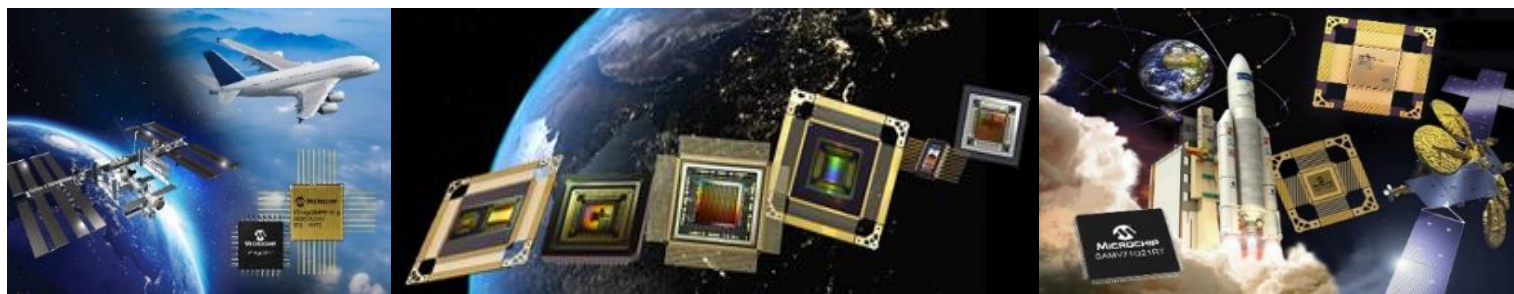




Facing New Space Challenges European Scalable Solutions



A Leading Provider of Smart, Connected and Secure Embedded Control Solutions



SMART | CONNECTED | SECURE

Nicolas GANRY - Microchip France

ESCCON – 9th Mar 2023

Facing New Space Challenges

- **Microchip Aerospace & Defense in Europe**
- **New Space Challenges @semiconductors**
- **Microchip Scalable Solutions in Europe**

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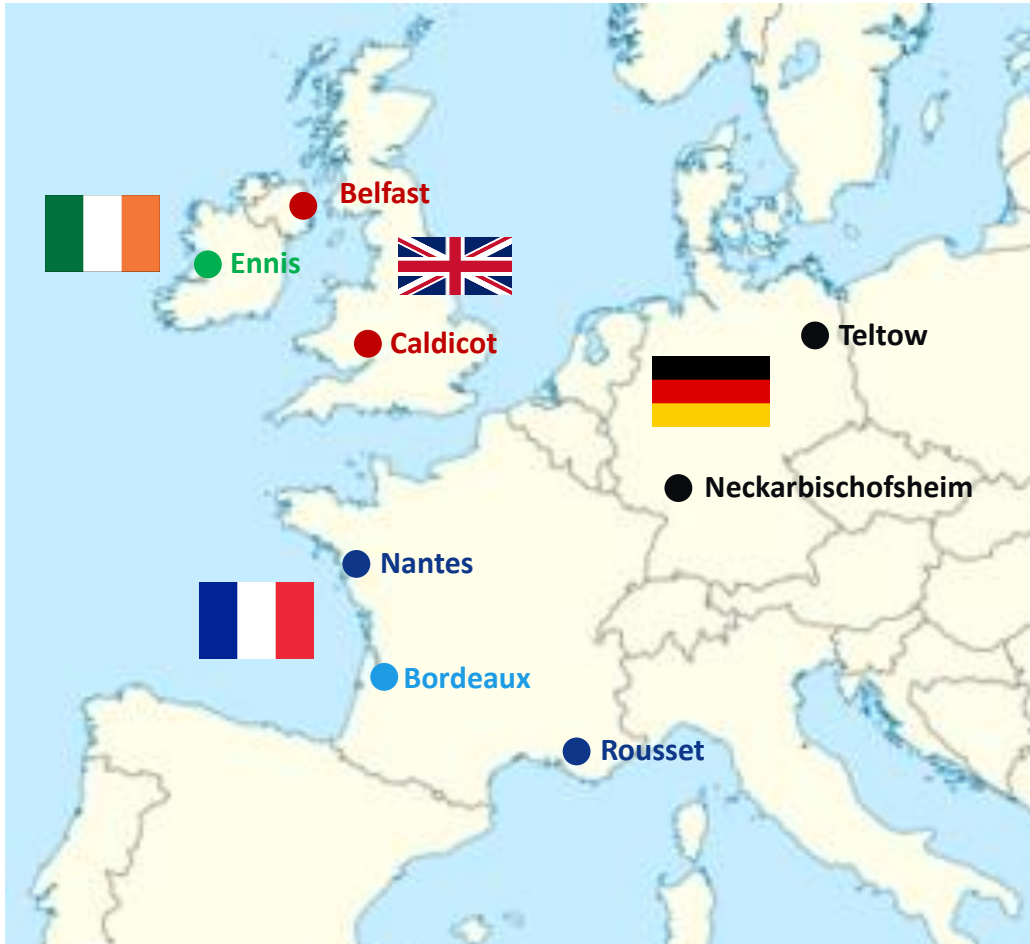
A&D Product Lines in Europe



Nantes, France



Rousset, France



- **Advanced Packaging UK**
 - ✓ Expertise in miniaturisation vs. size, power and reliability

- **ADG France**
 - ✓ Mixed Signal ASIC
 - ✓ Processors and Microcontrollers
 - ✓ Com interfaces and Memories

- **DPM France**
 - ✓ Power Modules

- **DPM Ireland**
 - ✓ Hi-Reliability Discrete
 - ✓ Power Modules

- **Vectron Germany**
 - ✓ Oscillators
 - ✓ RF SAW Filters



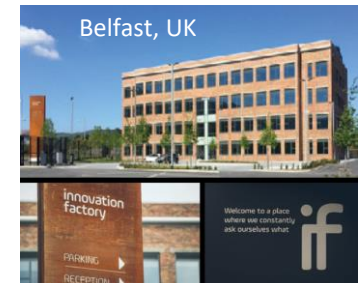
- **RF Microwave UK**
 - ✓ Amplifiers



Bordeaux, France



Ennis, Ireland



Belfast, UK



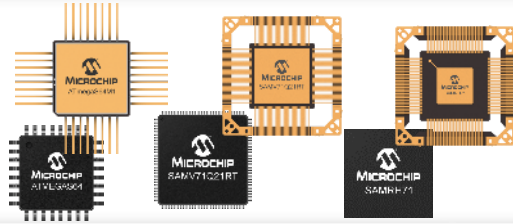
Teltow & Neckarbischofsheim, Germany



Largest Space Semiconductors Portfolio

MPUs and MCUs

8-bit AVR®
32-bit SPARC V8 and arm M3 & M7
GNSS SoC



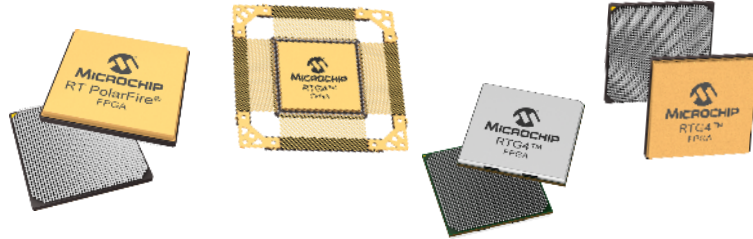
Communication Interface and memories

SpaceWire, Ethernet, CAN
SRAM
NVM memories



FPGAs

RT PolarFire®
RTG4™
RT ProASIC3®
RTAX™, RTSX-SU



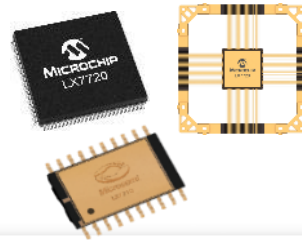
Power Solutions

Rad-hard JANS Diodes, Bi-Polar Small Signal Transistors
Rad-hard Isolated DC-DC Converter Modules
Custom Power Supplies 2 W to > 5 KW
Point of Load Hybrid Solutions
Electromechanical Relays



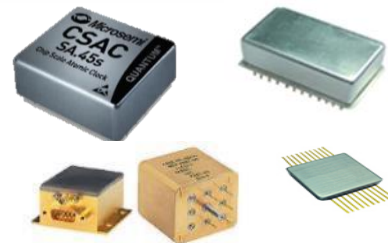
Mixed Signal Integrated Circuits

Telemetry and Motor Control Space System Managers
Power Supply protection



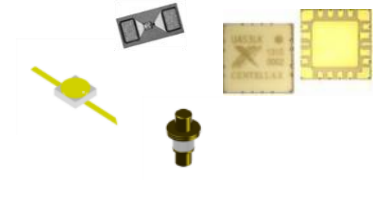
Timing solutions and Oscillators

Ovenized Quartz Oscillators
Hybrid Voltage Controlled and
Temperature Compensated Crystal Oscillators
Cesium Clocks
Chip Scale Atomic Clock (CSAC)



RF Products

Packaged and Chip Si and GaAs RF Diodes,
SAW filters,
Packaged and bare die GaN and GaAs MMICs
GaN on SiC HEMT transistors



Part of European Space Ecosystem

Our customers



Our partners



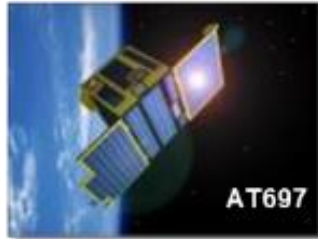
- More than 35 years history and unrivalled flight heritage
- Member of different ESA control boards and working groups
- Supported by local agencies CNES, DGA (FR), DLR (GER), UK Govt
- Contributing to European Commission funded programs
- ESCC / DLA Qualified Supply Chain in France, Ireland & Germany (target)



Processing : An Unrivalled Flight Heritage



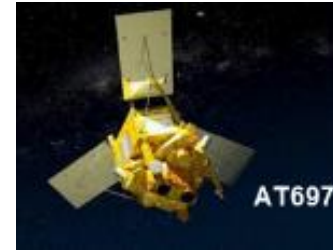
Colombus
2008



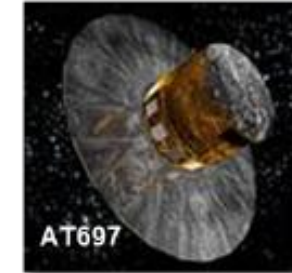
Proba2
2009



JUNO (Nasa)
2011



SPOT6
2012



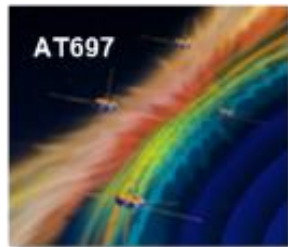
Gaia
2013



Sentinels &
Alphasat
2013



SVOM/Eclair
2013



MMS (Nasa)
2014



Exomars
2016



Solar Orbiter
2017



Bepi-Colombo
2018



Perseverance 2021



Mega Constellation
LEO Sat -2019

Thousands of flight models
delivered worldwide



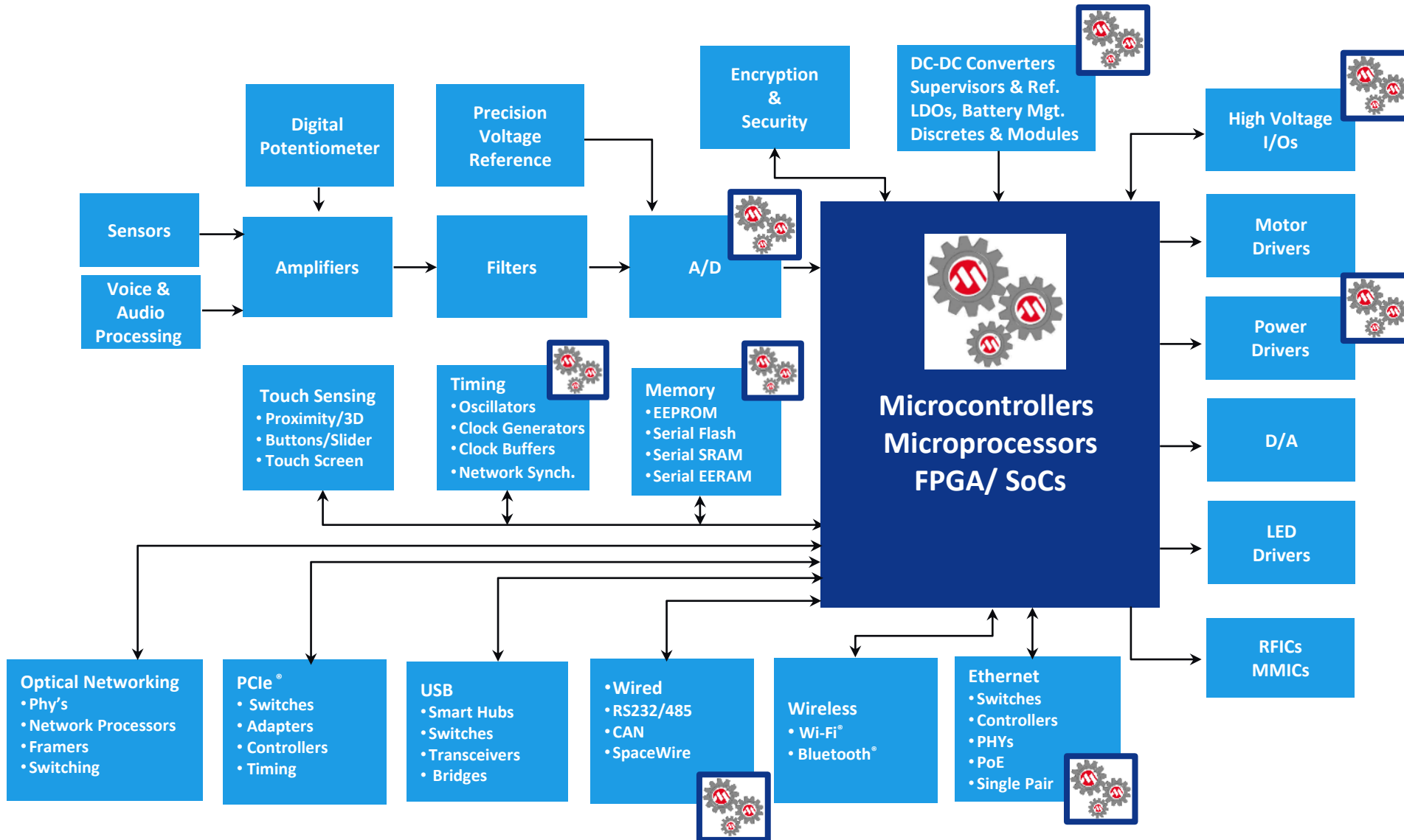
Capella Sequoia
Earth Obs 2020



ANGELS nanosat
2020



Drive innovation around processing solutions



Ethernet PHYs

Gbit/10Gbit

Switches 1588/TSN

PCIe solutions

Security devices

Flash/EEPROM

Power Modules

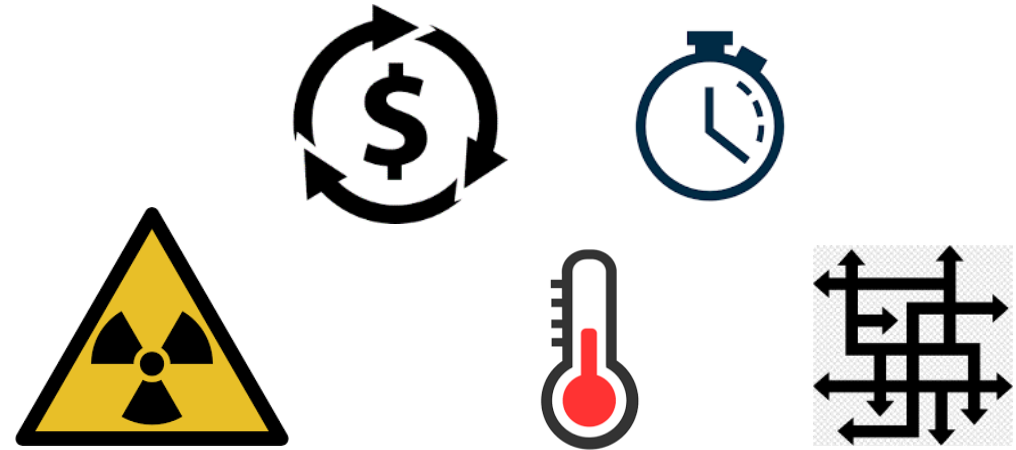
Clock Management

Facing New Space Challenges

- Microchip Aerospace & Defense in Europe
- **New Space Challenges @semiconductors**
- Microchip Scalable Solutions in Europe

New Space Challenges / Semiconductors

- **Cost reduction** (but still low volume)
 - Recurrent costs @component level (RE)
 - Development costs @system level (NRE)
- **Development lead time pull in**
 - Driven by a shorter time ROI
- **Performances & Quality leverage**
 - Depending on mission, duration, orbit but also risk management
- **New actors coming from industrial/automotive**
 - Looking for easy access solution with known technology (eg. Ethernet)
 - Bidding on different opportunities from class 1 space agencies program to mega LEO small sat constellations.
- **Semiconductors technology** driven by commercial with more advanced technologies & « System on Chip » => **more SEE events and higher access costs**



Space evolution w Microchip

Hirel Plastic * Rad Tolerant * Rad Hard

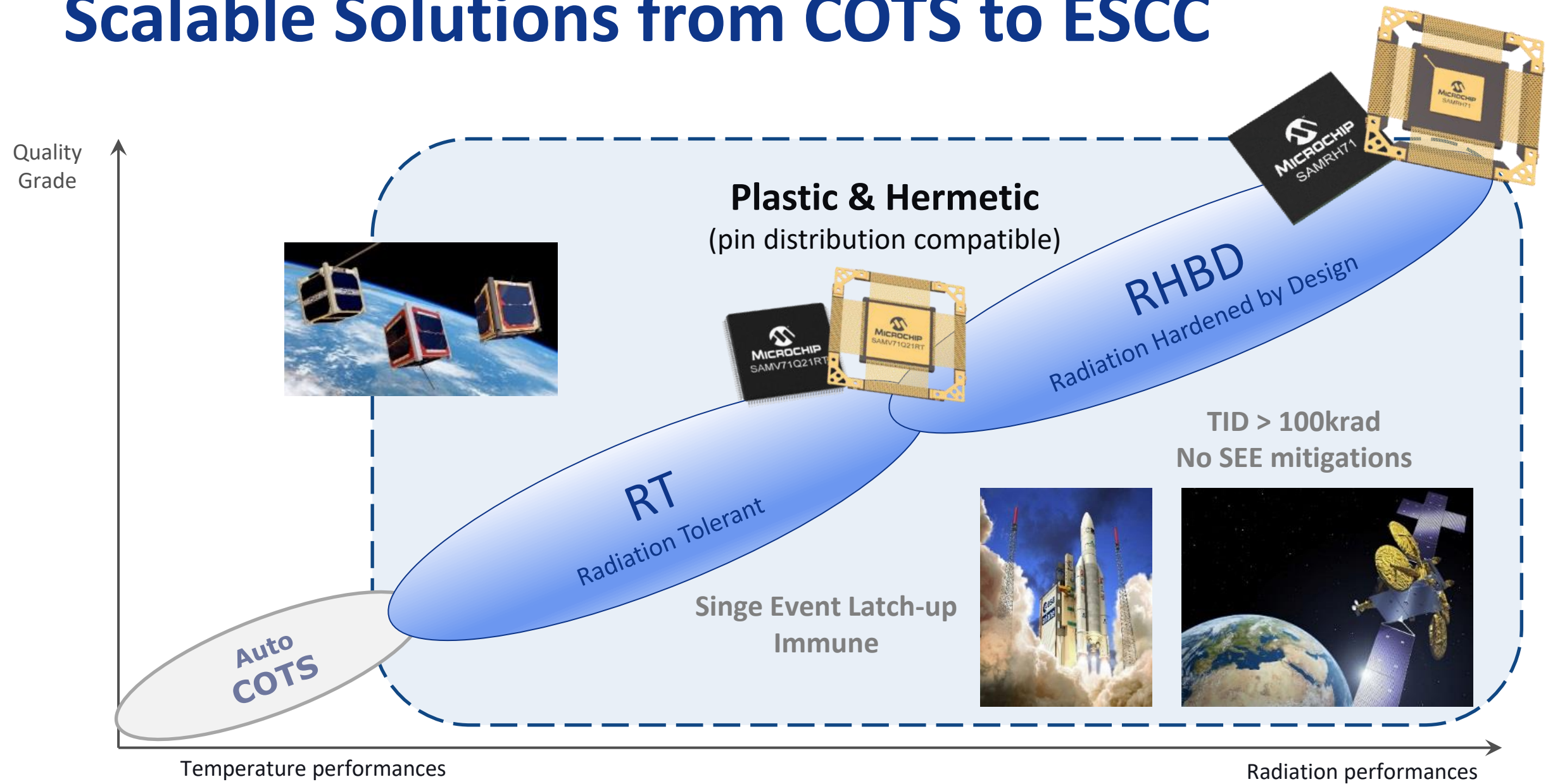


- **Commercial leadership**
 - Very high-volume COTS supplier
 - MCU & FPGA Market leader
 - Connectivity - Ethernet
 - Security
- **Leader in Space**
 - Number 1 for Semiconductors
 - Strong flight heritage
 - Radiation expertise
 - JANS/ QML/ ESCC portfolio
- **Customization capabilities**
 - Bridge from COTS to RT
 - Bridge from QML to Sub QML
 - Scalability

Facing New Space Challenges

- Microchip Aerospace & Defense in Europe
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- **Microchip Scalable Solutions in Europe**

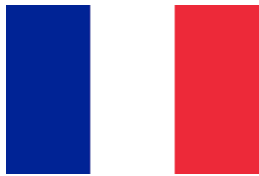
Scalable Solutions from COTS to ESCC



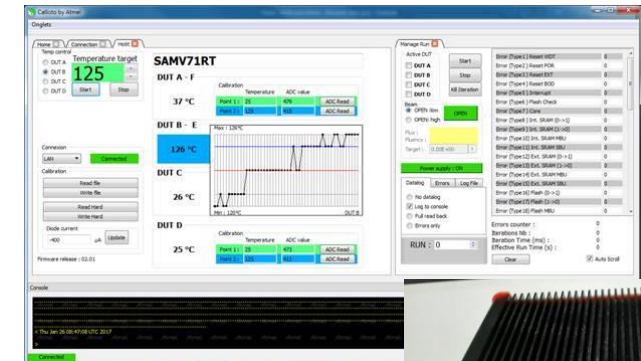
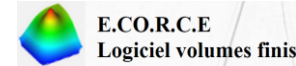
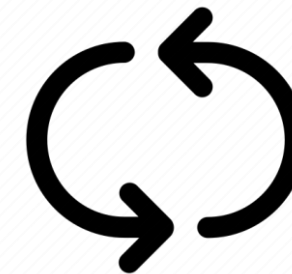
Hirel Plastic vs COTS Automotive

- Ensure **full traceability** : Single Fab & Assembly w Dedicated Wafers
- Access to « Single Lot Date Code »
- Extended temperature range -55/125°C*
- Low MOQ : hundred of units
- **Reliability** verified on the **full temperature range**
- Extended qualification : HAST, Life Tests, Temp Cycling ... => prod spec & CofC
- **Full access to Qualification Data** (Qual Pack)
- Extra screening options : burnin, T° cycling, ...
- **Extension towards QMLP – ESCC900P** standard qualification level

COTS to space qualified RT @Microchip



1. Identify industry needs, share roadmaps & input from other domains (eg. auto)
2. Select device in the Microchip's portfolio
 - Select the best Design/Technology couple. Based on our experience, we select potential winners.
3. Assess the device by simulation against SEE and TID using :
 - Based Technology information (Foundries)
 - And Design data base (GDSII)
4. Radiations Tests / defined boundary conditions
 - TID : To characterize the product capability
 - SEE : To evaluate destructive events
Single Event Latchup - Single Event Gate Rupture - Single Event Burnout
5. Product improvements towards RT level (process, fix, spec, ...)
6. Qualification for space applications including radiations (SEU & TID)
 - SEU : Characterization of all functional blocks of the device
 - Space qualification according to space standards / Ceramic & Plastic
7. RT datasheet, radiation report and mitigation guidelines
8. Introduce and support COTS RT on space market w a dedicated team
9. Products belongs to French Export Control when all activities done in France



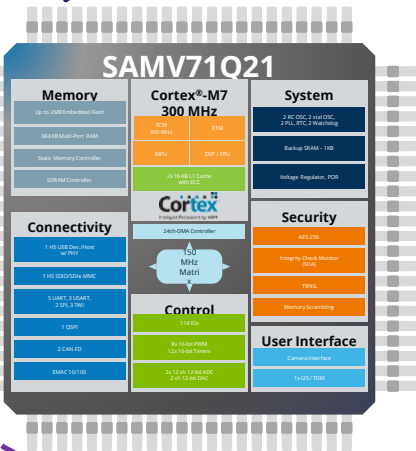
Arm® M7 SoC => COTS to RHBD

Unique Scalable Solution

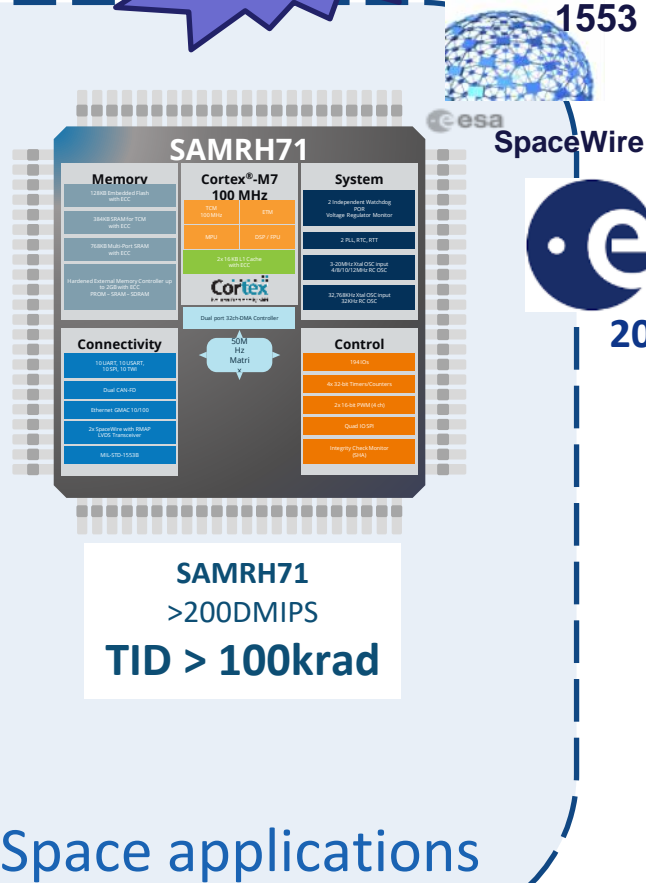
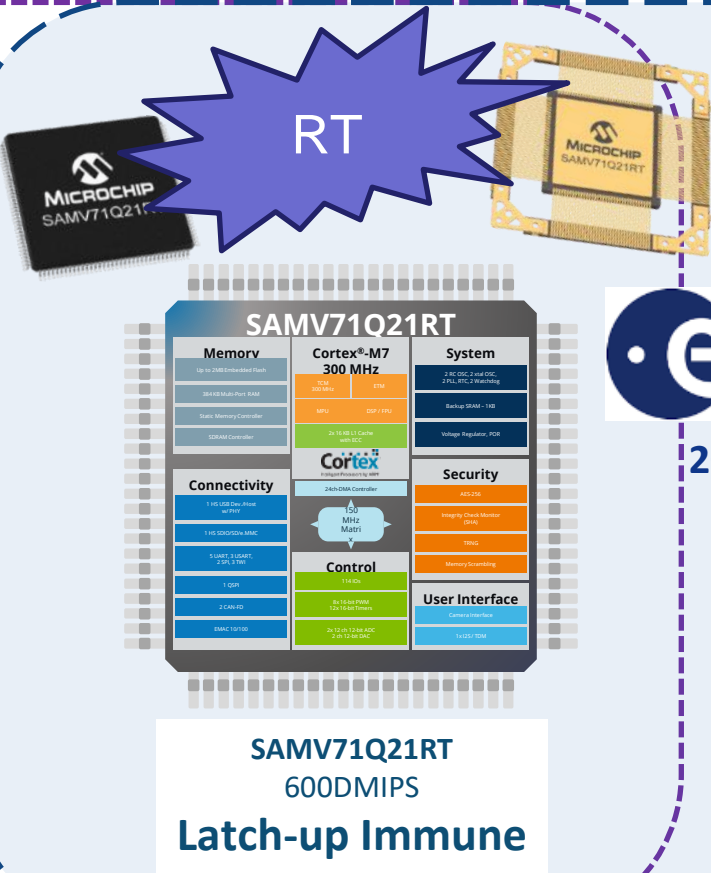
Qualification Level

Other aerospace applications

Auto COTS



Temperature performances

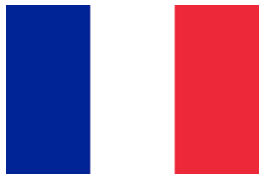


Space applications

Radiations performances

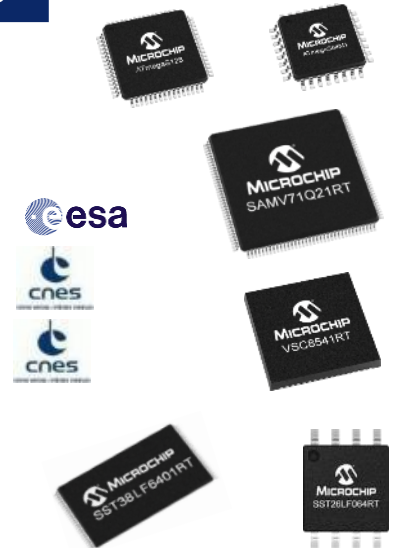


Scalable & Plastic solutions from ADG



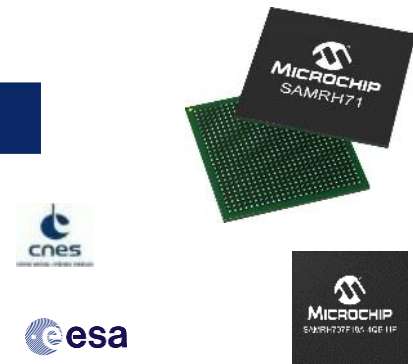
• COTS Rad Tolerant

Products	Type	Summary / Highlights	Flight Models
ATmegaS128	MCU AVR8	~10 DMIPS, SPI,TWI, UART, ADC	Feb 2017
ATmegaS64M1	MCU AVR8	~10 DMIPS, CAN, DAC and Motor Control	Dec 2017
SAMV71Q21RT	MCU ARM M7	600 DMIPS, CAN FD, Ethernet TSN, DSP	Dec 2018
SAM3X8ERT	MCU ARM M3	100 DMIPS, CAN, Ethernet, Dual CAN	Apr 2020
VSC8541RT	Ethernet PHY	100Mb/1Gbit Ethernet Transceiver, RMII/RGMII	Sep 2020
SST38LF6401RT	Parallel Flash	64 Mbit Parallel Rad Tolerant Flash Memory	Oct 2021
SST26LF064RT	Serial Flash	64 Mbit Serial Rad Tolerant Flash Memory	Nov 2022



• Rad Hard by Design

Products	RH Techno	Summary / Highlights	Flight Models
SAMRH71 MPU	ATMX150RHA	Arm Cortex-M7, >200 DMIPS Spw/1553/CAN FD/Eth, TCM/FPU/MPU/ECC	Dec 2020 ESCC9512006
SAMRH707 MCU "Jaguar"	ATMX150RHA	Arm Cortex-M7, 100 DMIPS Spw/1553/CAN FD, ADC/DAC, NVM+, small package	FM Q2 2023



MCHP “L” Series Oscillators



- **Address unique “4R” requirements**
 - Radiation – 50krad and below, SEE 60 MeV-cm²/mg and below
 - Reliability – Commercial to military assembly and screening
 - Rating – Commercial or military grade components
 - Ruggedization – Design and construction to survive launch and mission profile
- **Oscillators Families**
 - LX-703 – XO, X-tal Oscillator (Clock)
 - LT-400 – TCXO Temperature Compensated X-tal Oscillator
 - LT-802 – TCXO Temperature Compensated X-tal Oscillator
 - LO-200 – OCXO Oven Controlled X-tal Oscillator
 - LM-010 – PPS Module
- **All oscillators radiation tested as a complete, functioning oscillator for TID**



Discretes : Microchip New Space (MNS) Flow

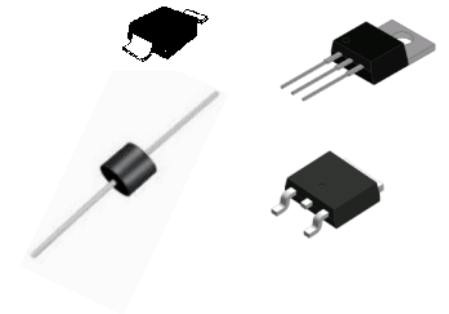
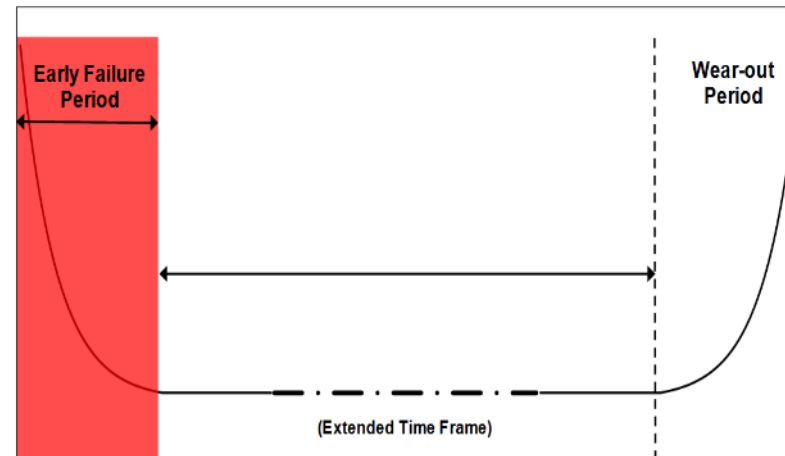


- **Objective**

- Create versions diodes and transistors that can meet aggressive price targets to serve New Space programs that will not use traditional JANS and JANTXV devices

- **Requirements**

- Reduction in cost and price
- Shorter lead-time and cycle-time



Screening removes early-period failures while ensuring performance over desired temperature range using production test vectors

- **Microchip Discrete Solutions**

- Microchip New Space (MNS) Flow – Hermetic and non-hermetic options
 - Hermetic – MNS flow -> Military Temperature Screening, PIND, Group A and D
 - Non-Hermetic / Plastic – MNS flow -> Military Temperature Screening, Group A and D

Time is the Essence of New Space

Reducing development costs leads to reduce development cycles

Microchip proposes « **System Use Cases** » to boost your development lead times & ease your system design:

- Suggesting a list of Microchip components working together
- Providing hardware example associating some Microchip components
- Developing software examples to interact with one or more Microchip components
- Demonstrating application use cases at system level
- Offering application notes, tools and presentations to ease customer system integration with Microchip components

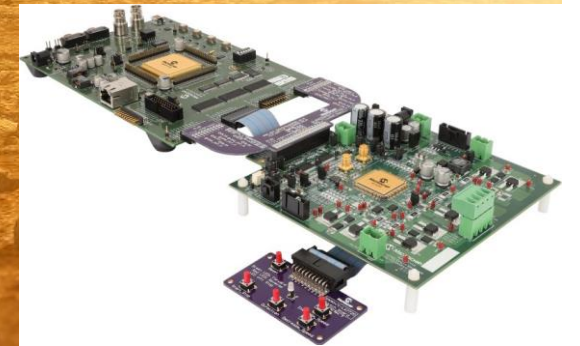
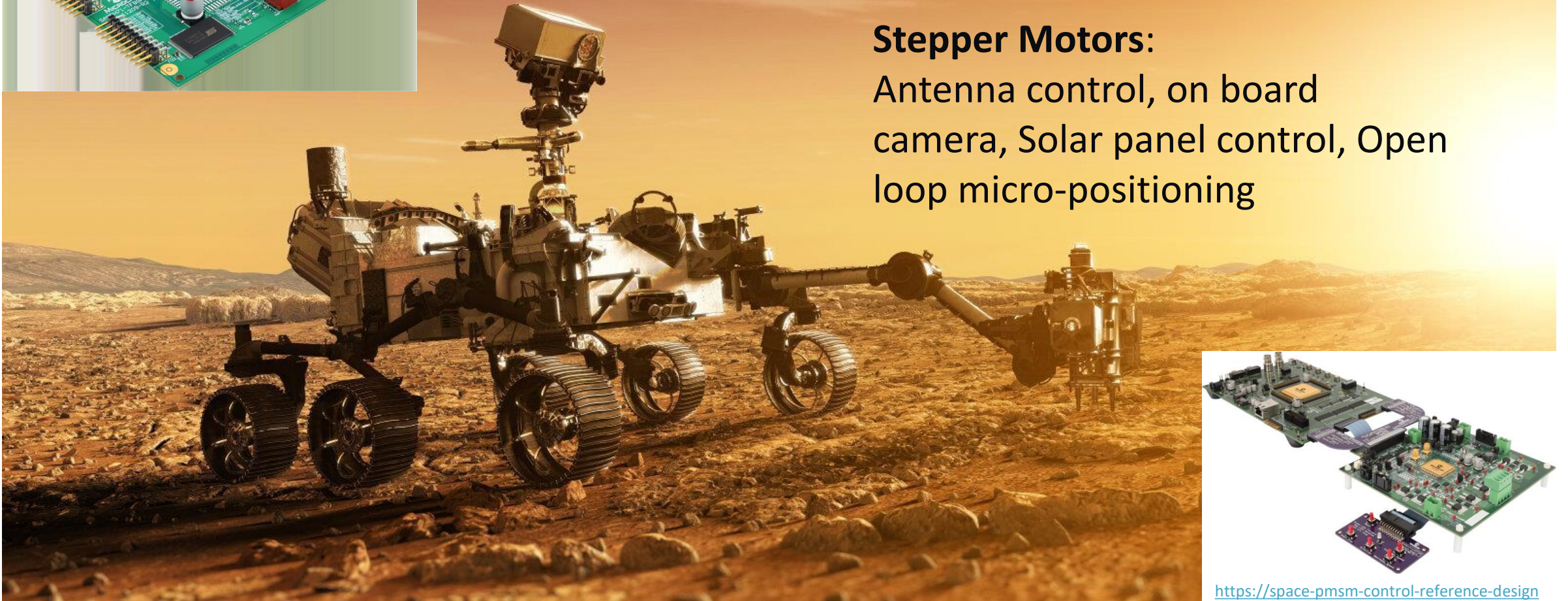


Motor Control in Space



Brushless DC Motors (BLDC - PMSM):
Solar panel control, Valve control

Stepper Motors:
Antenna control, on board camera, Solar panel control, Open loop micro-positioning



<https://space-pmsm-control-reference-design>

Summary – New Space Challenges

- **Microchip A&D product lines in Europe**
 - Contributing to largest space products portfolio
 - Drive space system innovation around processing solutions
- **New Space Challenges / Semiconductors**
 - Costs, Schedules, ROI, New players, Technology trend, ...
- **Scalable Solutions for New Space in Europe**
 - COTS upgrade to qualified plastic & ceramic for space
 - Solutions from Europe : MCU/MPU, Ethernet, Flash, Oscillators & discretes.
 - System use cases to reduce development lead times



Thank You

[New Space Web](#)

nicolas.ganry@microchip.com

