Investor meeting

2024-11-26

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Today's presenters

Johan Åman
CEO

Emil Rönnbäck
CFO

Lars Sundberg
Head of Operations

Anders Persson
Product Manager

Henrik Magnusson
Production Manager

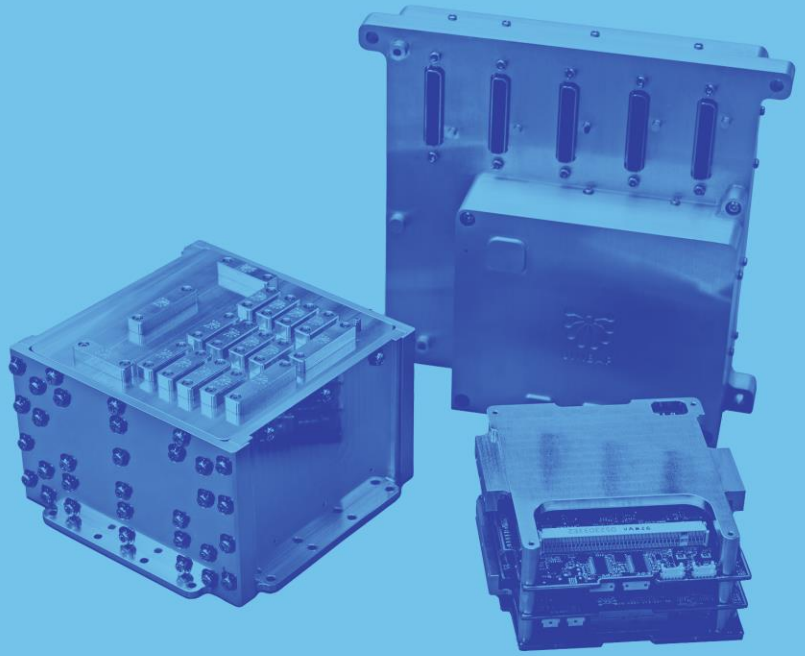
Josefine Nittler
Project Manager

Niklas Ulfvarson
Application Engineer

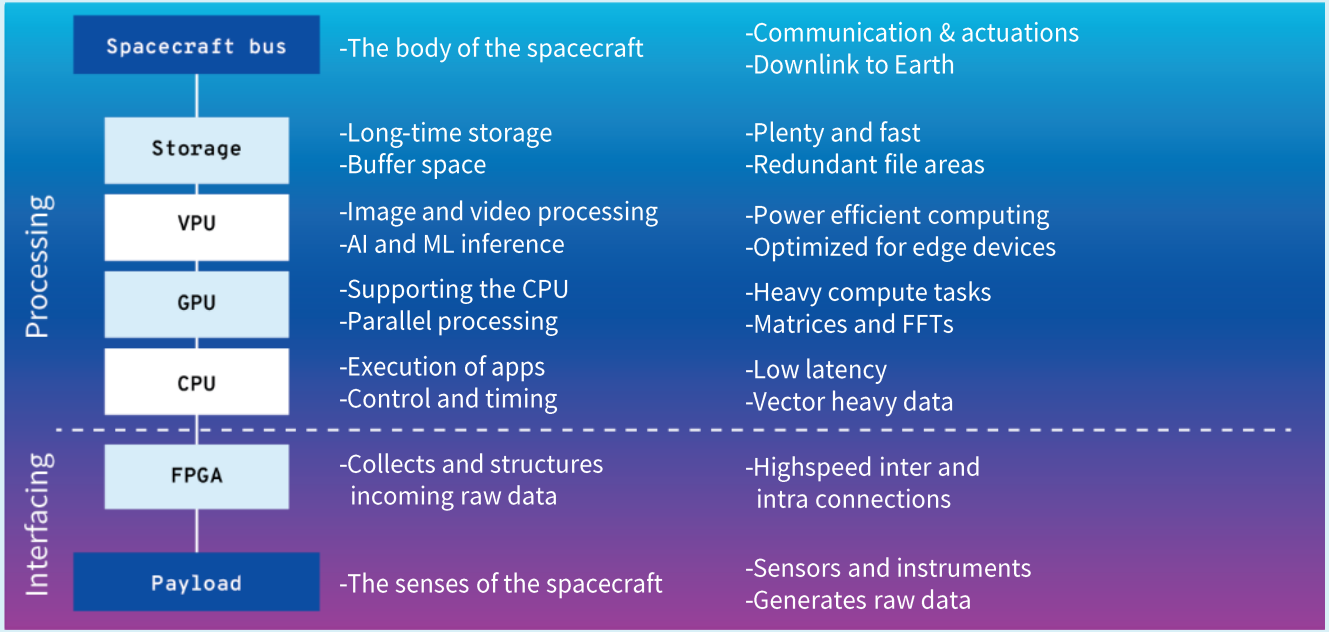
UNIBAP
SPACE SOLUTIONS

UNIBAP

- Space-grade Edge computers
- What are they?
- What are they used for?
- How are they qualified for space?



High performance



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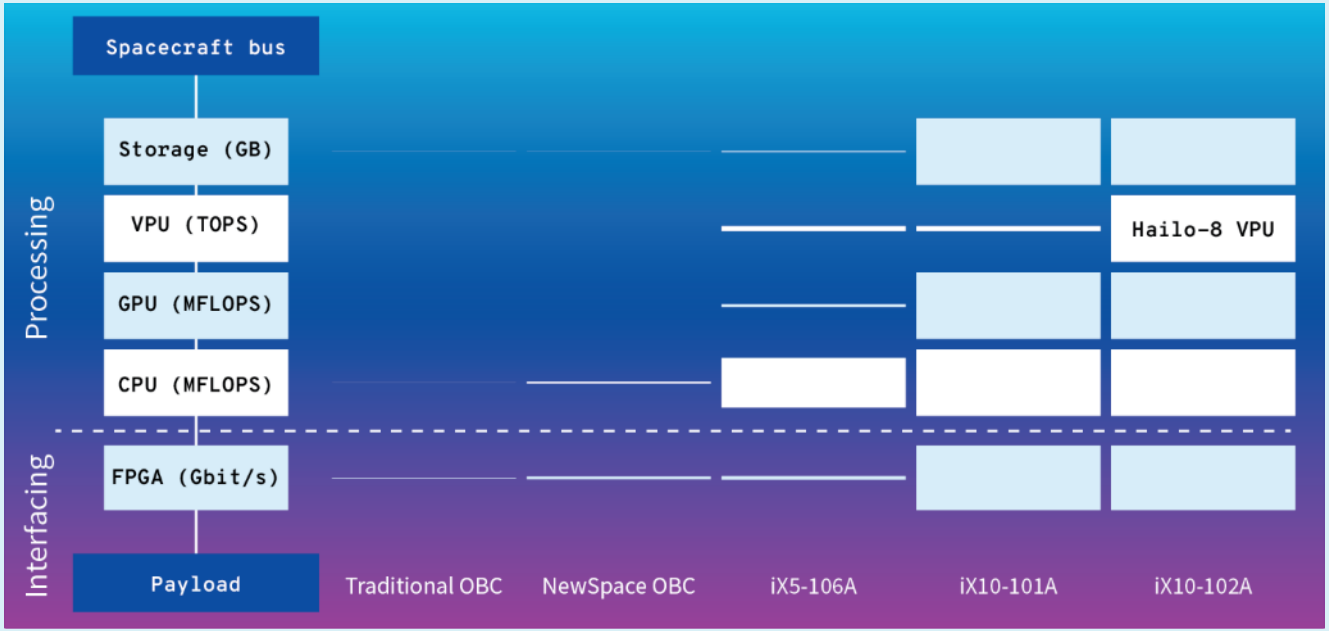


Challenges of the space market

Radiation belt

Low Earth Orbit

- Ne
- Ne
- Ne
- Ne

Atmosphere

Future of the space market – Solution

Almost all future value creation in space is focused on LEO
All LEO satellites will face these challenges
All challenges can be addressed by:

Standardization

Edge computing

AI inference

characterized by:

High performance

User friendliness

Reliability

Unibap's solution is tailor-made to meet these needs

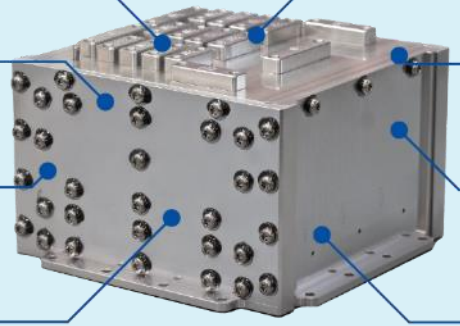
Unibap's Solution

Serial production – *SW configured standard HW*
Inspired by ***Featured-locked approaches***

Operating systems – *Space resilience & Software application framework*
Inspired by ***Open platform (Linux)***

Functions – *Performance optimizations*
Inspired by ***Deep learning***

Applications – *Edge computing & AI inference*
Inspired by ***more than 40 software partners***



Input / Output – *Data collection*
Inspired by ***more than 20 missions***

VPU – *AI inference*
Inspired by ***Automotive***

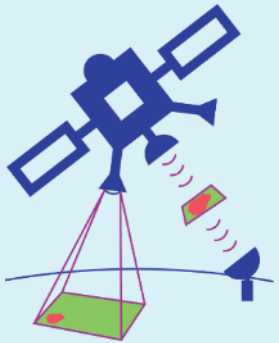
GPU – *Pre-processing*
Inspired by ***Gaming***

CPU – *Orchestration*
Inspired by ***Industrial PC***

Use cases

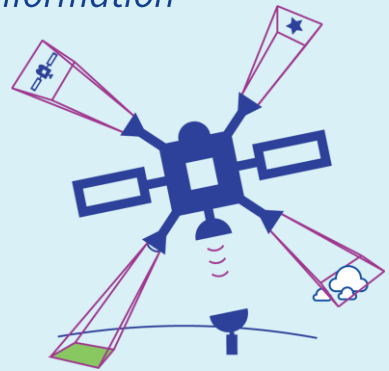
Edge Computing

- **Compressing** and condensing space data
- *Finding interesting objects in satellite images*



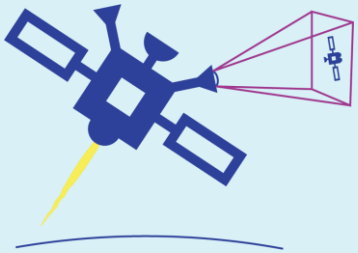
Payload Control

- **Combining** many sensors to a greater whole
- *Combining UV, visual and IR imaging for denser information*



Autonomous Operation

- **Compiling** actionable information for autonomous decision making
- *Fire thruster to avoid to avoid collision with incoming debris*



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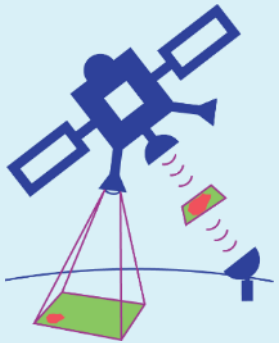

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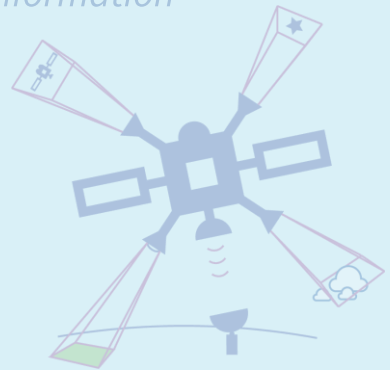

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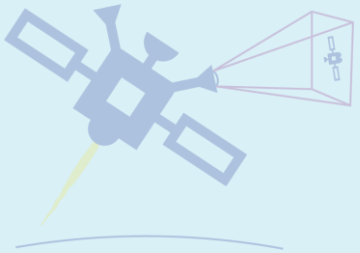
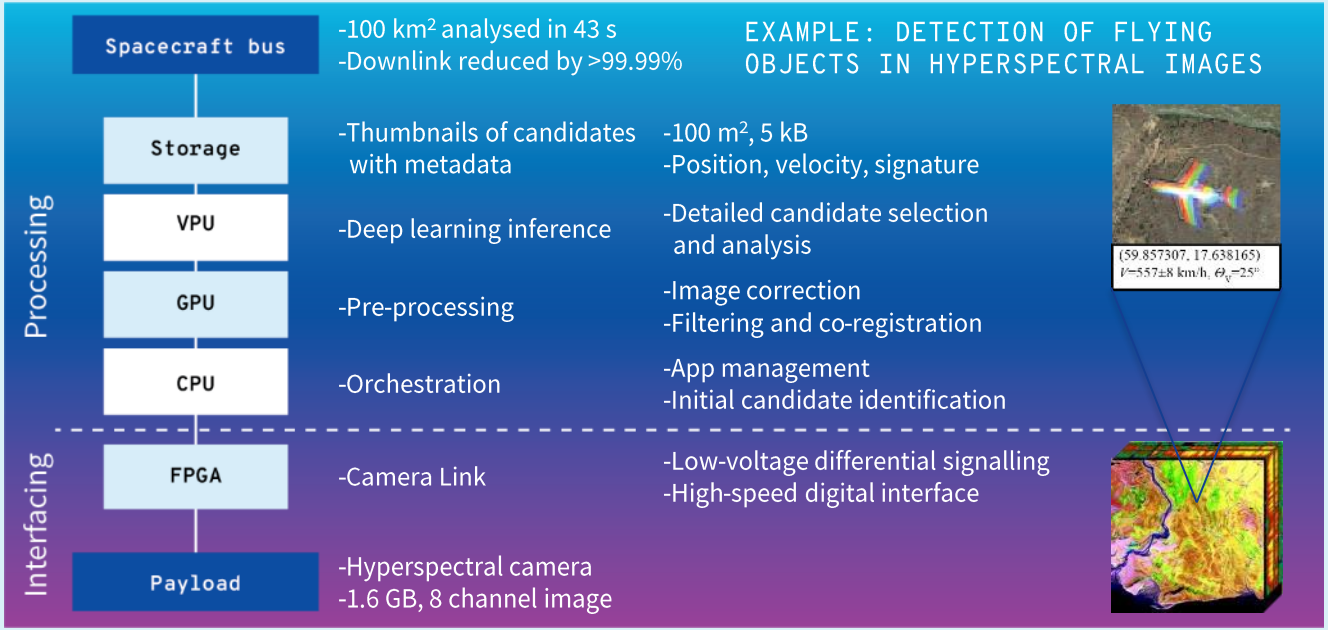


Edge computing- Example



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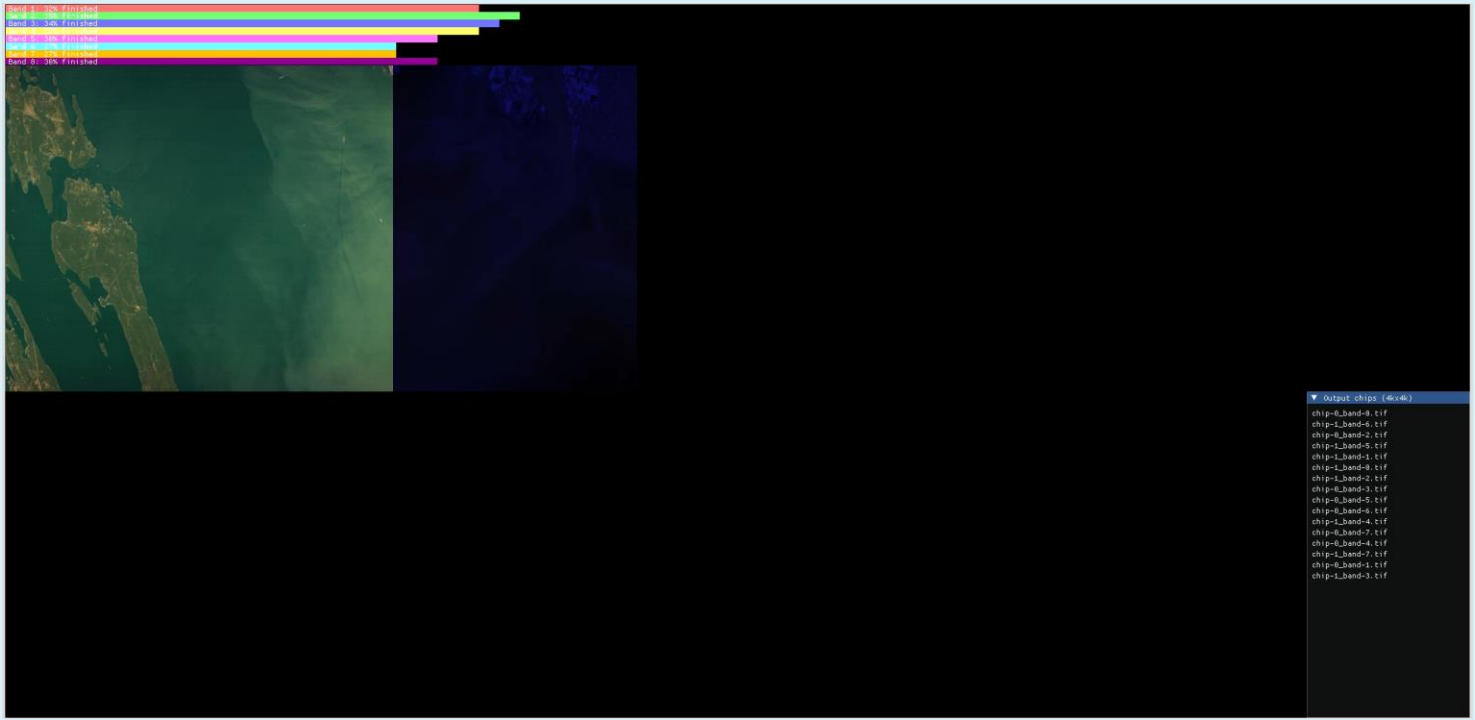

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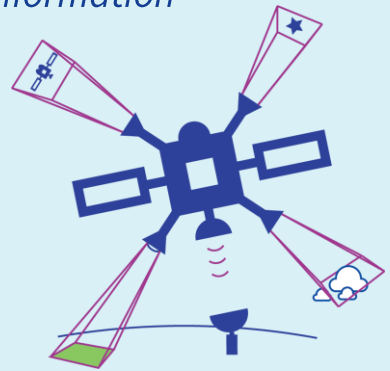

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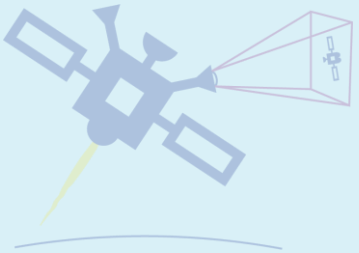


Bifrost – On-orbit AI surveillance

Nordic defence collaboration for spaceborne marine surveillance

- Ordered by **Swedish** and **Danish** defence materiel administrations
- Demo satellite for **in-orbit AI inference**
- Advanced **image** and **signal analysis**
- **Marine surveillance** in **the Arctic**

Unibap has delivered the **edge computer,** and will support **software development**

SPACE INVENTOR

UNIBAP

DTU

TERMA

GateHouse

Bifrost – On-orbit AI surveillance

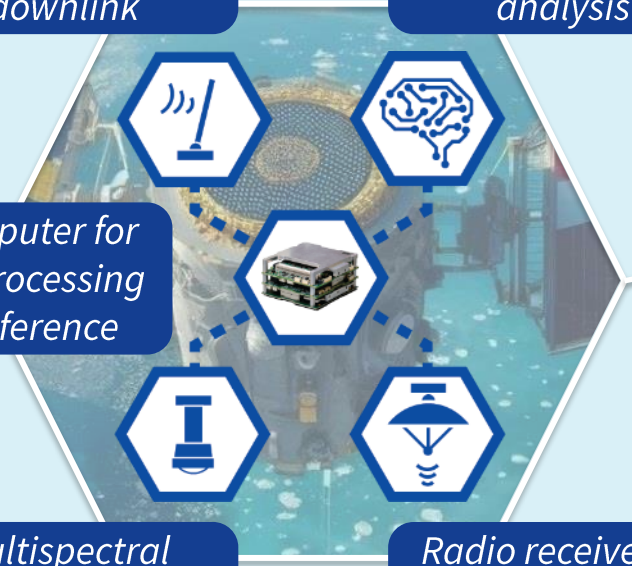
Satellite modem for low-latency downlink

AI app for object detection and analysis

Edge computer for data preprocessing and AI inference

Multispectral camera for Earth observation

Radio receiver for signal tracking & reconnaissance



SPACE INVENTOR

UNIBAP

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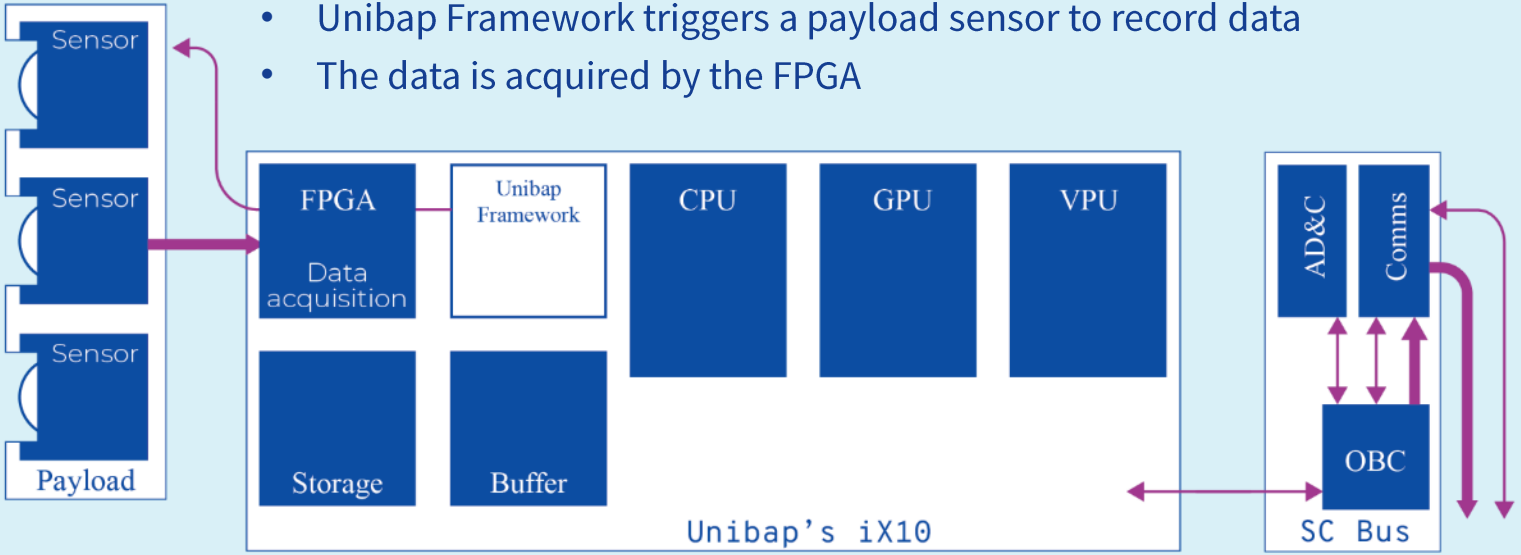
GateHouse

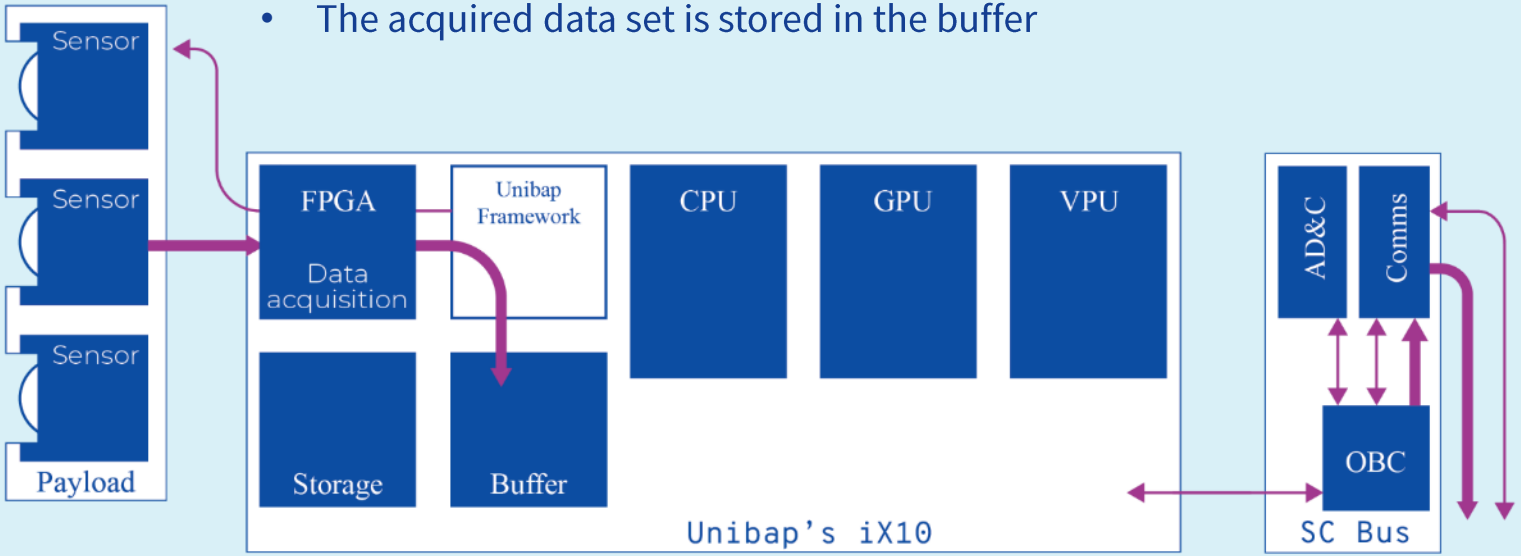
Satellite-as-a-service

- Unibap Framework triggers a payload sensor to record data
- The data is acquired by the FPGA



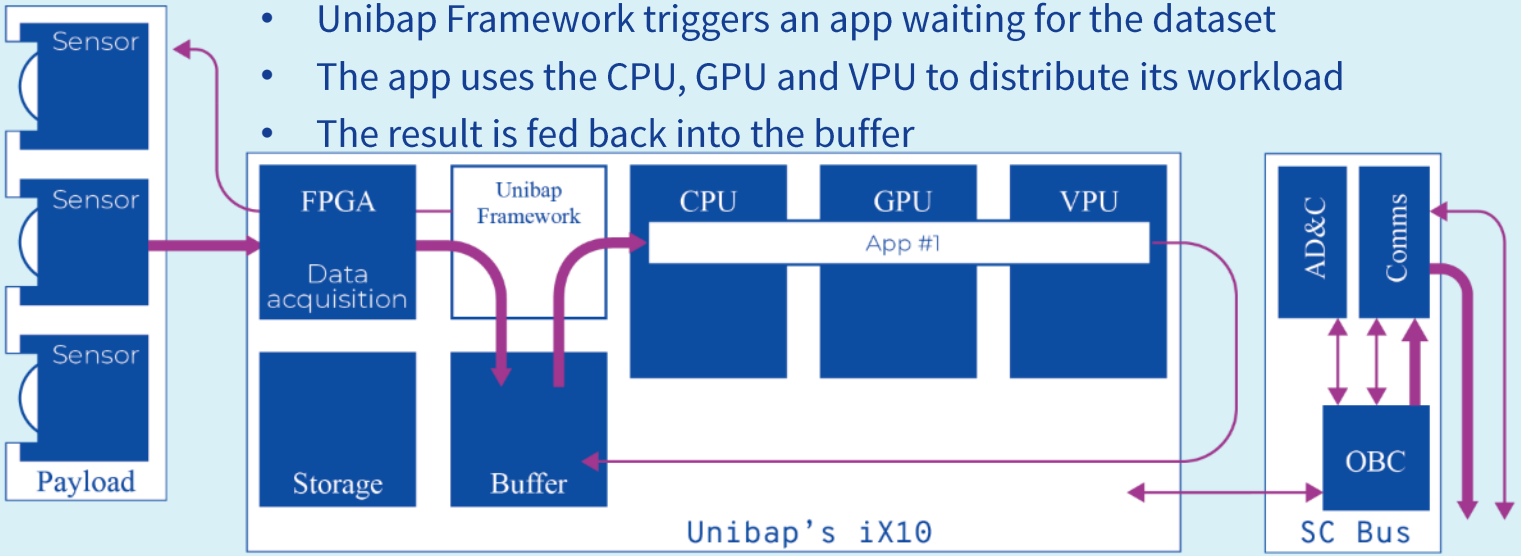
Satellite-as-a-service

- The acquired data set is stored in the buffer



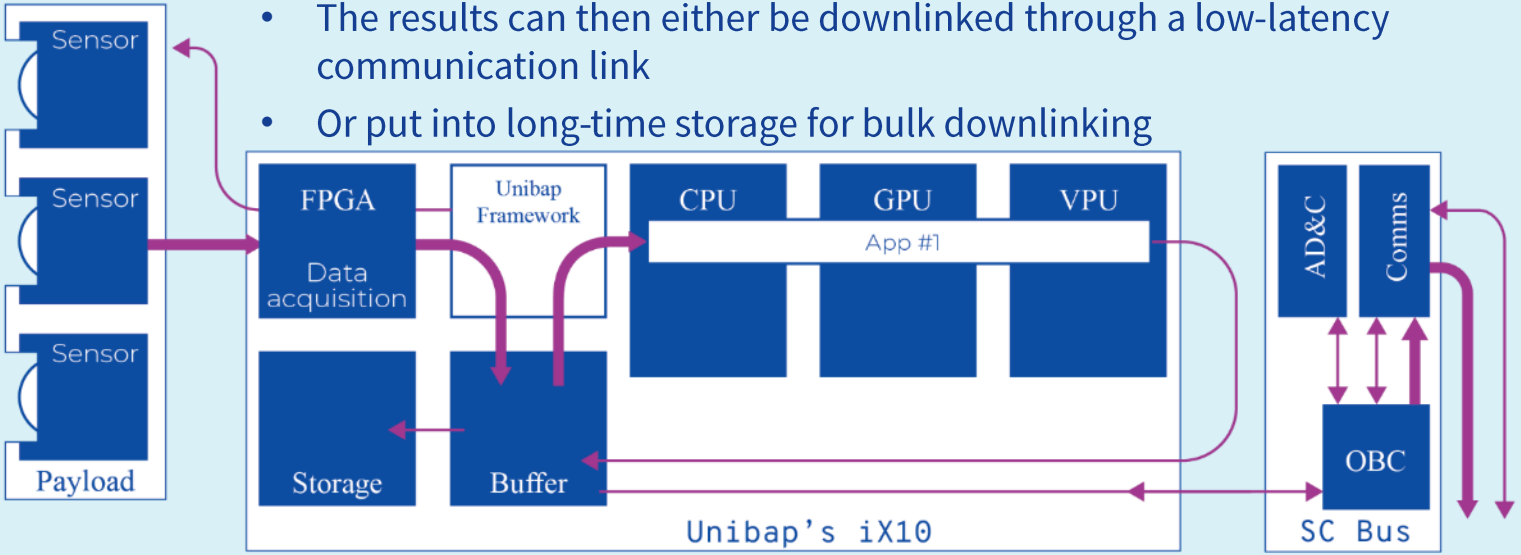
Satellite-as-a-service

- Unibap Framework triggers an app waiting for the dataset
- The app uses the CPU, GPU and VPU to distribute its workload
- The result is fed back into the buffer



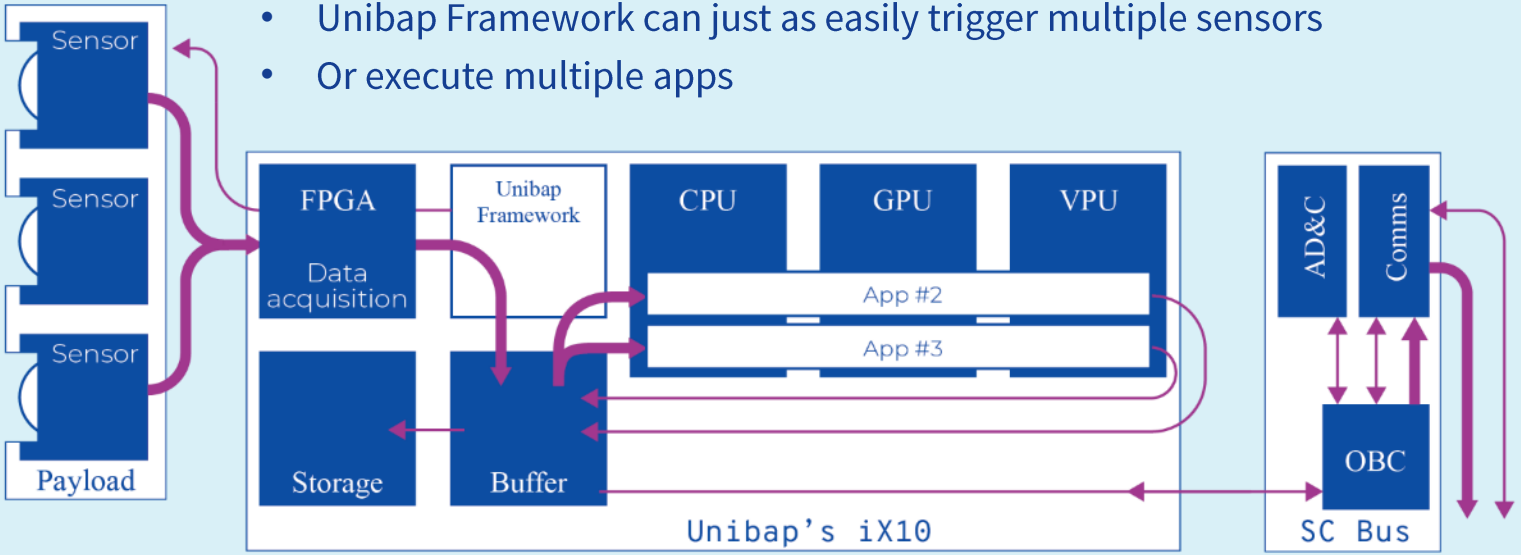
Satellite-as-a-service

- The results can then either be downlinked through a low-latency communication link
- Or put into long-time storage for bulk downlinking



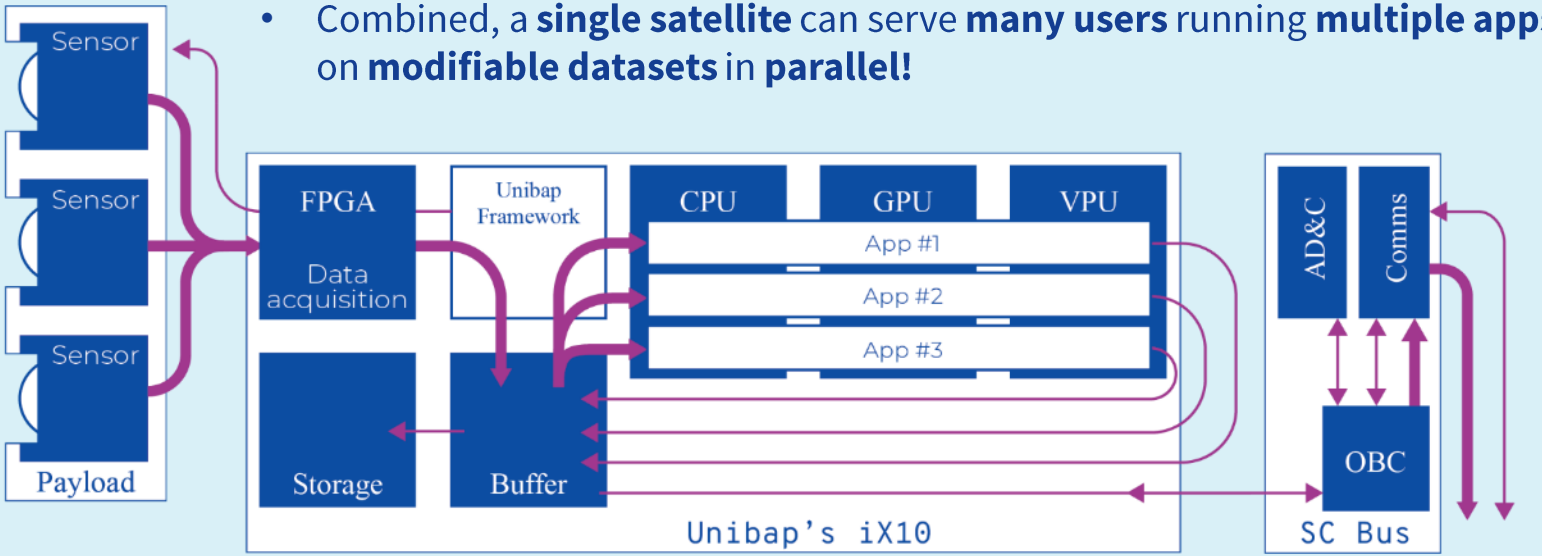
Satellite-as-a-service

- Unibap Framework can just as easily trigger multiple sensors
- Or execute multiple apps



Satellite-as-a-service

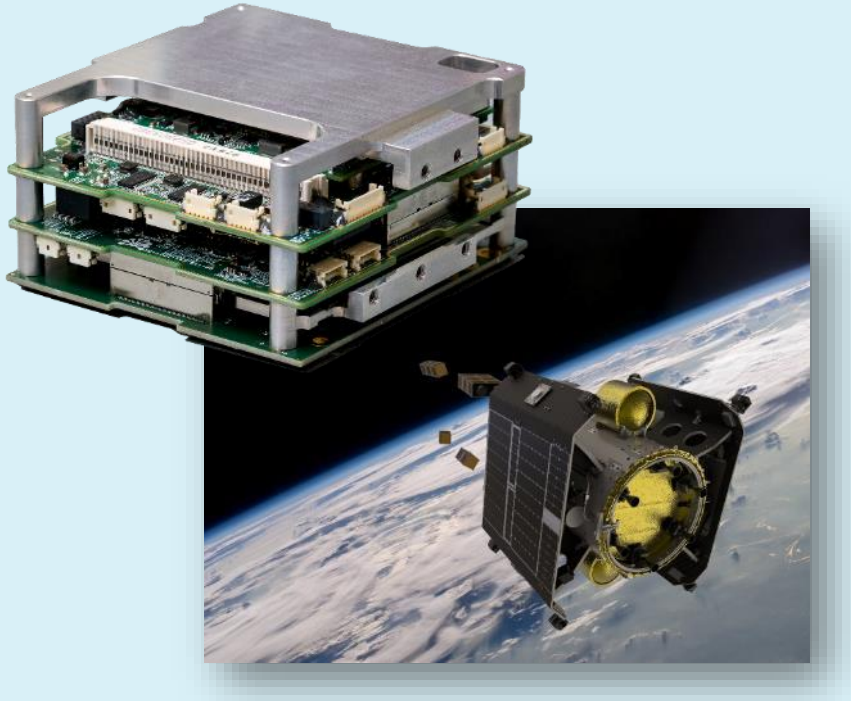
- Combined, a **single satellite** can serve **many users** running **multiple apps** on **modifiable datasets** in **parallel!**



In Orbit Demonstration missions

D-ORBIT + UNIBAP

- Service to verify 3rd party software in space
  - *Flight heritage for apps*
- Unibap iX5:s on D-Orbit's ION Satellite Carriers
- Two missions and more to come:
  - *Wild ride (2021-2023)*
  - *Dashing through the stars (since 2022)*
    - *Next launch in Q4 2024*



In Orbit Demonstration missions

More than **40 different** software apps **packaged**, **launched** and **verified**!

Use cases

Edge Computing

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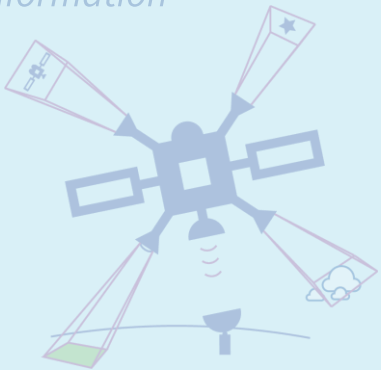

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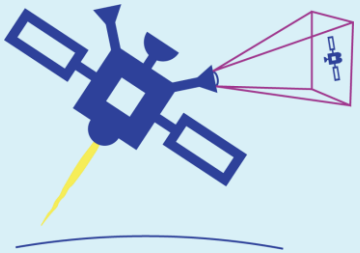
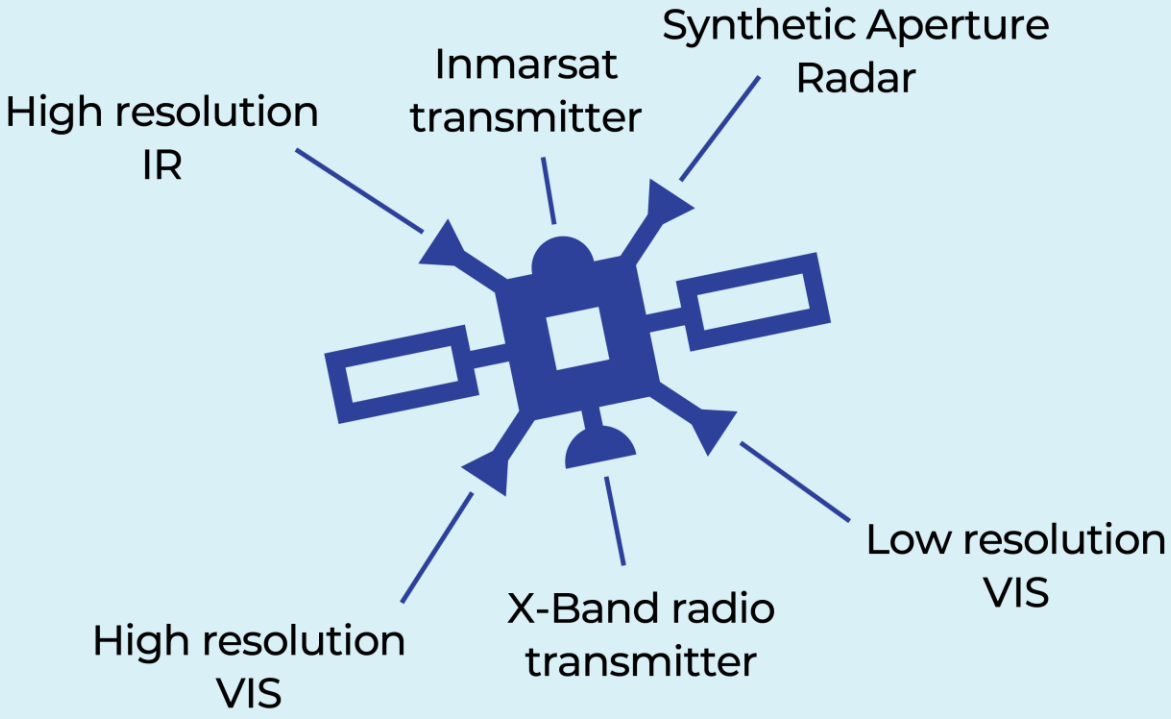
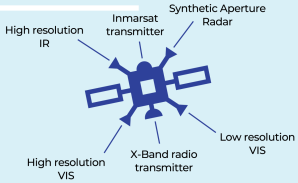


Cognitive imaging modes



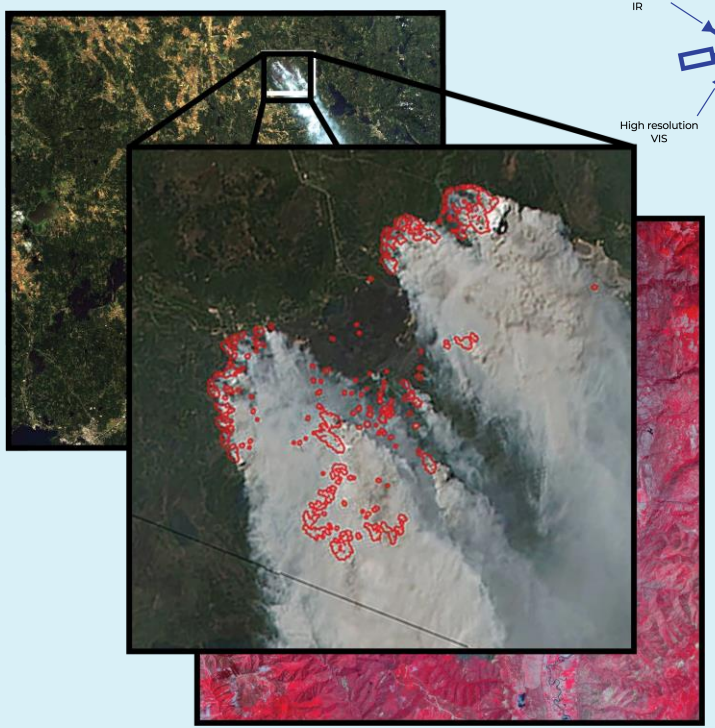
Cognitive imaging modes

- Imaging mode #1
  - *Low resolution VIS used to look for signs of forest fires*



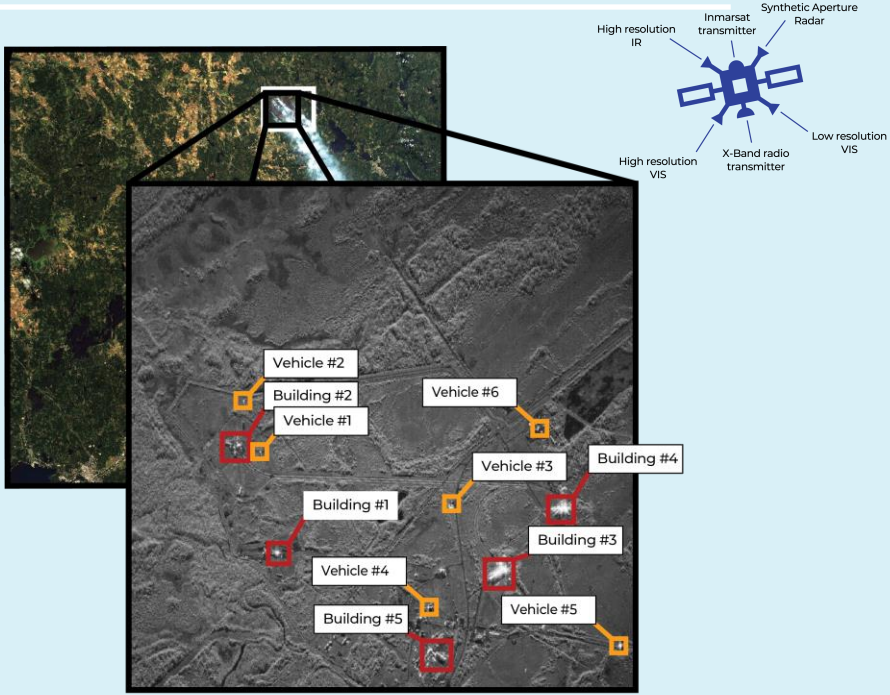
Cognitive imaging modes

- Imaging mode #1
  - *Low resolution VIS used to look for signs of forest fires*
- Detection triggers high resolution sensors
- Imaging mode #2
  - *High resolution VIS and IR cameras are used to identify the active foci of the fire*



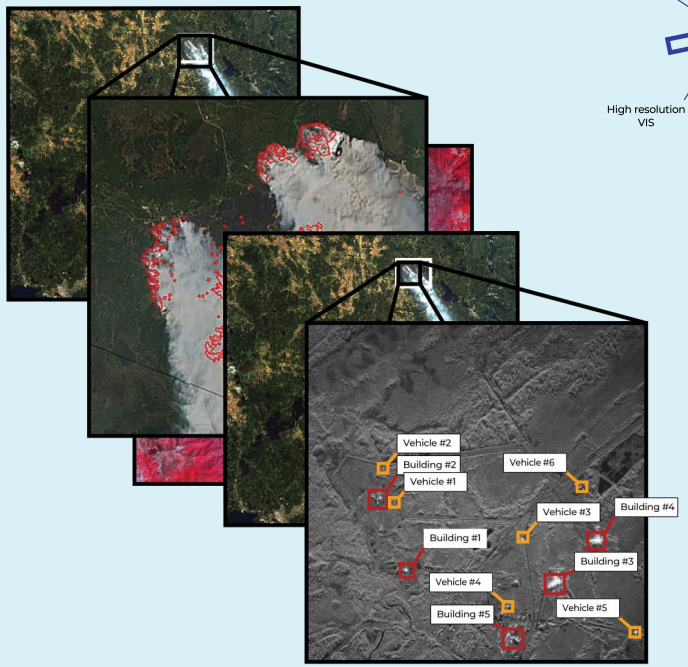
Cognitive imaging modes

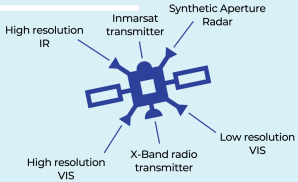
- Imaging mode #1
  - *Low resolution VIS used to look for signs of forest fires*
- Detection triggers high resolution sensors
- Imaging mode #2
  - *High resolution VIS and IR cameras are used to identify the active foci of the fire*
- Imaging mode #3
  - *SAR is used to identify all buildings and vehicles in the affected area*



Cognitive imaging modes

- Raw data:
  - ***Type***: *Disperse and difficult-to-interpret raw data*
  - ***Size***: *>100 GB*
  - ***Latency***: *Hours to days to downlink*
- Downlink:
  - ***Type***: *Map polygons of active fire foci. Coordinates of buildings and vehicles in the risk area*
  - ***Size***: *~100 kB*
  - ***Latency***: *Seconds over Inmarsat or similar*





Unibap Solutions

A holistic suite of *computing hardware*, *software*, and *services* for every stage of your space mission

User-friendly

- Open platform
- Fast delivery
- Holistic services and support

High performance

- State-of-the-art CPU, GPU and VPU for space
- Vast range of I/O interfaces
- Advanced AI inference

Reliable

- Flight heritage
- Space qualification
- Serial production

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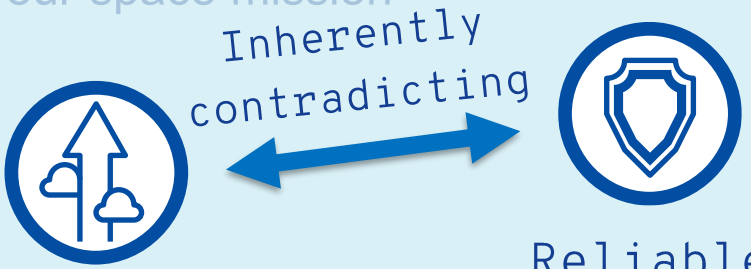

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Mission examples

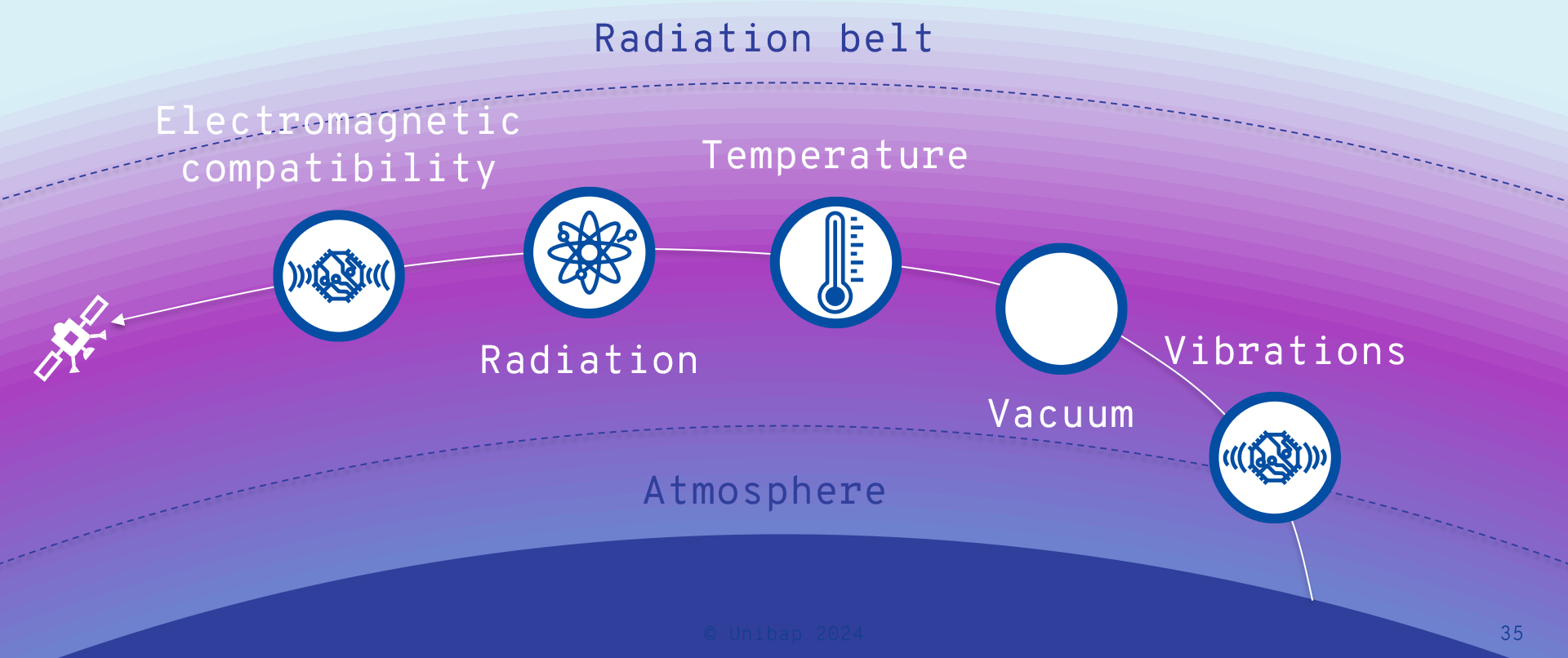
Q7 Compute cards

- Earth observation constellation
  - **Launch:** *Since 2016*
  - **Operation:** *Ongoing*
  - **Mission:** *CubeSats for Earth observation*

iX5

- D-Orbit – Wild Ride
  - **Launch**: *June 2021*
  - **Operation:** *Decommissioned*
  - **Mission:** *Space qualification of the iX5 and SpaceCloud OS*
- D-Orbit - Dashing Through the Stars
  - **Launch**: *January 2022*
  - **Operation:** *Ongoing*
  - **Mission:** *In-Orbit Demonstration service for software providers*
- Loft Orbital – YAM5
  - **Launch**: *January 2023*

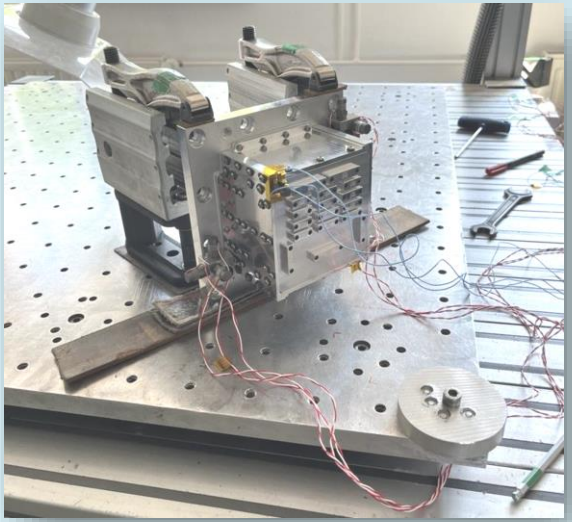
Space qualification



Vibration & shock testing

- Once in space, satellites float in comfortable micro-gravity
- But getting there is a bumpy ride
- All space technology must handle
  - *Vibrations*
  - *Mechanical shock*
- Corresponding to levels induced during launch

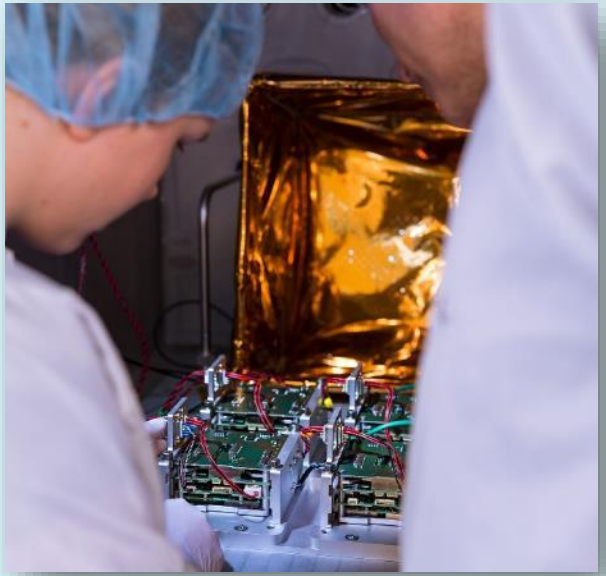
- Unibap **qualify** our hardware for vibrations and shock at even **higher levels than most launches**



Thermal vacuum testing

- Heat and cold works differently in space than on Earth
- The average temperature in LEO is ~15°C
- But:
  - *Direct sunlight can be very warm*
  - *Shadow can be very cold*
- In vacuum, heat cannot be lost by convection or conduction, only by radiation
- Space technology must:
  - *Handle the heat it generates*
  - *Work in a wide temperature interval*

- Unibap **qualify** our hardware for temperatures between **-20°C and 55°C**



Radiation testing

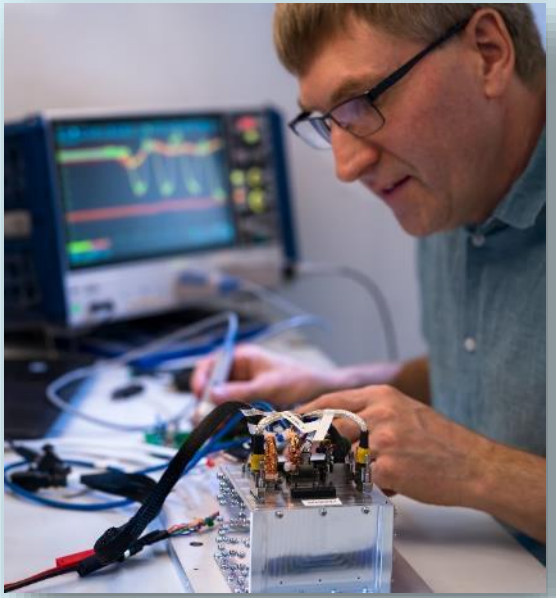
- Space is full of dangerous radiation
- Harmful to humans and technology
- Computers are extra sensitive
- Radiation can do anything from
  - *Switching a 1 to a 0 corrupting the memory*
- …to:
  - *Locking a transistor making it un-writable*
- …or:
  - *Burning a whole circuit*

- Unibap **qualify** our hardware in radiation equivalent to the **worst environments** expected in Low-Earth Orbit

Electromagnetic testing

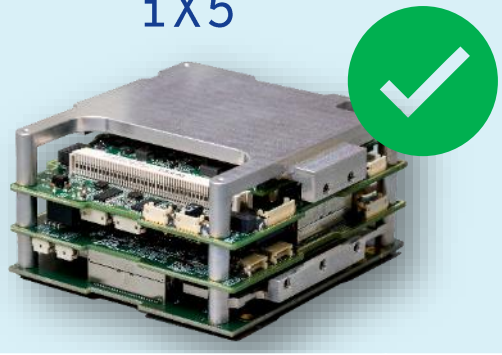
- Most space systems work and talk electromagnetically
- Some measure weak signals
- Some emit a lot of noise
- The more complex the system, the more noise it creates
- Space computers are very complex!
- On a spacecraft, they must work together

- Unibap **qualify** our hardware for frequencies between **10 kHz and 18 GHz**



Space qualification status

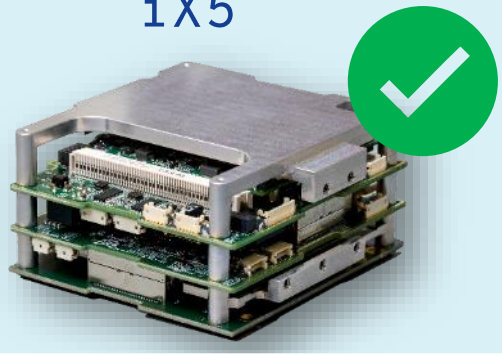
iX5



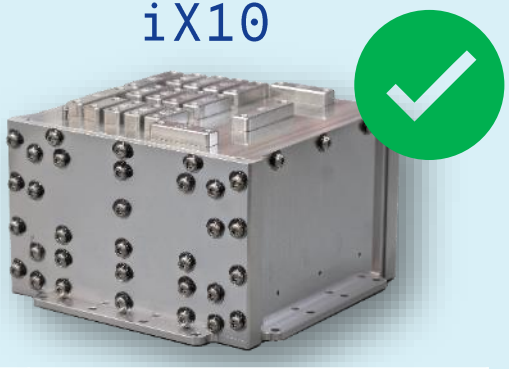
Qualification	iX5
Vibration	YES
Thermal vacuum	YES
Radiation (proton/photon)	N/A / YES
EMC	N/A
Flight heritage	YES

Space qualification status

iX5



iX10



Qualification	iX5	iX10
Vibration	YES	YES
Thermal vacuum	YES	YES
Radiation (proton/photon)	N/A / YES	YES
EMC	N/A	YES
Flight heritage	TRL* 9	TRL 8 , TRL 9 in 2024/2025

*Technology Readiness Level

Edge Computing in Space Market

UNIBAP

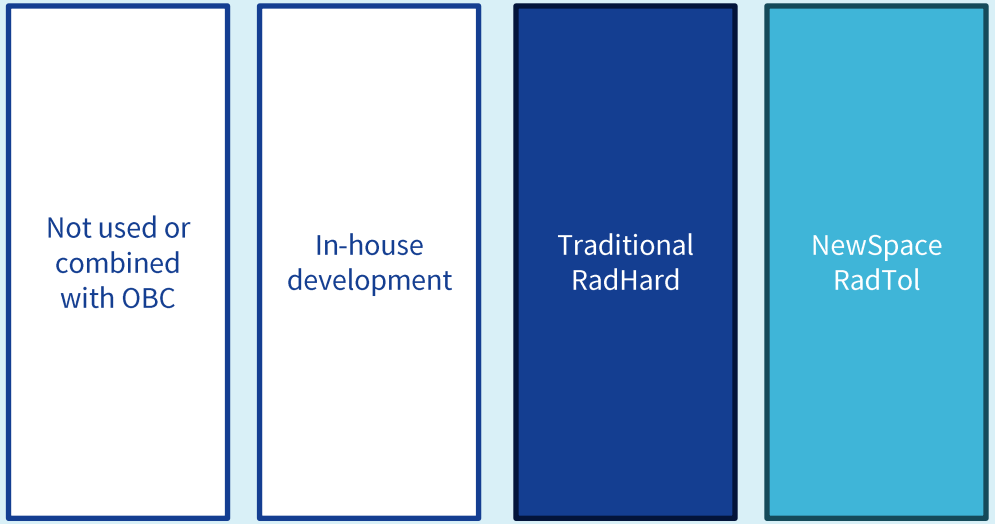
Distinct categories of Space computers…

Competitive landscape for Space Computing

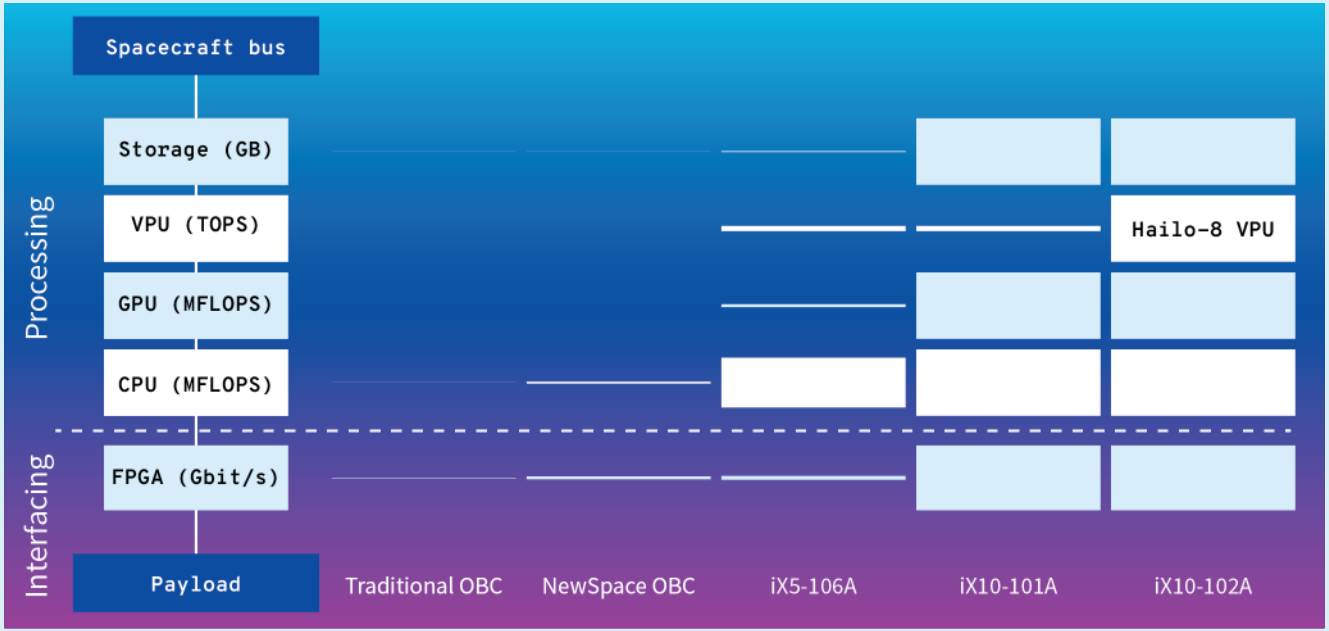
Other than payload

OBC

Payload computers for e.g. Edge Computing

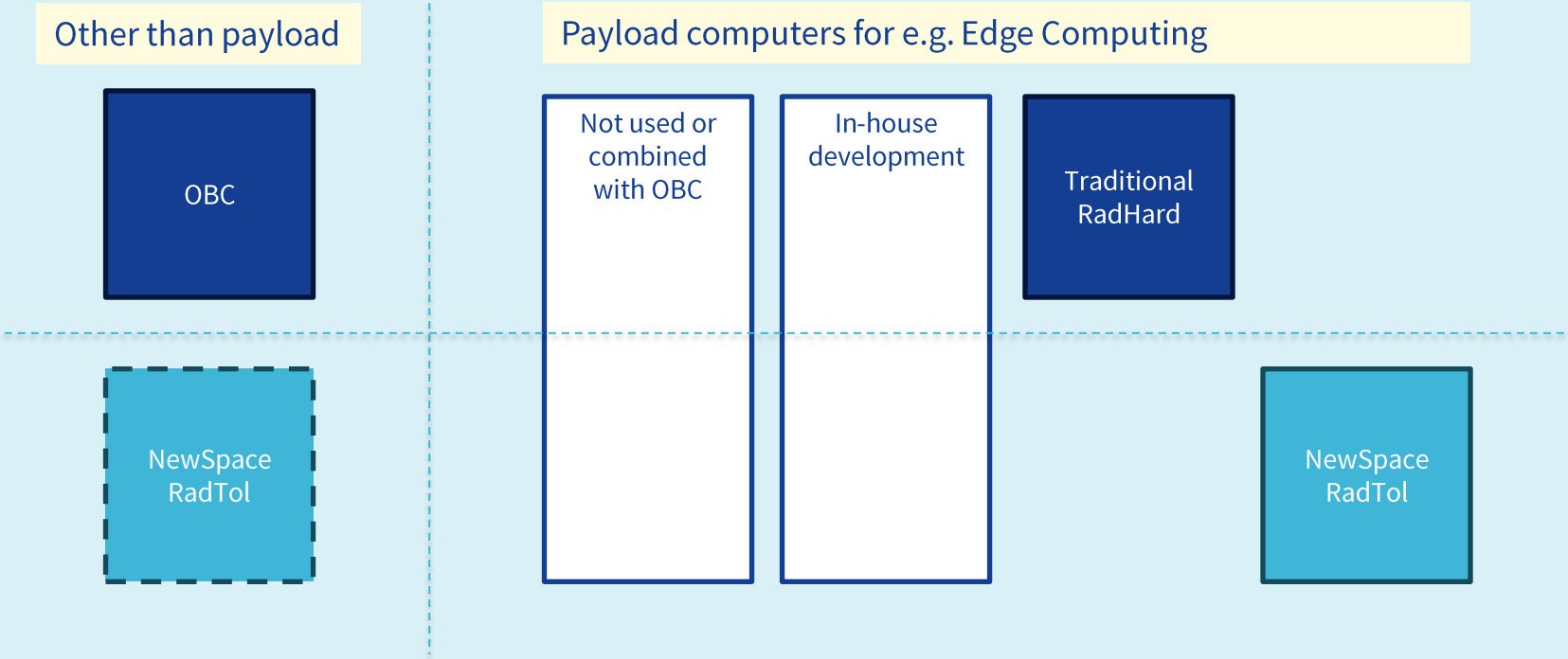


High performance



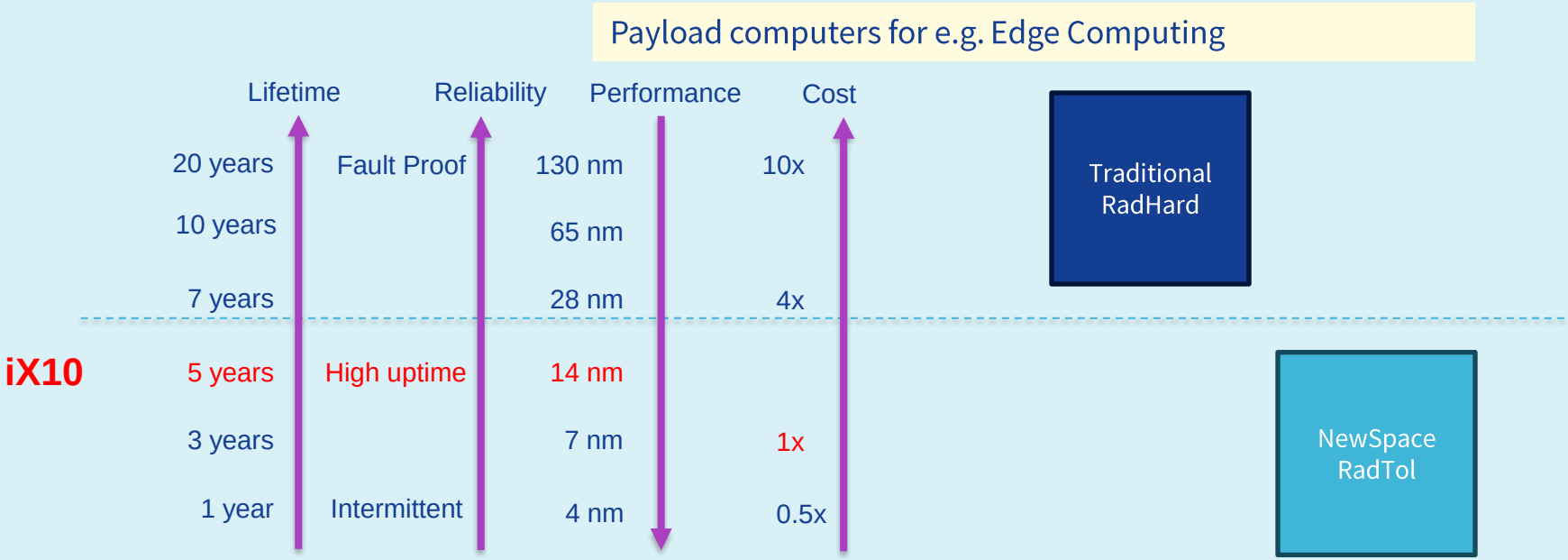
Distinct categories of Space computers…

Competitive landscape for Space Computing



Distinct categories of Space computers…

Competitive landscape for Space Computing*



*Illustrative comparison

Sales and Delivery Cycle – *illustrative*

Competitive landscape for Space Computing

Payload computers for e.g. Edge Computing

7 years development + 2 years delivery + 10 years lifetime

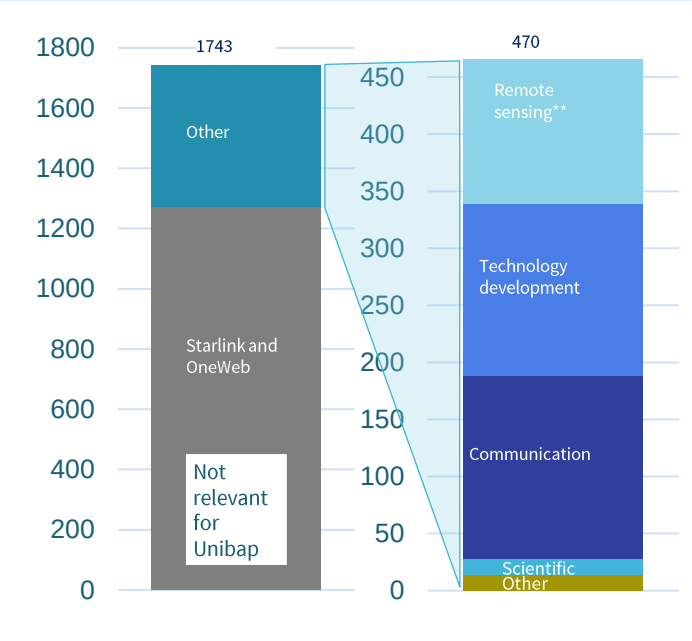
Traditional RadHard

3 years development + 3 months delivery + 5 years lifetime

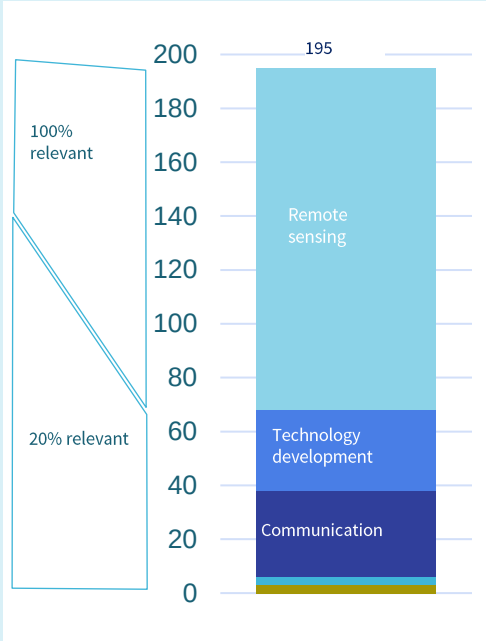
NewSpace RadTol

SmallSat launches 2021

Total number of small* satellites launched, 2021



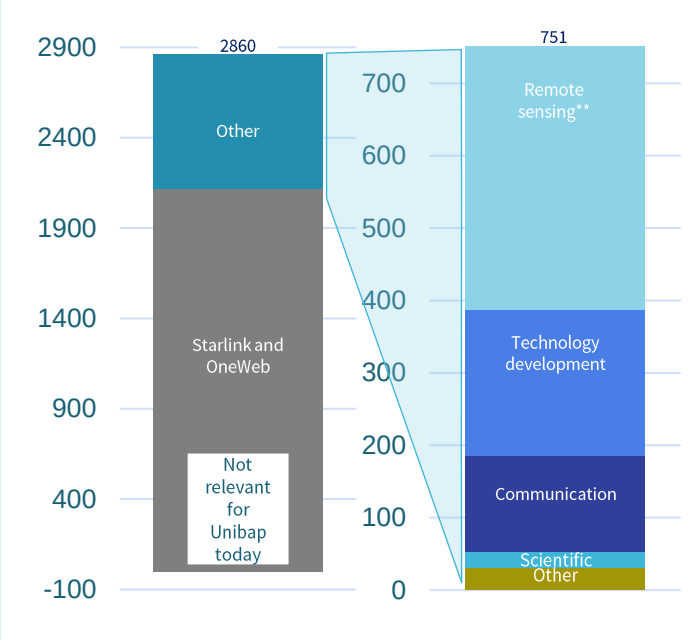
Number potentially relevant for Unibap solutions per year



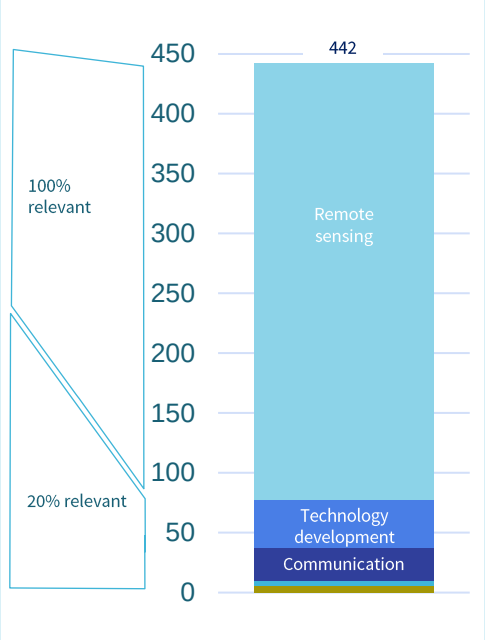
Source: BryceTech 2022, company analysis
*Smallsat **<600kg**, **Earth observation the large share, also includes other observations

SmallSat launches 2023

Total number of small* satellites launched, 2023



Number potentially relevant for Unibap solutions per year



Order in 2024 → Launch in 2025 or later

Source: BryceTech 2024, company analysis
*Smallsat **<1200kg**, **Earth observation the large share, also includes other observations

Edge Computing in Space

COMPUTING IN SPACE

- Dominated by traditional space technology
- **1200 M€** in 2022
- Growing moderately:
  - **CAGR**: 12%*
- Cannot support the full value creation of space data

EDGE COMPUTING IN SPACE

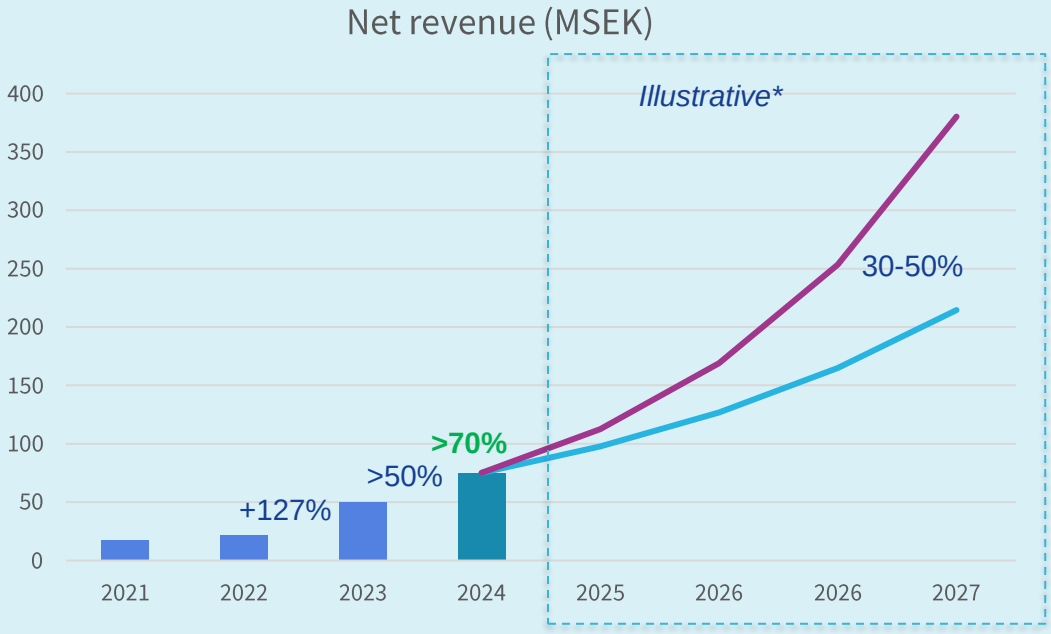
- Novel approaches on traditional platforms
- Growing faster:
  - **CAGR**: 21%**
- Proves the concept but is hampered by the slow innovation pace

NON-TRADITIONAL EDGE COMPUTING

- The latest Edge COTS from gaming and automotive
- Software-centric approach
- Unleashes the full value of space data
- Expected to gain market share*
- **Our short to medium-term growth ambition**: 30-50%

* Markets and markets, Space on-board computing platform market - 2022. ** BIS Research 2022 (Global Space-Based Edge Computing Market).

Medium-term growth ambition



Customer revenue only

Funded projects or grants excluded

Actual 2022 → 2023: 127%

Outlook 2023 → 2024: >50% → **>70%**

Medium-term ambition beyond 2024: 30-50%

* The illustrative customer revenues for 2025-2027 are based solely on our ambition to grow customer revenues by 30-50% per year. Figures are illustrative and not forecasts.

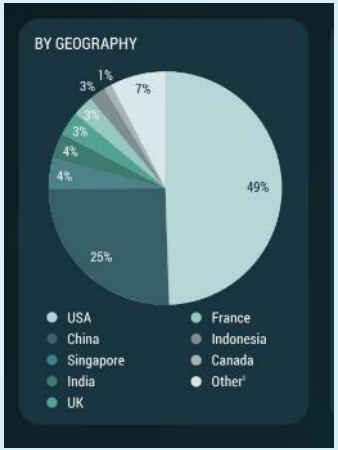
The 5:1 divide

24 BUSD/y

29 BUSD/y

100 satellites/y

Private investments



5 BUSD / Quarter

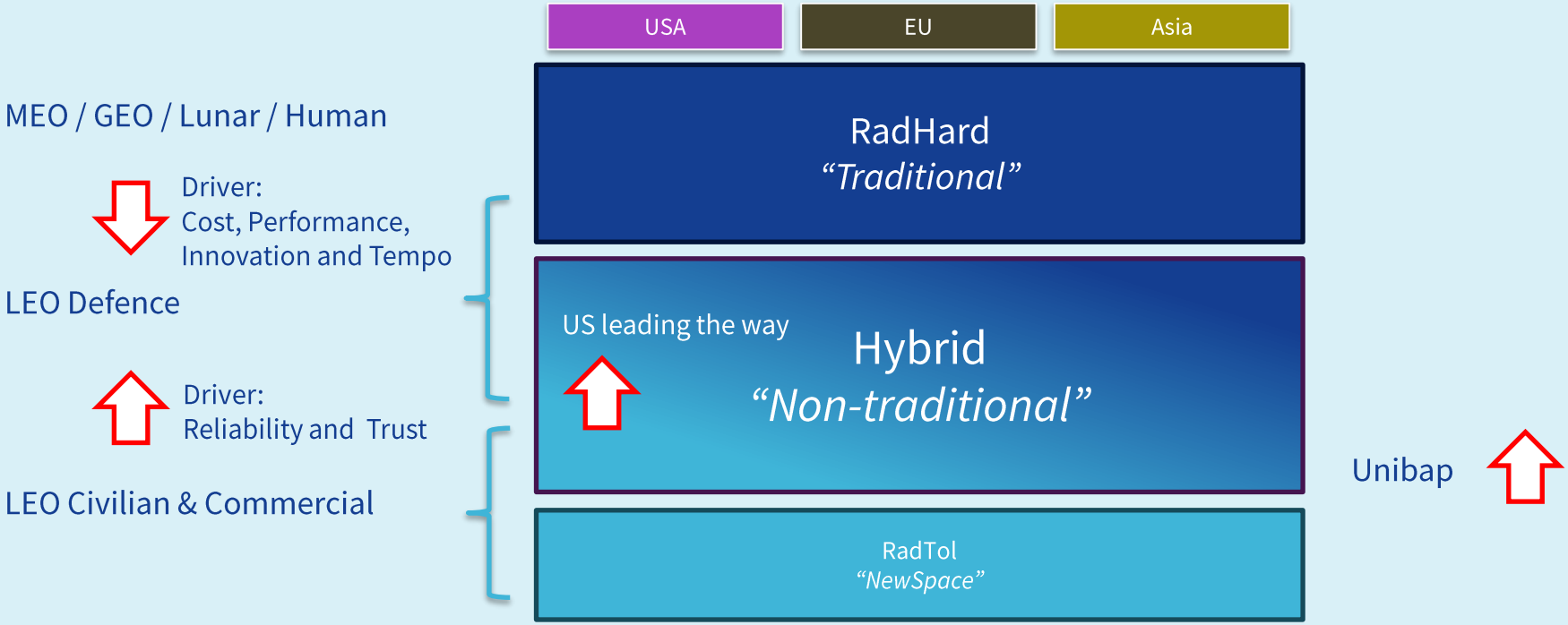
6.5 BEUR/y

Rymdstyrelsen
Swedish National Space Agency

1,300 MSEK/y

Regeringen har idag beslutat att tilldela Försvarsmakten en miljard mellan 2024–2032 för att kunna utveckla sin rymdförmåga. Det handlar om att förbättra Försvarsmaktens rymdlägesbild, bygga ut infrastrukturen vid rymdbasen Esrange och möjliggöra för Försvarsmakten att kunna skjuta upp ett flertal satelliter i rymden.4 okt. 2024

“SDA driving the SmallSat market”



“SDA driving the SmallSat market”

Structure:

1) Iterative cycles to introduce **innovations** → New tranche every 2 years
2) Short **lead time** from contract to launch → 30 months
3) True fixed price → Expecting better **price-performance** every tranche
4) **Competitive** bidding → Several suppliers to every tranche
5) Volume purchasing → **Standard** setting
6) On-ramp program for new suppliers → **Challengers** to established primes

Consequences:

1) No time to develop after contract → **Product** strategy
2) Innovations and price-performance → **Non-traditional** suppliers
3) Challengers → **Lower entry barriers**

Challenge:

1) Trust in reliability → **Good enough**
2) Trust in supplier → **Made-in-US**

Market overview

Market growth

- Space Computing growing moderately @ 12%
- Starting from low penetration of Edge Computing → Growing faster @ 21%
- Non-traditional Edge Computing expected to gain market share – Software-centric approach
- **Our medium-term growth ambition**: 30-50%

Market potential

- Smallsat launches 2021 to 2023:
  - 1743 → 2860 (+28%/year)
- Non-megaconstellations:
  - 470 → 751 (+26%/year)
- **High likelihood for Edge Compute:**
  - 195 → 442 (+51%/year)
- Order in 2024 → Launch in 2025 or later

Market trends

- LEO Defence most active up-and-coming segment
- SDA (under Space Force) in USA setting market requirements
- LEO Defence driving “hybrid requirements” suitable for non-traditional suppliers
- **Unibap is targeting this hybrid segment**
- Unibap is planning to increase presence in the US in 2025

Financial model

Business shifts over next years

STANDARD PRODUCTS

- *Focus on standardized hardware and software based on own roadmap*
- *Less Customization Services*

CONSTELLATION PROJECTS

- *More Qualification Projects converted into Constellation Projects*
- *More Flight Hardware*

INCREASING SOFTWARE FOCUS

- *Introduced SaaS license model*
- *Gradually broadened SW portfolio*

FINANCIAL IMPROVEMENT

- *Mix shift toward higher margins for SW and Flight Hardware relative Services*

Mix shifts over the next years

Offering	Subcategory	Historical mix	Expectation	Gross margin ambitions	Expected shifts in mix
Services	Engineering	**Dominant**	Smaller	20-40%	Standard Products reduce Customization Services
	Support	Small	Increasing	20-40%	
Hardware	Evaluation (EM)	Even	Smaller	60-80%	
	Flight (FM)	Even	**Dominant**	70-85%	Constellation Projects increase FM content
Software	Embedded	N/A (included in HW)	Increasing	95-100%	New SaaS license model introduced
	Applications	N/A	Over time	95-100%	Gradually expanding portfolio

Ambitions in 2024

TECHNOLOGY MATURITY

- *Reach TRL9 for iX10*
- *Dependent on customers and partners – **UPDATE: Postponed by customer until early 2025***

OPERATIONAL READINESS

- *Secure production capacity of 100 computer units per year*

BUSINESS DEVELOPMENT

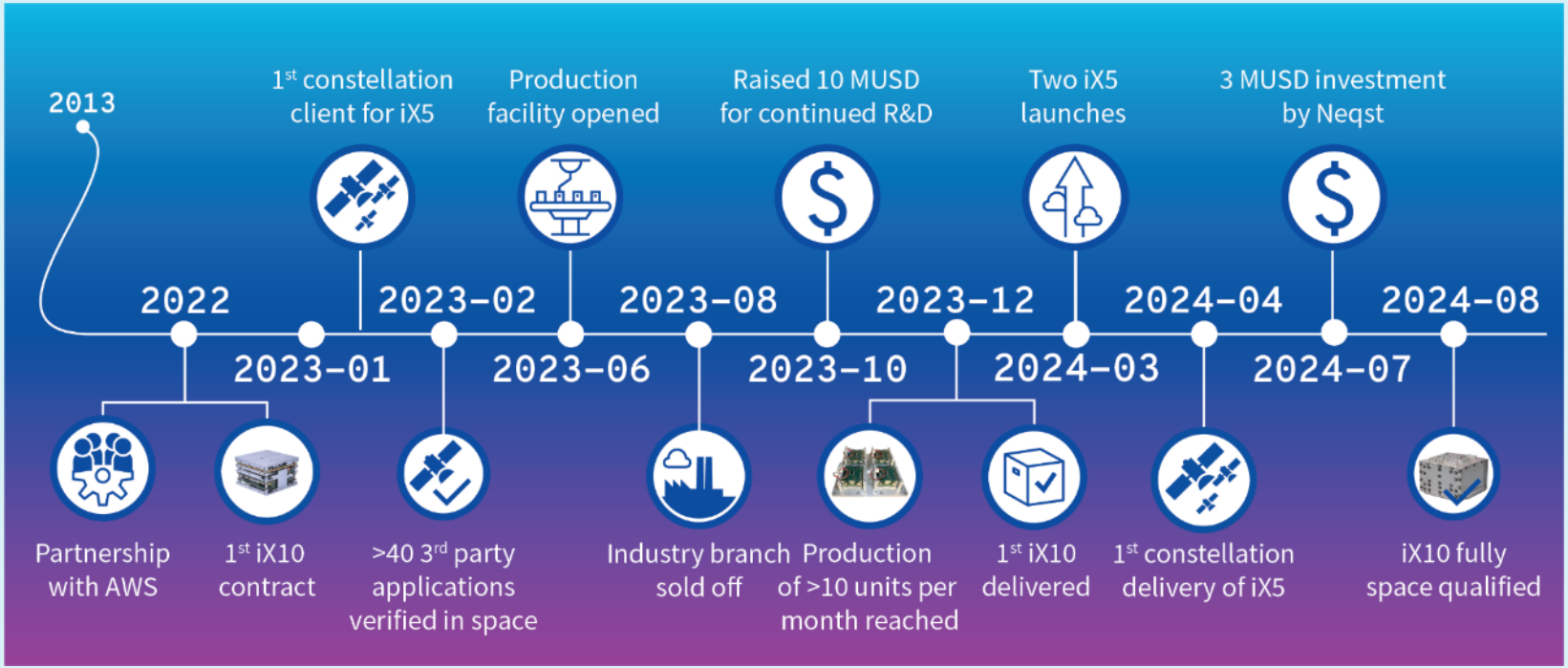
- *Capture Qualification Projects*
- *Convert at least one into Constellation Project – **UPDATE: Batch #2 ordered***

FINANCIAL IMPROVEMENT

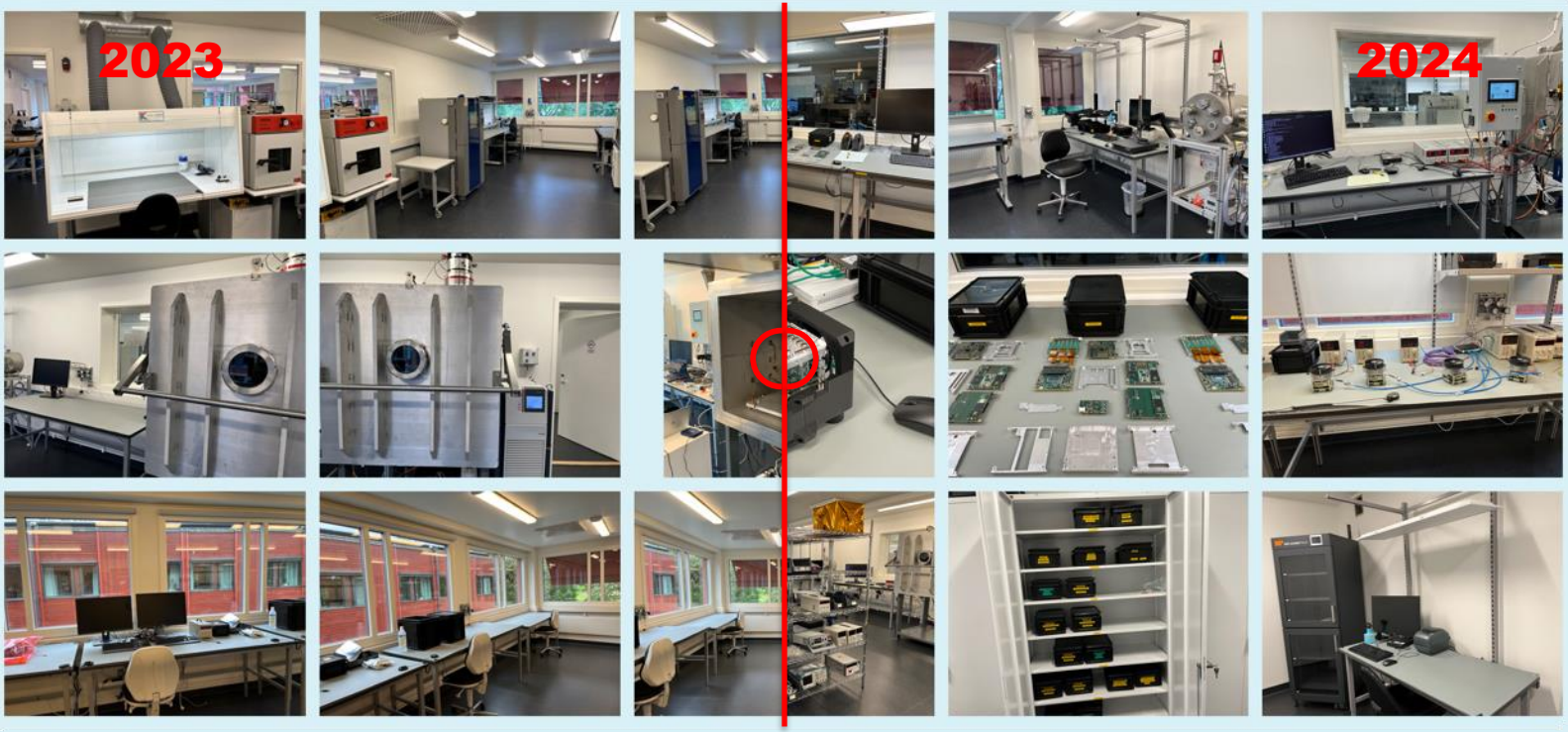
- *50% revenue growth – **UPDATE: Revised to 70%***
- *30-50% average mid-term revenue growth*

Operations

Timeline



Production – now and then



Production – now and then

Production – now and then