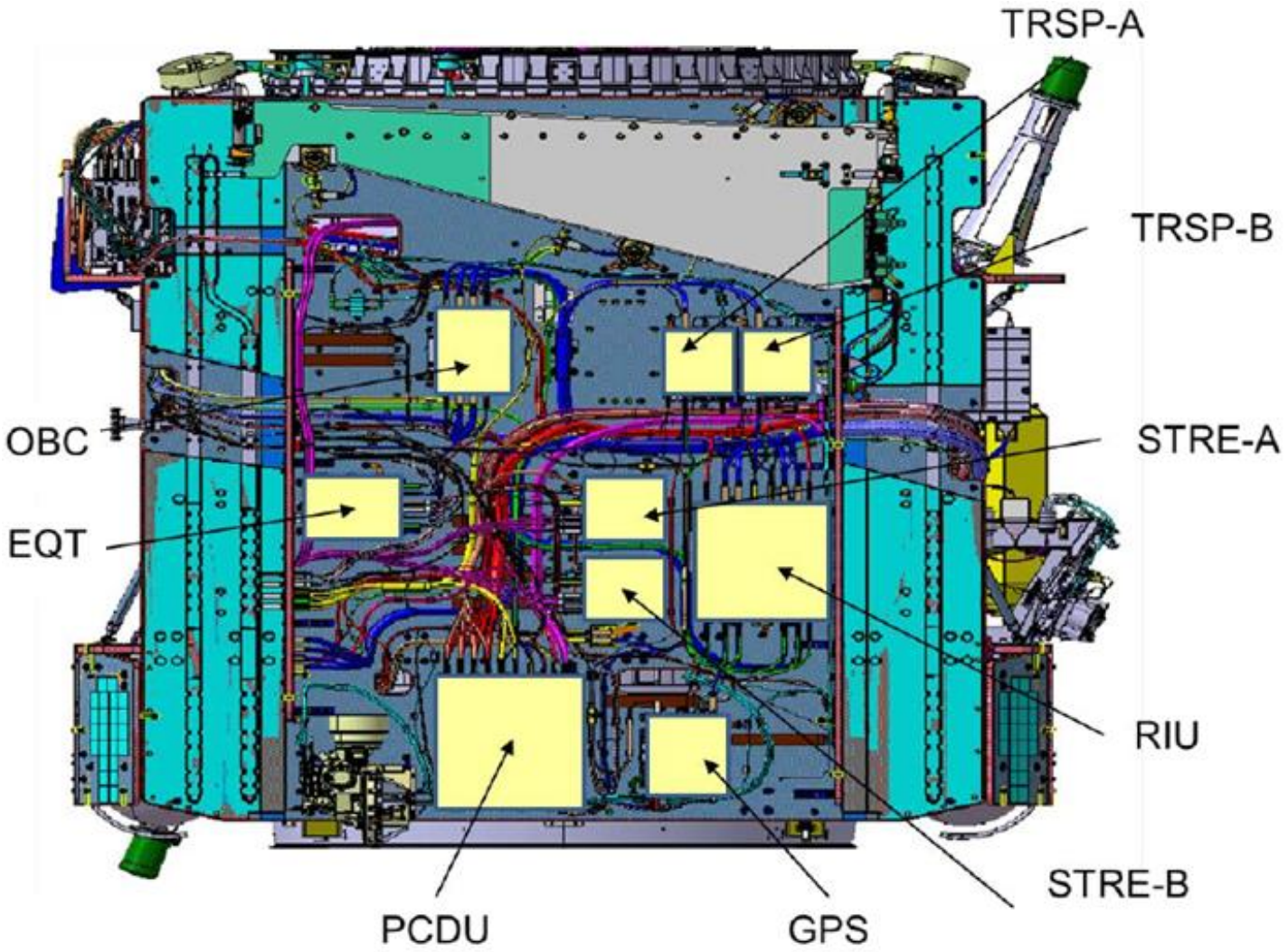

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As units have different length, width and height it is not possible to accommodate them perfectly, therefore some volume is left unused.

⇒ In ADHA the length, width and height is standardized.

Units do not share resources (e.g. power or processing)

⇒ In ADHA resources can be shared.

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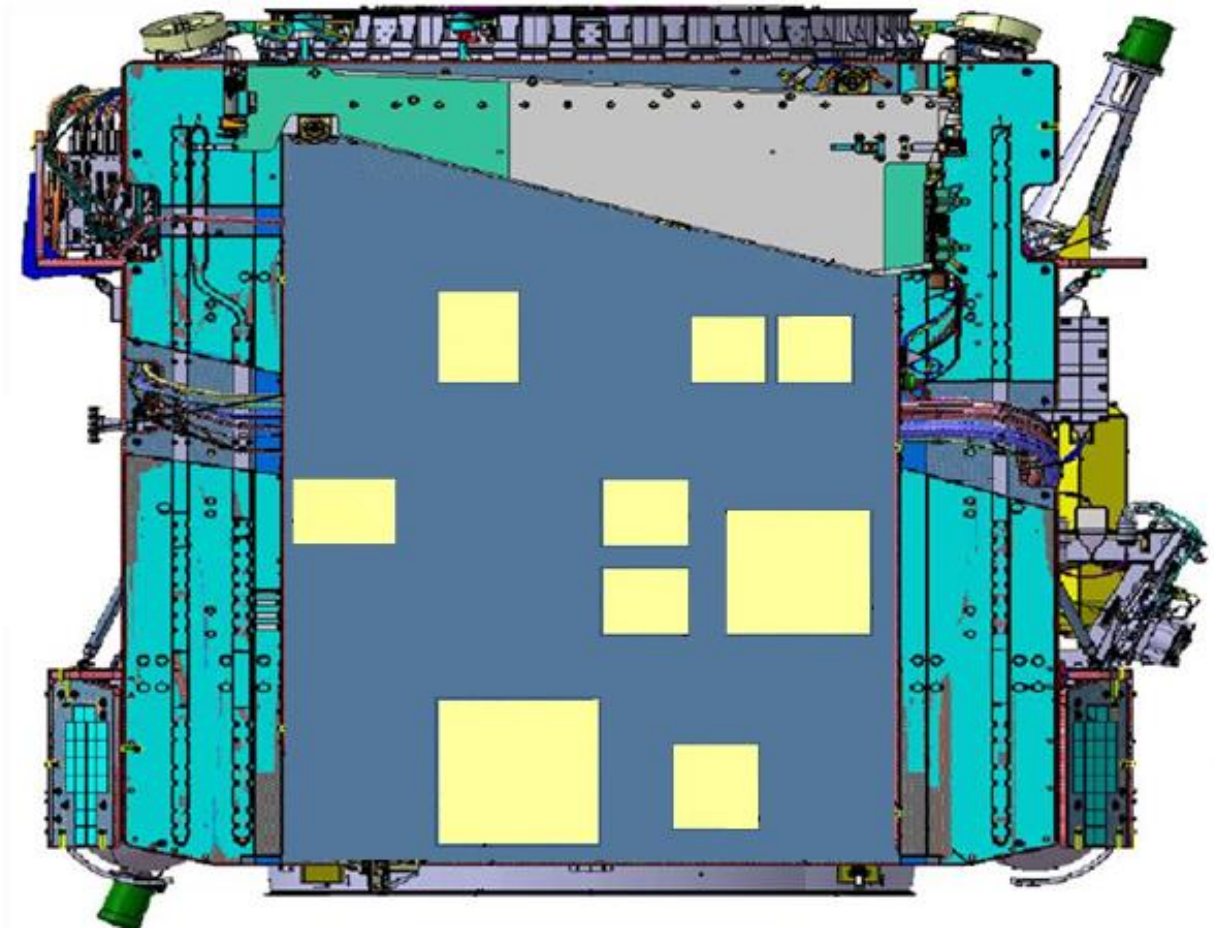
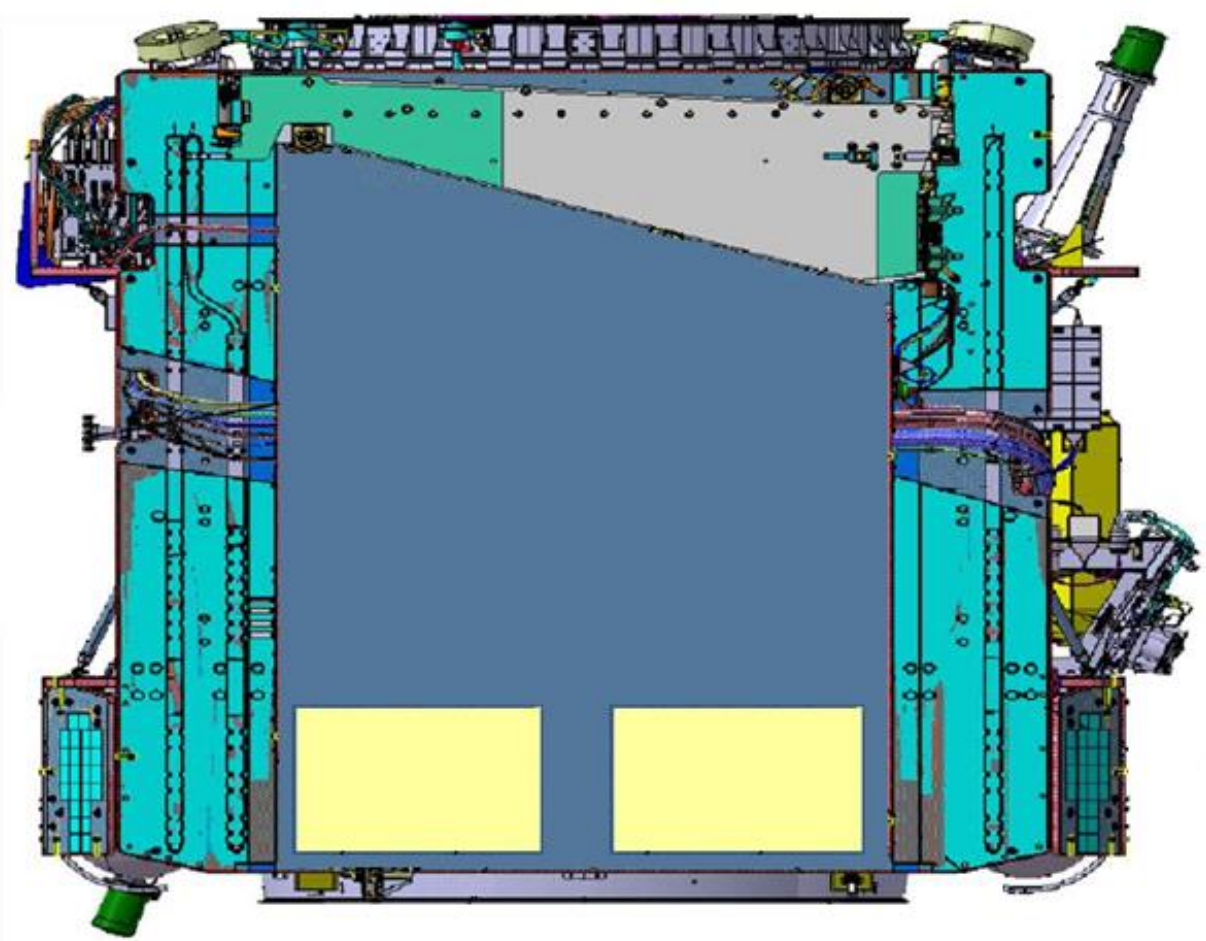
Accomodation

Without ADHA/APA



With ADHA/APA



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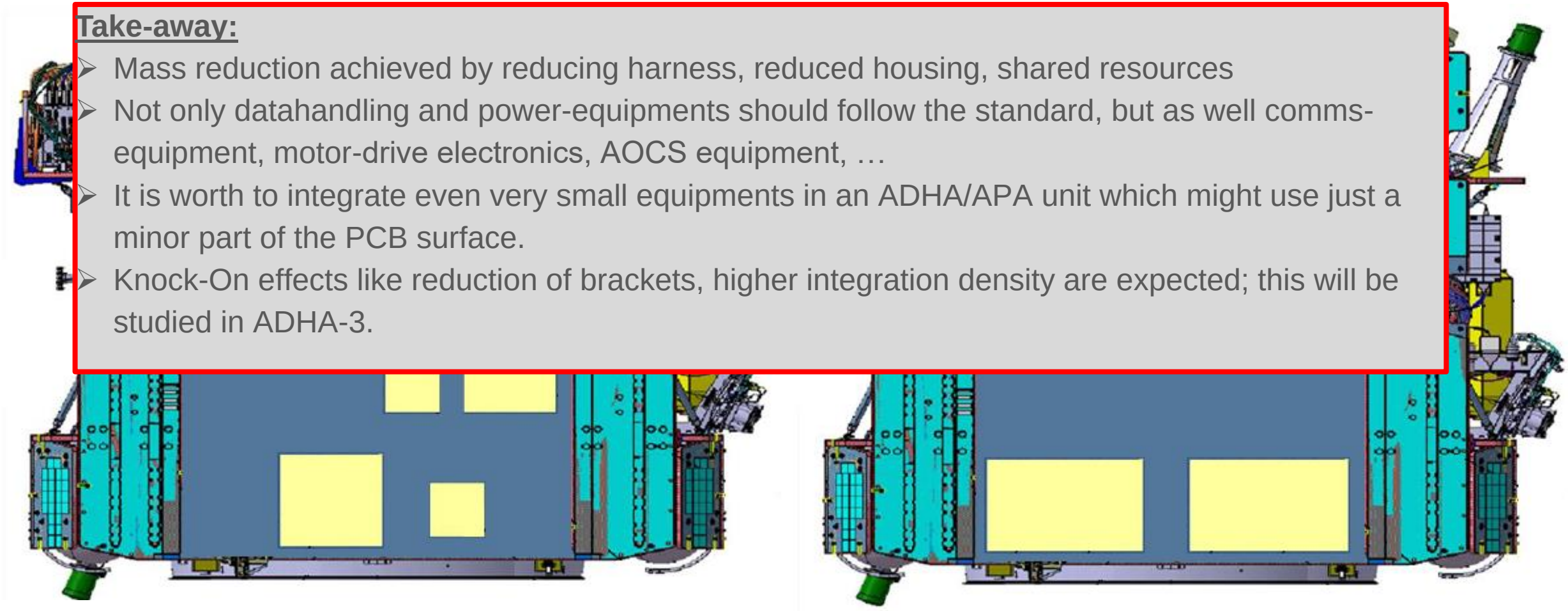
Accomodation

Without ADHA/APA

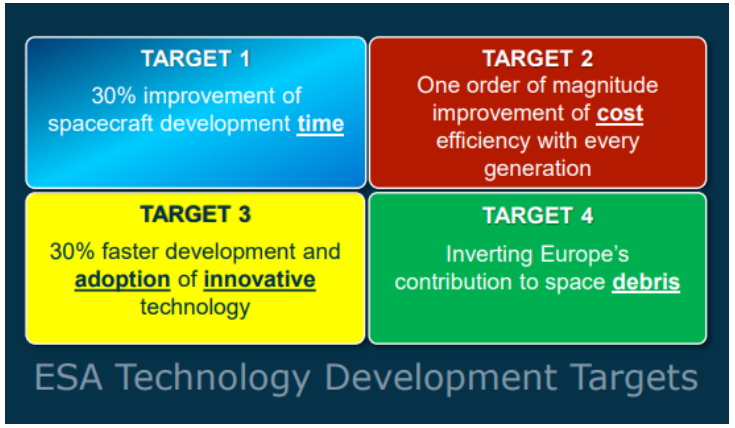
With ADHA/APA

Take-away:

- Mass reduction achieved by reducing harness, reduced housing, shared resources
- Not only datahandling and power-equipments should follow the standard, but as well comms-equipment, motor-drive electronics, AOCS equipment, …
- It is worth to integrate even very small equipments in an ADHA/APA unit which might use just a minor part of the PCB surface.
- Knock-On effects like reduction of brackets, higher integration density are expected; this will be studied in ADHA-3.



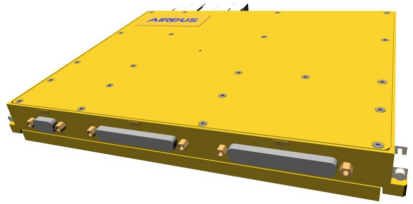
Conclusion

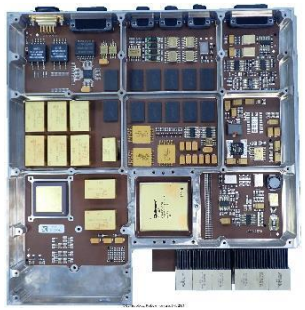


- ADHA support the ESA technology development targets fully shared by Airbus

- ADHA-2 Phase 1 „Consolidation & Standardization“ is successfully completed
- ADHA-2 Phase 2 for Integration, Test and Verification started.
- ADHA-3 under final preparation with the target to widen the scope and to improve on some limitations.

- Many ADHA-module developments started like:
  - the ADHA Power Module,
  - Stream and
  - NICE





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Thank you