

ESA EDHPC 2023

Amethyst constellation OBC mass production

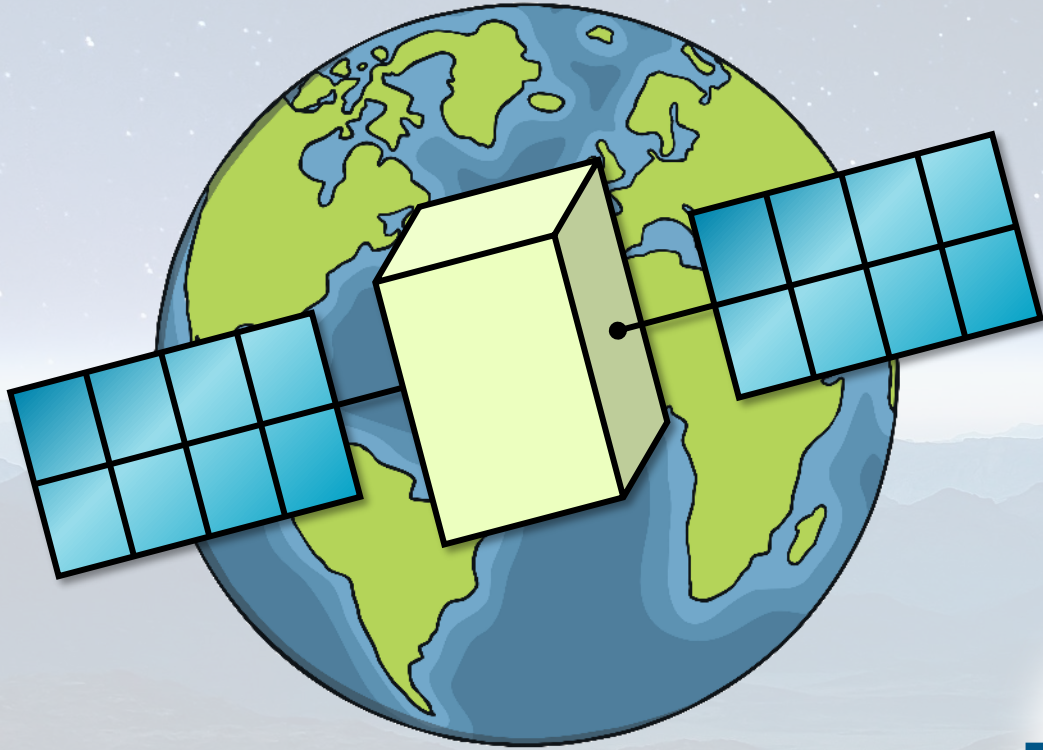
Jean-Luc POUPAT & Christophe CHAMINADE

DEFENCE AND SPACE

October 2023 at Juan Les Pins

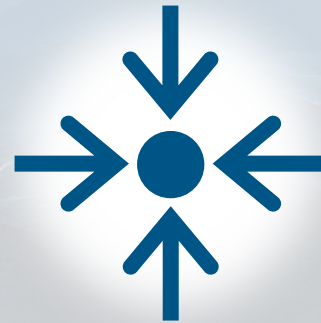
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# Constellation requires to be at the meeting point of two worlds



## Space industry

Space environment constraints

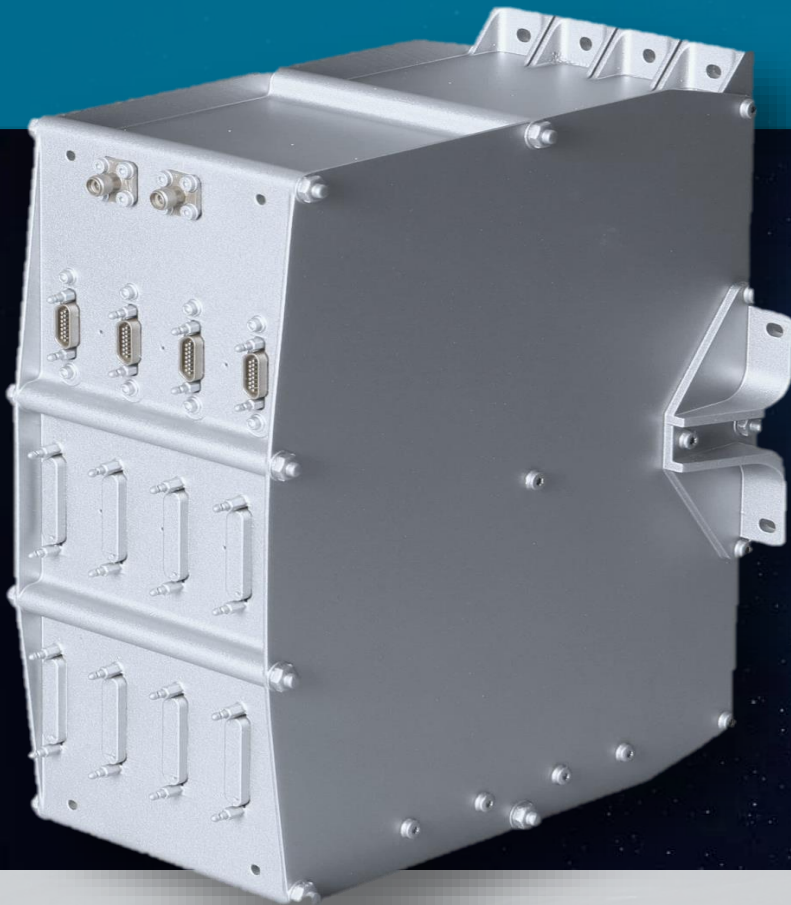


## Automotive industry

High volumes  
Short delivery times

*“They did not know it was impossible  
so they did it.”*

Mark Twain



# Some astonishing numbers

20

50

$\sqrt{2}$

32

$\pi$

1000

# Main Challenges & Achievements



Very short development time → **20 months** from T0 to first FM batch delivery

**50**

**32**

**1000**

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**1000**

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With

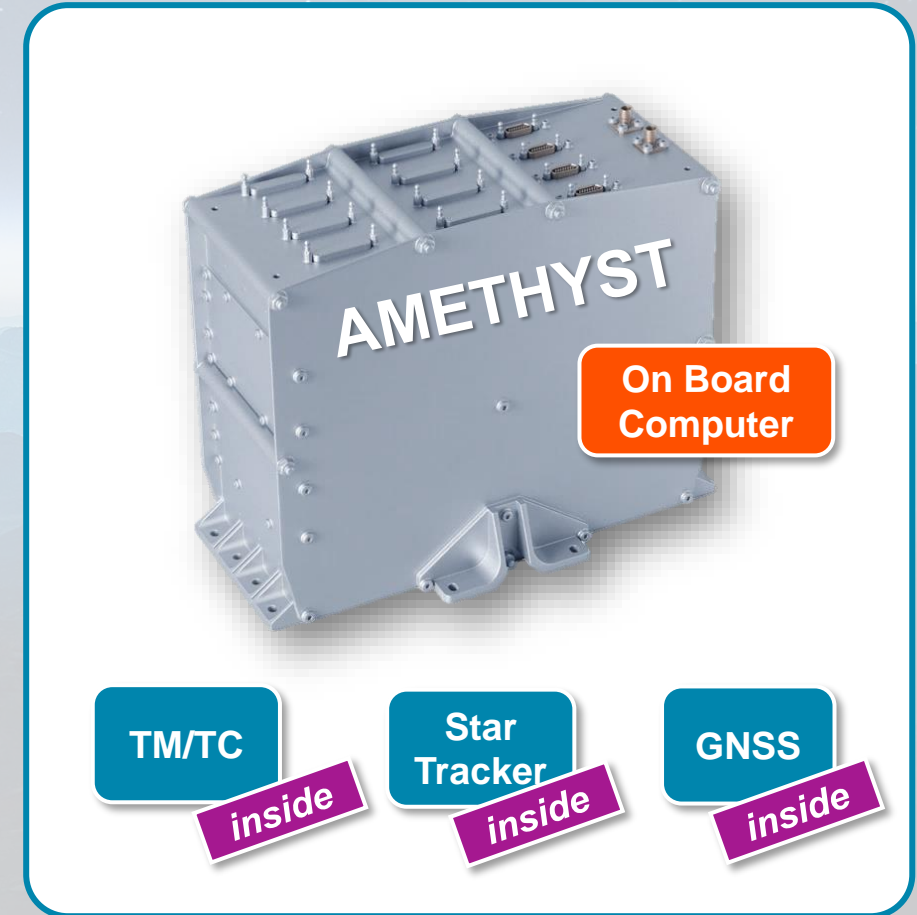
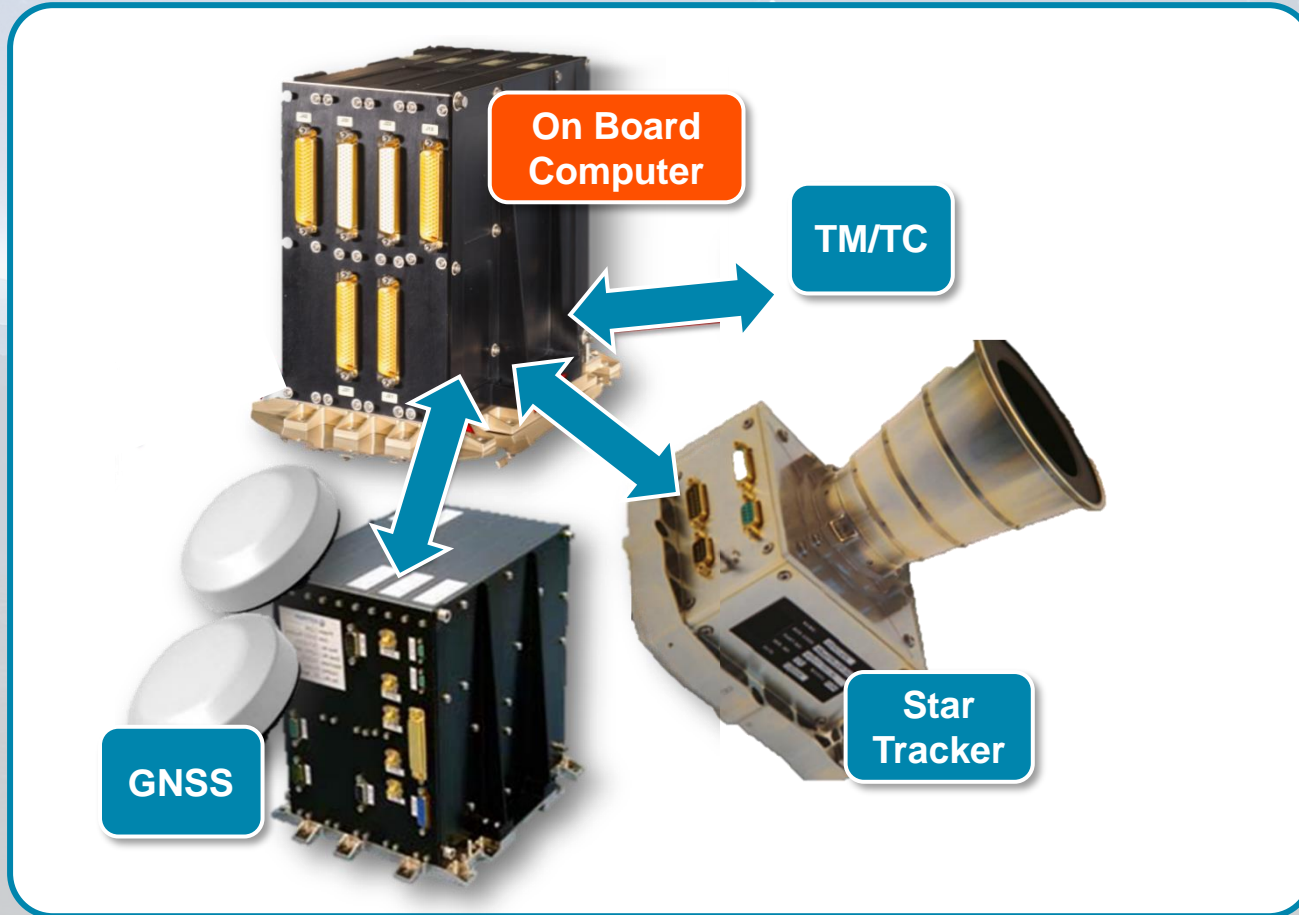


**No compromise on quality** → More than **1000 years** successful in orbit operation





- Agile approach
- Disruptive innovation from Design to Delivery
- Centralized avionics concept pushed to an upper level





**COST** → **?**



# COST → COTS

COTS = very interesting for cost reduction, but can jeopardize unit behavior if used without precautions



# COST → COTS

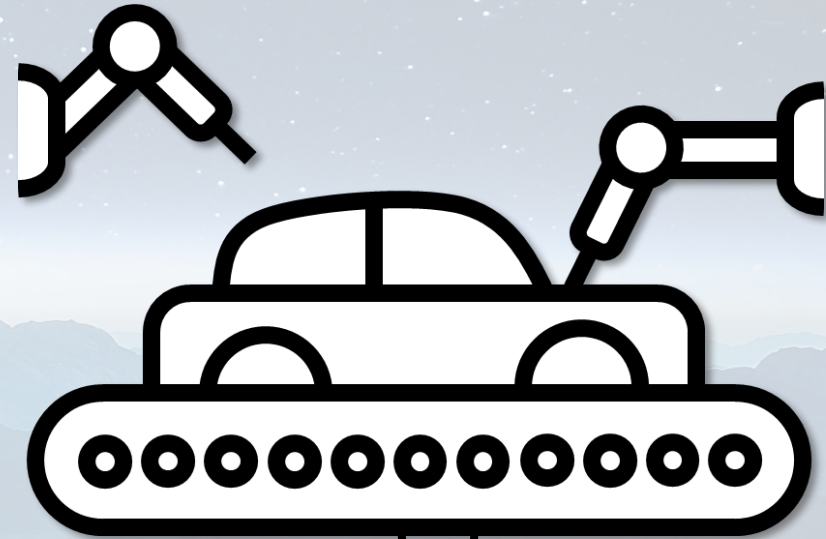
COTS = very interesting for cost reduction, but can jeopardize unit behavior if used without precautions

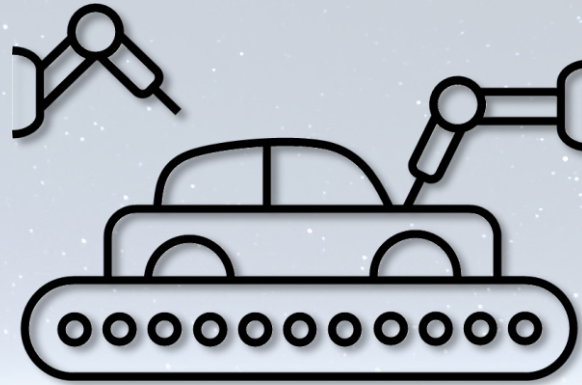
- **Step 1 - Research** > **selection** of the right components & the right manufacturers
- **Step 2 - Testing** > all COTS components of Amethyst intensively **radiation-tested**
- **Step 3 - Design** > define appropriate **hardening mechanisms** to mitigate all known radiation effects
- **Step 4 - Design** > create a **Preferred Part List** to be used by design team without any exception
- **Step 5 - Procurement** > no screening but LAT on most critical parts

All of this to ensure flawless in-orbit operations for typical 10-years lifetime in LEO

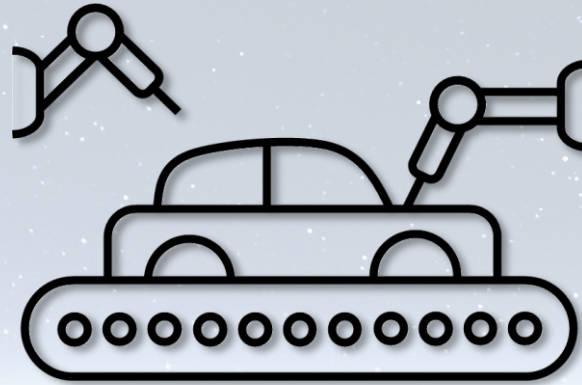


**COST**





- **Step 1 - Select** partners that usually deal with medium or high volume production
- **Step 2 - Share** our requirement constraints, but not impose them (ex TVAC)
- **Step 3 - Align** our quality standards (table of correspondence)
- **Step 4 - Design** since the beginning with DFM and DFT as objectives
- **Step 5 - Produce** by batch
- **Achievements on Amethyst** > 128 boards per months, acceptance tests = 2 units per day



**Quality** guaranteed through

- Mastering manufacturing process and repeatability
- Work per batch, bringing stability and homogeneity
- Each element of the equipment is seen at least once in the test & control process

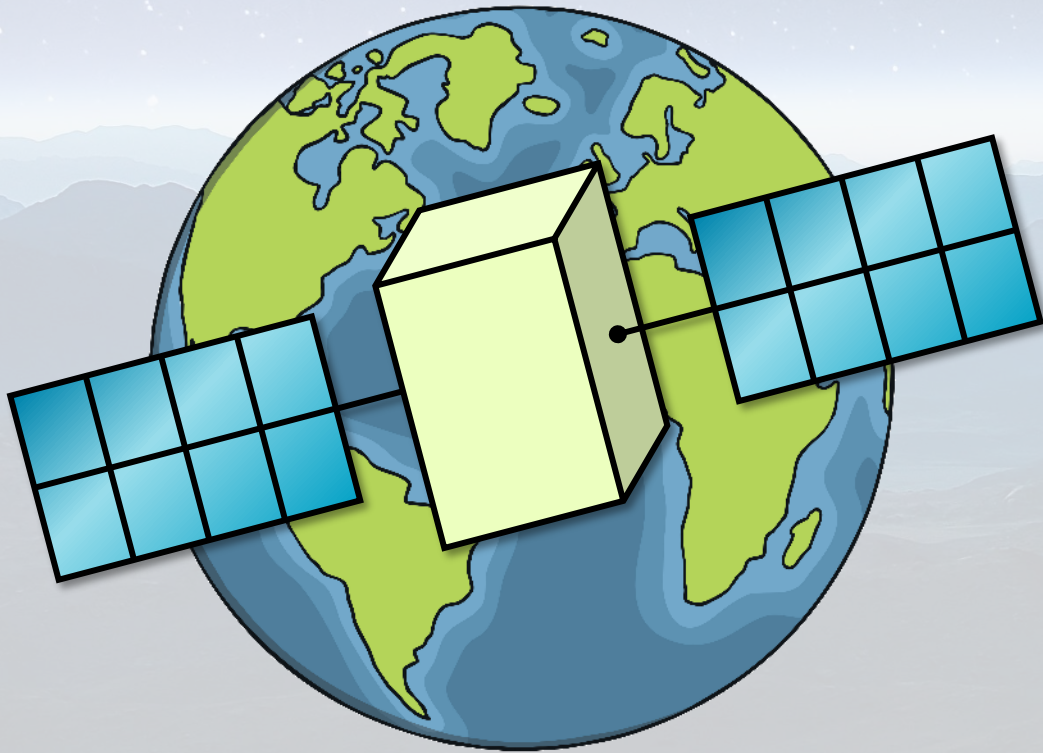
In case of **default**

- short decision = repair or put the product aside



## Lessons learned

- Successful cooperation between Airbus & partners keeping the very best of the two worlds
- Pioneering large volume electronics unit for large volume spacecraft production
- Amethyst = not a “one shot” lucky success → same approach applied on Emerald, Pearl and Topaz





# Amethyst

Centralized Avionics



# Amethyst

Centralized Avionics

# Emerald

Payload Interface Unit



# Amethyst

Centralized Avionics

# Emerald

Payload Interface Unit

# Pearl

Power Conditioning and  
Distribution Unit



# Amethyst

Centralized Avionics

# Emerald

Payload Interface Unit

# Pearl

Power Conditioning and  
Distribution Unit

# Topaz

Power Processing Unit

**1000 years**  
of flight heritage



# Conclusion

## Next steps

- We have invested into **an internal production line** to support future projects
- Objectives = to be able to develop and qualify new products **in 18 months worst case**, if no reuse

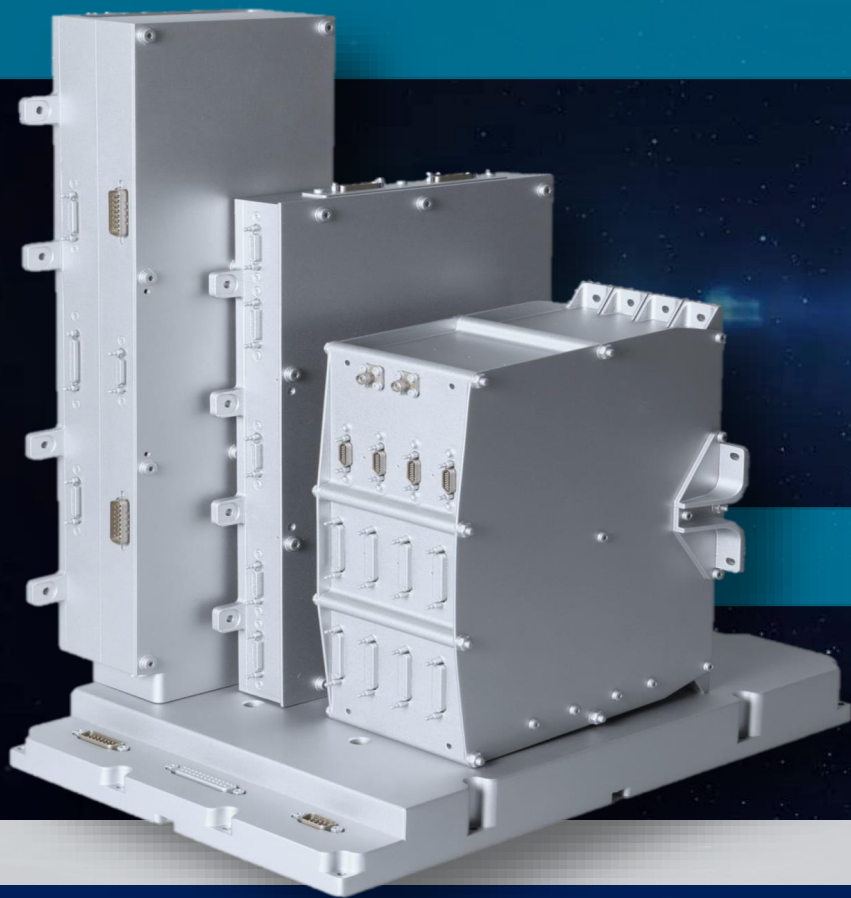
**AIRBUS** World leader for New Space GEO solutions *(with OneSat)*

**AIRBUS** European leader for New Space LEO solutions *(with OneWeb)*

More than ever, we are ready **to take up new challenges** to satisfy our customers !

***“We did not know it was impossible  
so we did it.”***

Airbus Teams



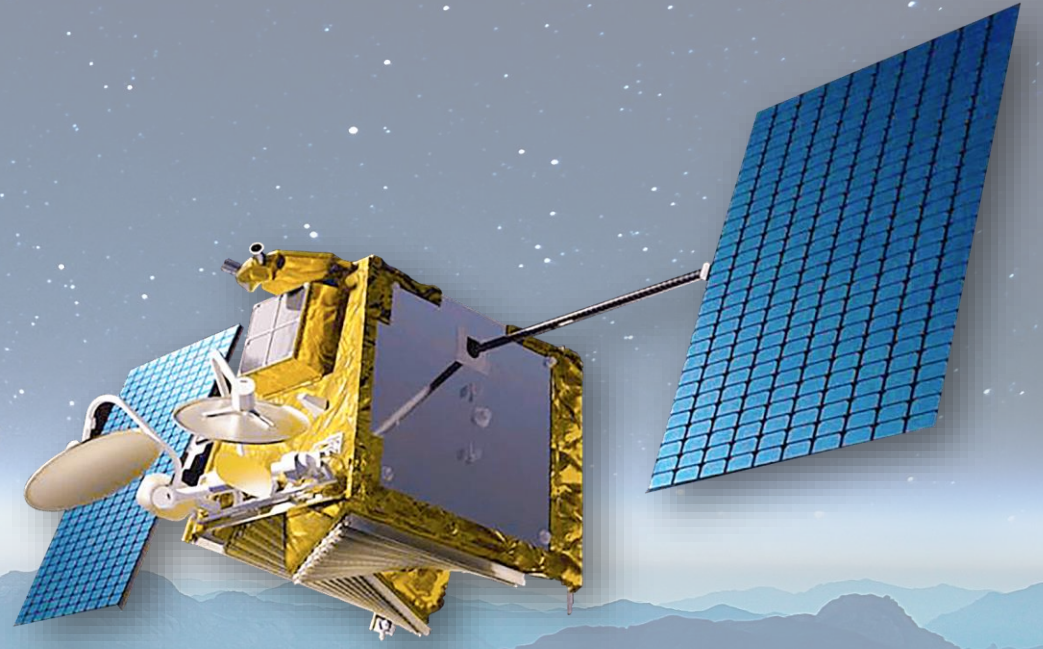
# Thank you

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# Backup Slides

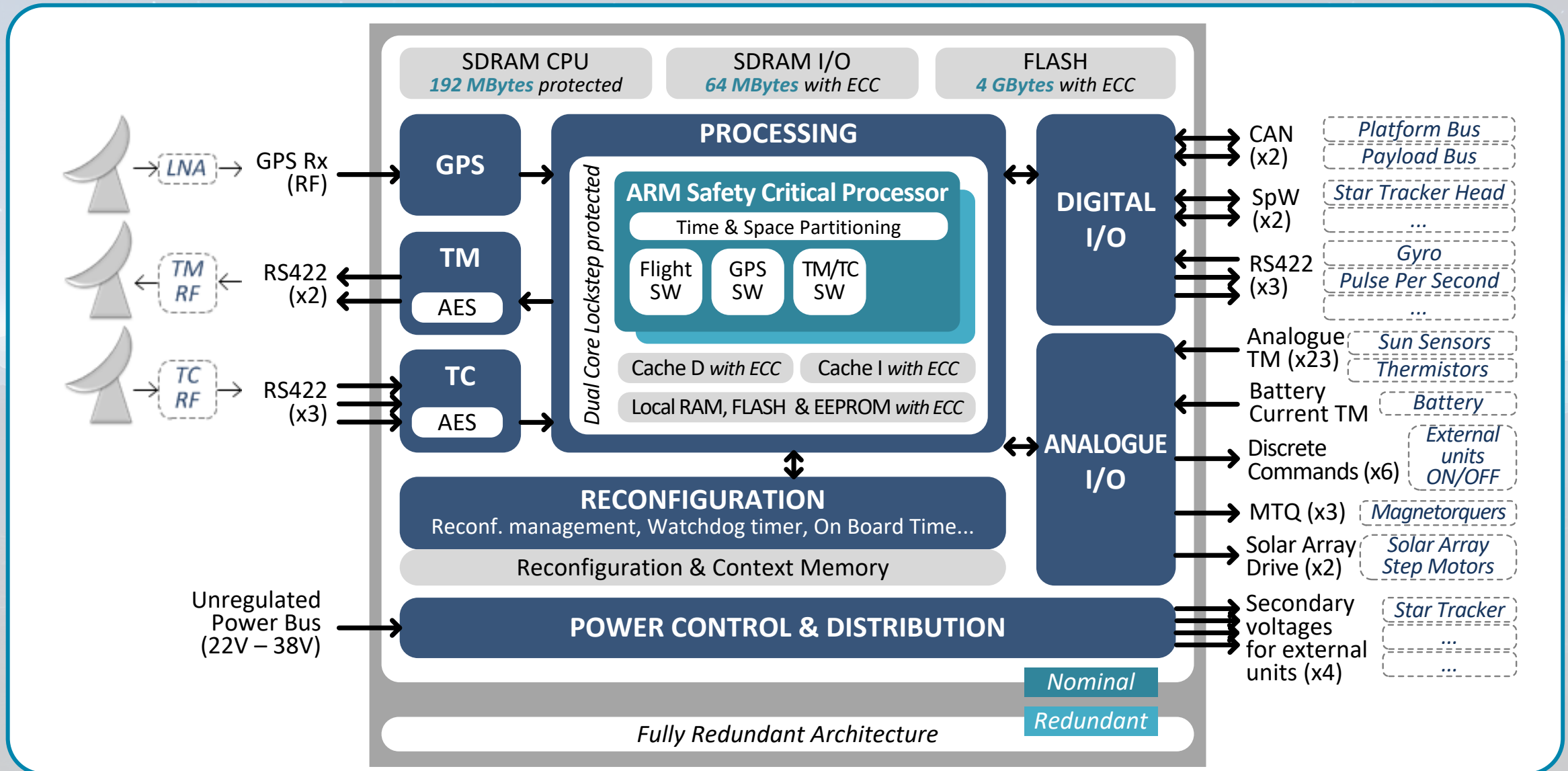
Just in case you want more...

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# Amethyst Detailed Architecture



# Amethyst Budget Summary

**215 DMIPS**  
Processing performance

**3.5kg**  
Weight

**11 x 24 x 17cm<sup>3</sup>**  
Assembly Volume

**20 - 50W**  
Consumption

