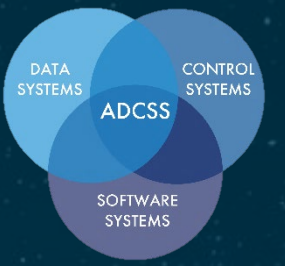


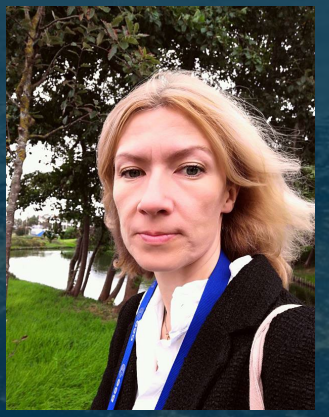
16th ESA Workshop on Avionics, Data, Control and Software Systems - ADCSS 2022
Welcome & Logistics

Ali Zadeh Head of Data Systems, Microelectronics and Component Technology Division
Benedicte Girouart Head of GNC, AOCS and Pointing Division
Joachim Fuchs Head of Software System Division
Maris Tali, Alberto Urbón, Tomasz Szewczyk
ESA ESTEC – 25 October 2022
Ref: ESA-TECED-HO-2022-003293

Organisation Team

DATA SYSTEMS CONTROL SYSTEMS SOFTWARE SYSTEMS

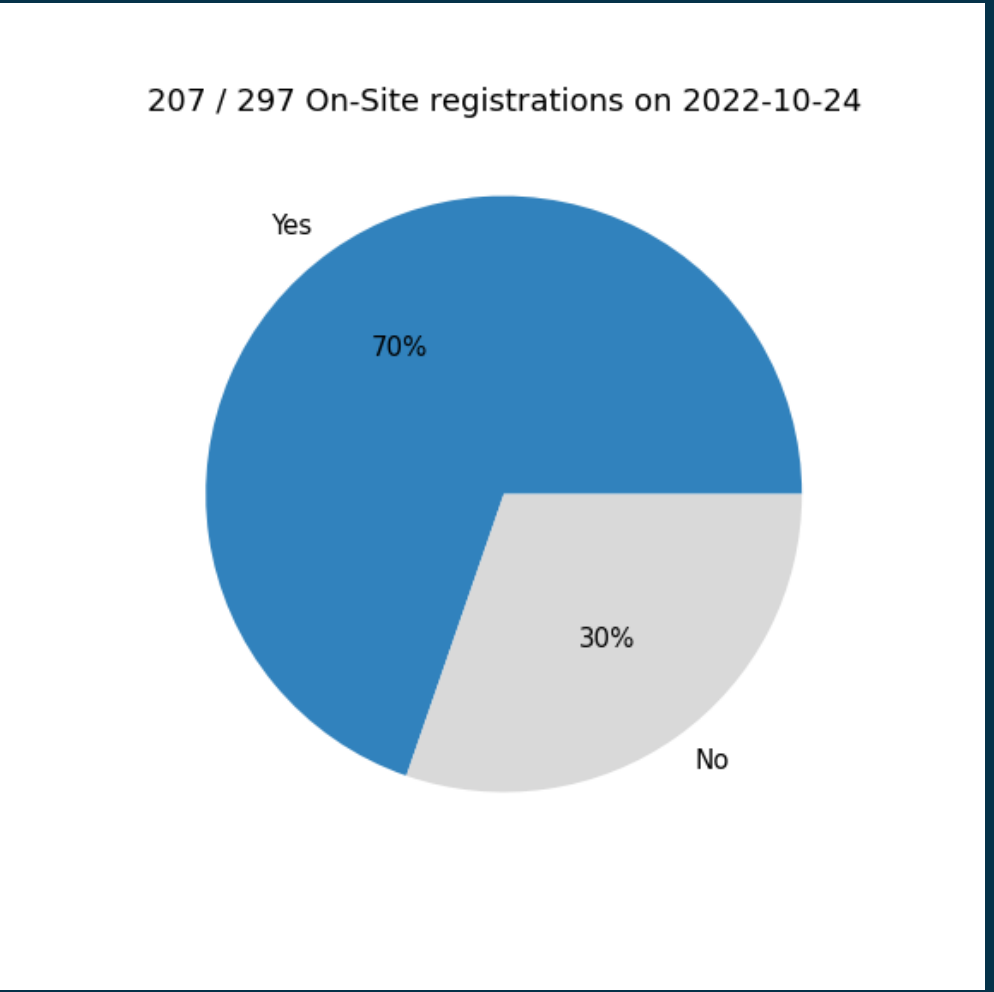
esa

Maris Tali	Alberto Urbón	Milena Van Schendel	Tomasz Szewczyk	Kathleen Gerlo
				

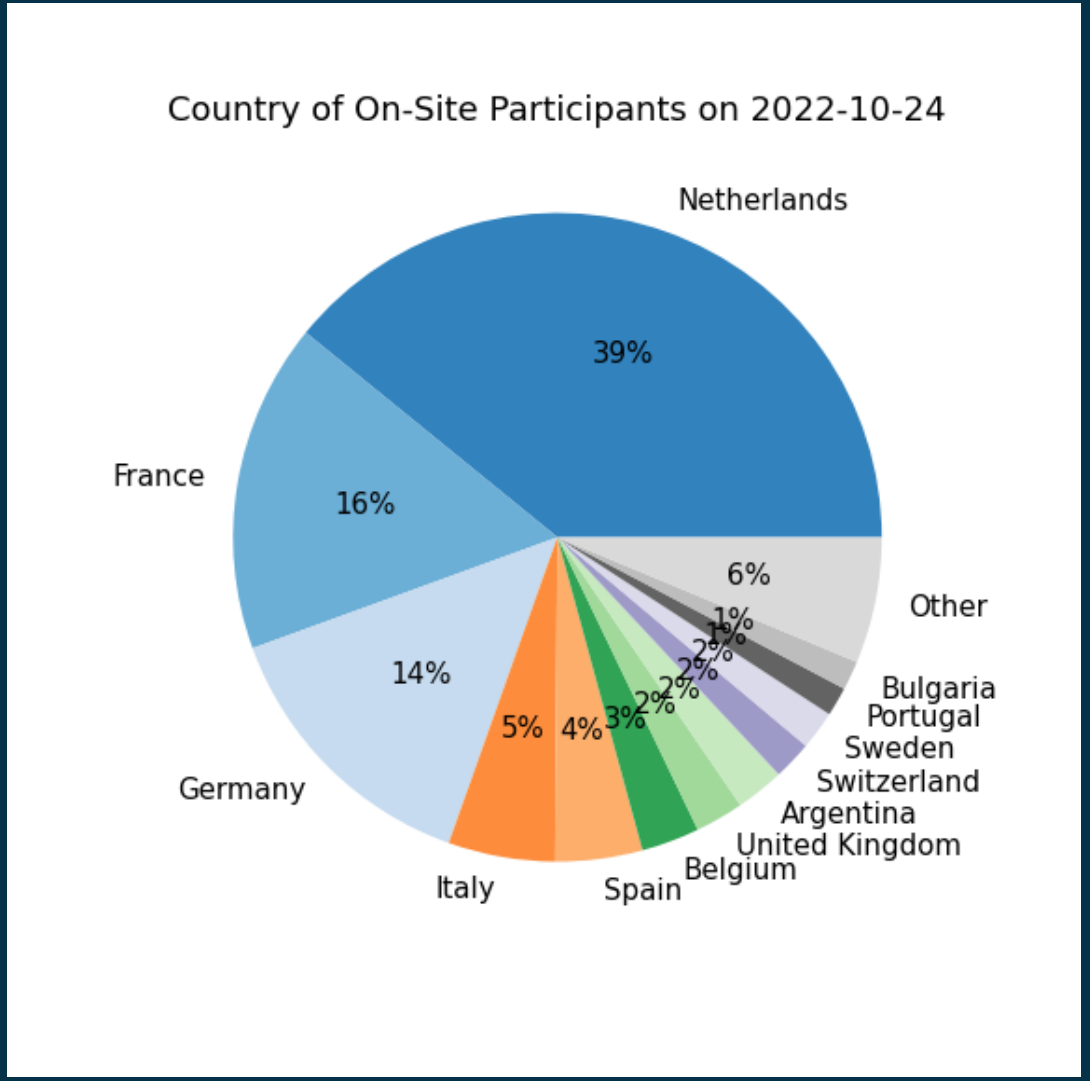
- Questions?
- Last version of slides or issues with Indico, wifi
- Please don’t hesitate to contact us!

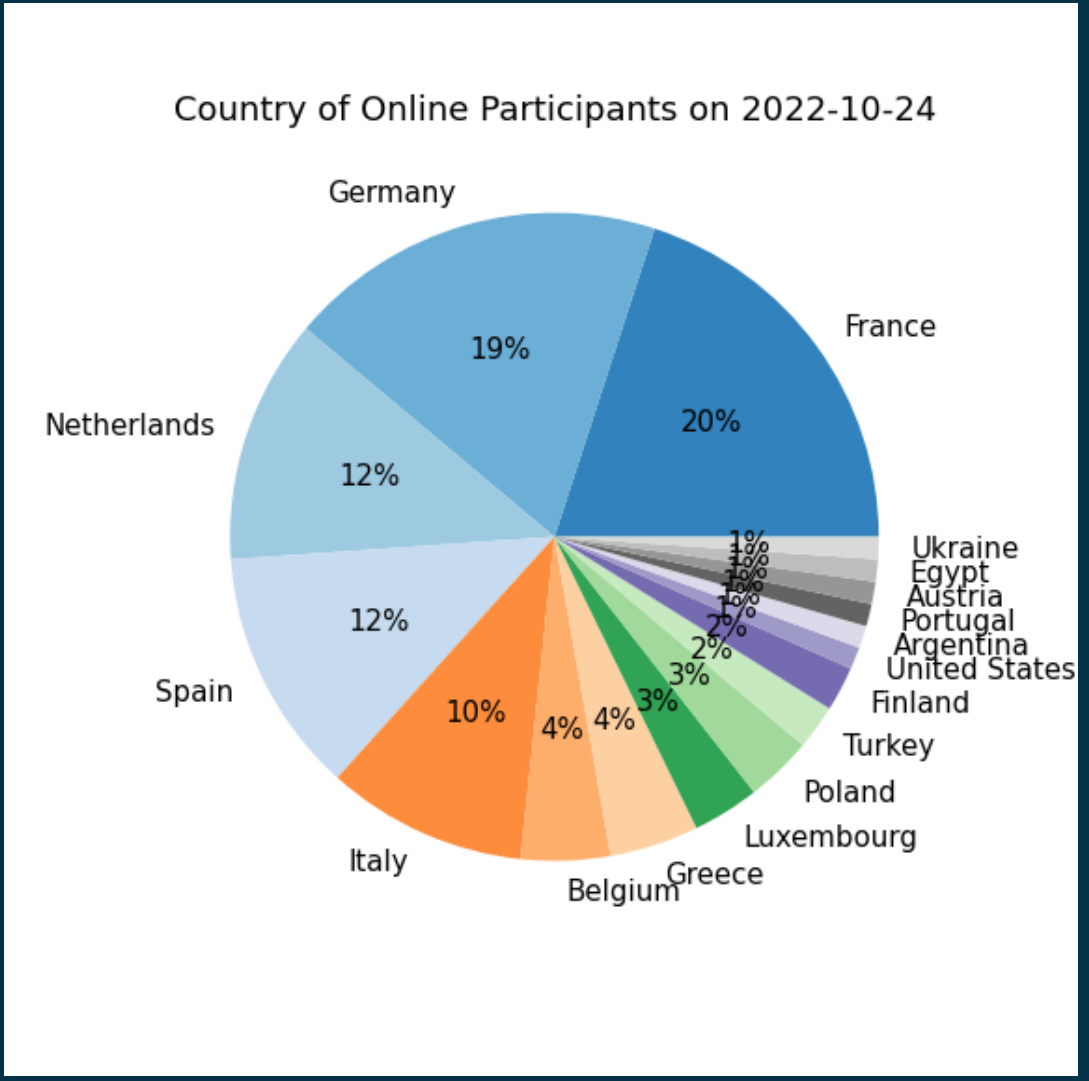
Registrations Statistics

Total number of participants **297**, Onsite **209**, Non-ESA **148**

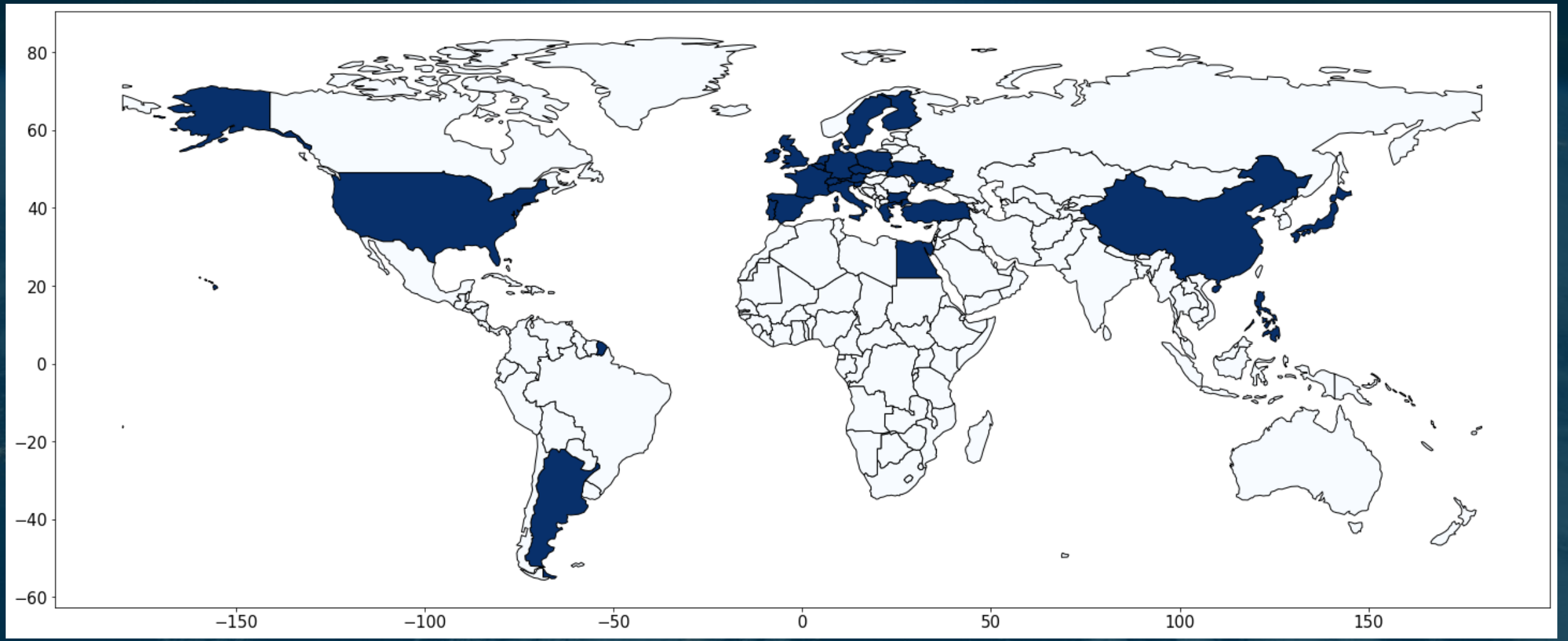


Participants Countries Statistics





Registrations Statistics

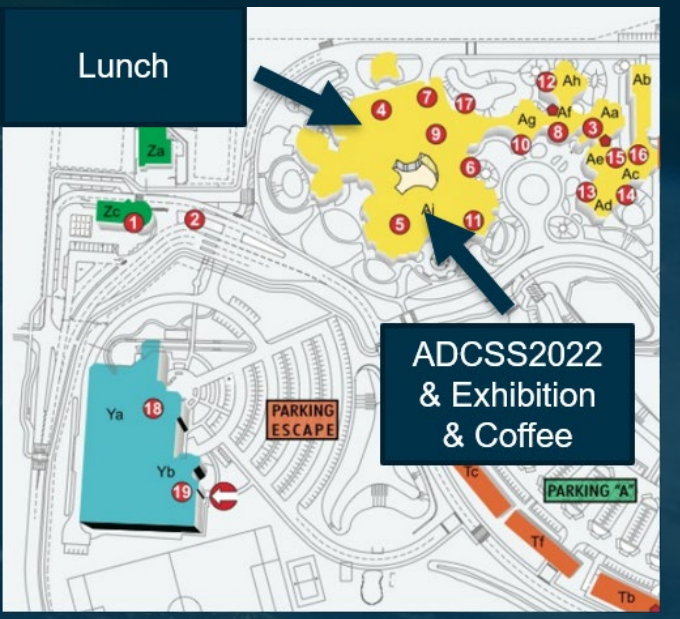


Industrial Exhibition

Location – Outside Newton

Opportunities for Networking:

- Day 1 17:20 - 19:00 – Flash Presentations and Welcome Drink
- Day 2 12:30 - 13:00 – Exhibition & Networking
- Coffee Breaks



Companies:

CAES PIONEERING ADVANCED ELECTRONICS

MICROCHIP

3plusD a HEICO Company

NanoXplore

MathWorks®

InnaLabs®

Welcome and Overview

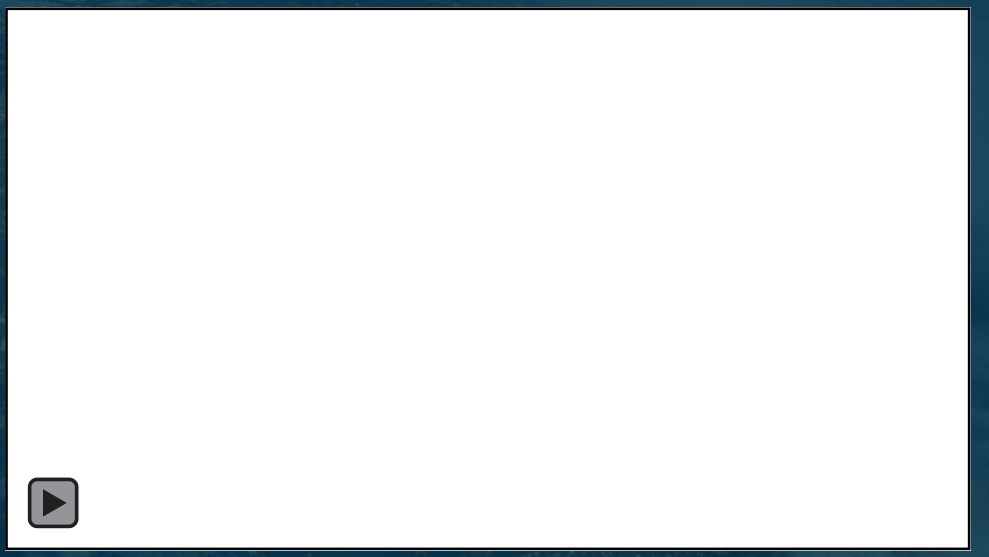
- **Day 1 – SAVOIR (to be detailed by Jean-Loup Terraillon)**
  - **Industrial Exhibition Flash Presentations**
    - 17:20 – 17:50 | Newton
  - **Welcome Drink**
    - 17:50 – 19:00 | Outside Newton

- **Day 2 – Technical Sessions**
  - On-board processing, co-processing and SW
  - GNC – New generation of inertial sensors

- **Day 3 – Technical Sessions**
  - Processor architectures & SW supporting multi core
  - Functional verification
    - Round Table

Data Handling and Microelectronics

- Future fleet of ESA spacecraft, in particular Earth Observation missions, move towards greater use of platform commonalties
- Lessons learned from the High Priority Copernicus missions showed the way forward
- Large efforts in coordination with industry, ESA programmes and national agencies resulted in the initiation of the Advance Data Handling Architecture (ADHA)
- ADHA is quickly gaining traction and on track based on original development plans.
- New European high-value complex devices (Microprocessors, FPGAs, etc.) enables advanced applications such as ADHA and others



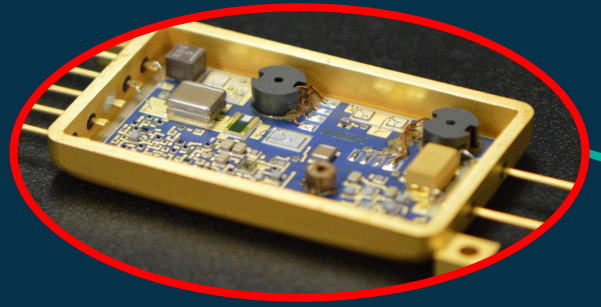
Animation of Sentinel-1 operation

EEE Space Component Sovereignty for Europe

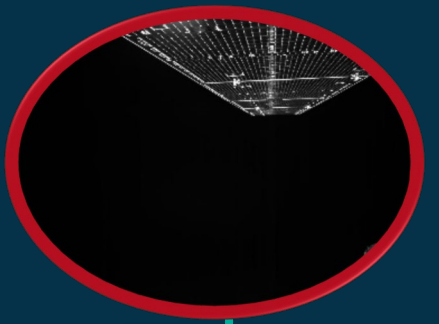
- → Establishing a long-term sustainable and uninterrupted access of state-of-the-art technologies to ESA programmes through long term partnership with European Supply-Chains.
- → Enabling European competitiveness, by ensuring that the right technology, at the right maturity level is available at the right time unhindered by (export) restrictions.
- → Fostering long-term industrial partnerships with strategic EEE-manufacturers allowing continuous access of relevant EEE Components.
- → Pursuing a tight-knit collaborative framework mechanism with supply-chain, end users, national MS activities and EC/EDA with flexible development up to qualification, adopting E2E secured funding to achieve time-to-market.
- → Smart verification and qualification approach including flight on IOD/IOV as part of process acceleration (time-to-market)
- → Optional Activity as a GSTP Component

Key Technology Lines

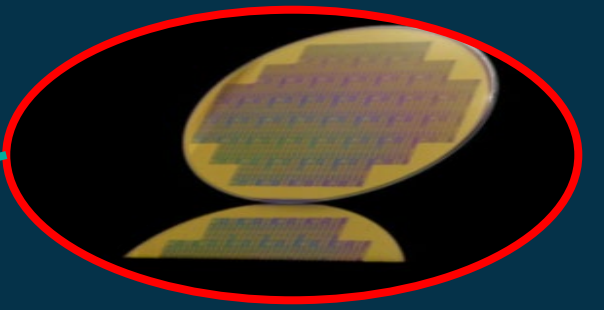
Packaging and Hybrids,
PCB, Electronic assembly

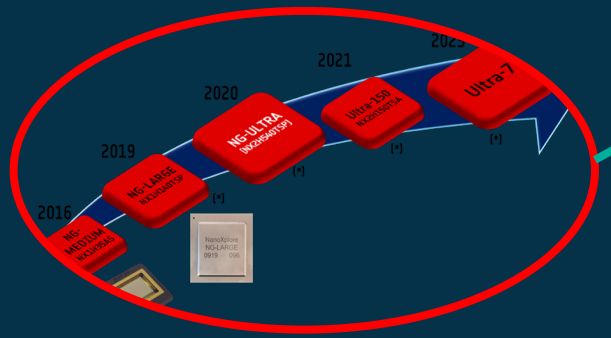


Solar Cells



Wide Band Gap: GaN/SiC
Microwave/Power





(Ultra)Deep Sub Micron

Photonics

On-board processing and co-processing – Day 2

- *The Astral Intelligence Toolbox – A Framework for Assured On-board Data Solutions (*Craft Prospect Ltd.)
  - An InCubed activity to drive requirement and design of AITB with final view for provision of a modular and rapidly-configurable frame work closing the gap between user needs and on-board data processing outputs.
- *A novel multithreading approach to high performance artificial intelligence on-board* (Klepsydra Technologies)
  - Provision of a novel data processing approach based on algorithm pipelining for improved efficiency and reliability.
- *Deterministic COTS based OBC for high performance and mixed criticality applications (*Evoleo Technologies)
  - ADAH compliant high-performance dual lane OBC based on a marriage of COTS and Rad-Tolerant devices.
- *Flash-based Mass Memories for space, flight heritage, perspective for the next generation and ADS Electronics roadmap (*ADS)
  - With the advent of more sophisticated and demanding payloads, the presentation discusses SSMM challenges and how these are met with future technologies.
- *High Data Rate Interface Solutions for Earth Observation Payload Data Handling* (TESAT)
  - To avoid downlink bottlenecks, state-of-he-art communication solutions are presented both for RF and laser based.
- Innovations in electrical interfaces for visible imaging sensors to support future big data and high-speed missions (Teledyne)
  - High data throughput CMOS sensors require high-performance Gbits/s interfaces presented here

Processor architectures & SW supporting multi core – Day 3

- *Vision for Spaceflight Computing* (NASA)
  - NASA presents its High Performance Spacecraft Computing project utilising multi-core processors
- *GR740, GR765 and GR7xV: SPARC V8 and RISC-V for On-Board Computing* (Cobham Gaisler)
  - State-of-the-art current and next generation microprocessors based on SPARC and RISC-V are presented
- *Space Processing solutions from Microchip ARM & RISC-V* (Microchip)
  - High-complexity high-performance Microchip devices also utilising RISC-V are described in this presentation.
- *Linux goes to space in Ultra7* (NanoXplore)
  - The European BRAVE family of FPGAs look towards the 7nm technology addressing Linux to support space applications
- *NG-Ultra, the European rad-hard multicore ARM system-on-chip + FPGA suitable for future space applications* (ADS)
  - A European BRAVE FPGA end-user view of NG-Ultra utilisation in future applications
- *HW/SW experience with Integrated OBC featuring MultiCore SoC* (TAS)
  - An Prime's experience with utilisation of multi-core microprocessors, various ISAs and future perspective
- *Introduction of a Space Grade Micro Processing Unit for Future Space Applications* (JAXA)
  - JAXA next generation dual core MPU including and OS suitable for multi-core processors

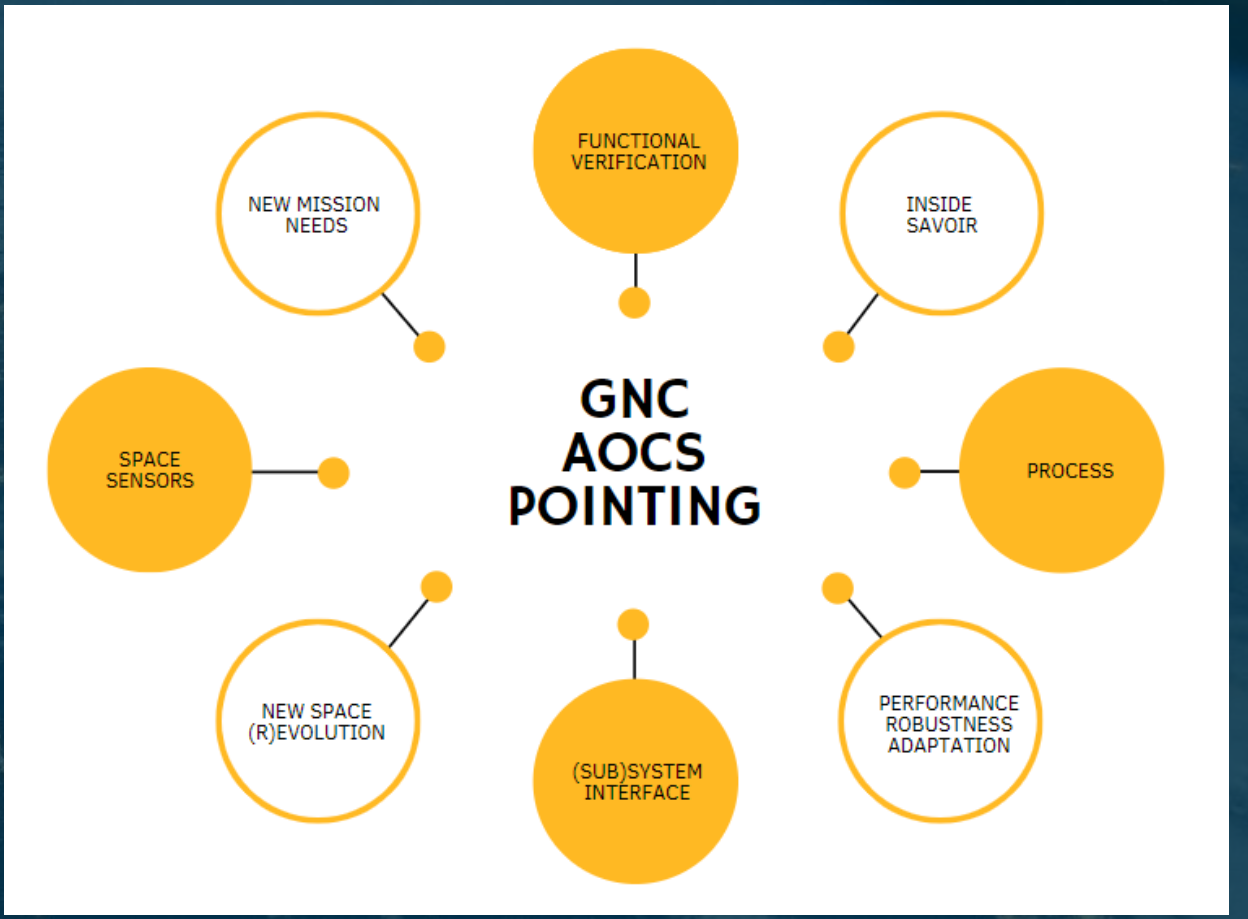
Control Systems

Presentation by Benedicte Girouart

TEC-SA – GNC, AOCS and Pointing Division

GNC, AOCS and Pointing

. **New Mission Needs**
  . Higher performance / accuracy
  . Missionisation / Adaptation
  . Autonomy / Robustness / Re-usability
. **New Space sector** / cost-driven development
. **Non deterministic algorithms**, e.g. AI-based
. **Process (R)evolution**
  . Model based Engineering
  . Digitalisation
  . Verification & Mission classes



Guidance Navigation & Control (GNC) - New generation of inertial sensors - Day 2 PM

- State of the art inertial sensors & Inertial Measurement Units (IMUs)
- Innovation by: miniaturization, New Space (NS) development, performance improvement
- Main objective: to reduce equipment SWaP and cost, push the boundary of performance
  - Astrix NS : The new, space-qualified, compact gyroscope and IMU of the Astrix family (iXblue)

In 2023, iXblue will release the space-qualified Astrix NS. iXblue will show the latest results of the Astrix NS including inertial performances and verification of the main environments as vacuum, thermal cycling and shock/vibrations.

  - SiREUS GM20, A Cost Competitive Gyro Solution for XEO (Thales Alenia Space Ltd)

The SiREUS GM20 is a MEMS-based, cost-effective, coarse-to-medium performance three-axis gyro for missions of ten-or-more years in adverse radiation environments including MEO/GEO, with rate detectors controlled by a dedicated microcontroller.

  - Astrix 200+ : Introducing a new development to push the known boundaries of Gyros performances (Airbus D&S)

The Astrix 200+ will be the new member of the Astrix family, breaking through the current model limitations to reach highest performance.

  - Miniaturized high performance MEMS accelerometer (Safran Colibrys)

Safran STS develop a closed-loop MEMS accelerometer to meet the requirements of a rad-hard accelerometer for incorporation in a low-resource standalone three-axis MEMS accelerometer or Inertial Measurement Unit for Space vehicles.

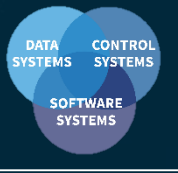
  - NAVIGA, a modular space navigation unit for space transportation systems (Sener)

NAVIGA is a European navigation unit, fulfilling performance needs and recurrent cost for the VEGA Space Transportation System (VSTS), with a flexible architecture adaptable to other environments and space transportation missions

  - Arietis-NS: Preliminary qualification results of an innovative 3-Axis Space Rad-Tolerant Gyro (Innalabs)

ARIETIS-NS is a Rad-Tolerant, space qualified 3-axis gyro. Using mostly commercial EEE upscreened components, ARIETIS-NS is based on Innalabs proprietary Coriolis Vibratory Gyroscope (CVG) technology largely used in terrestrial commercial products.

Software Systems



SW methods and technologies change on the “classical” development approaches, e.g.

- More integrated HW/SW interaction (re-programmable HW, …)
- Artificial Intelligence
- Autocoding
- Agile and lean processes

Impact on the approach to functional verification

- Potential re-focus on the final product verification
- Process improvements to advance more verification elements
- Further standardisation of verification means

→ Exchange of views on FV on Day 3

Presenter Instructions

1. Register at the Conference

Register to both Indico and the ADCSS2022 and log in to Indico

2. Navigate to My contributions

My Conference -> My contributions can be found in the main menu

3. Choose The Contribution to Edit

Click on the Contribution you would like to Edit. You can only see contributions where you are the presenter.

4. Upload the Presentation

You can upload either a Powerpoint or a PDF file, you can edit your contribution as many times as you like.

Upcoming Events

- **22-23 November 2022 ESTEC ADHA 2022 Workshop (Advanced Data Handling Architecture)**
  https://indico.esa.int/event/427/

- **30 Nov - 01 Dec 2022 ESTEC TEC-ED & TEC-SW Final Presentation Days - Autumn 2022**
  https://indico.esa.int/event/405/

- **13-14 December GR740 User Day and RISC-V in Space Day**
  https://indico.esa.int/event/431/

- **12 Jun - 16 Jun 2023 ESA GNC & ICATT conference (Sopot, Poland)**