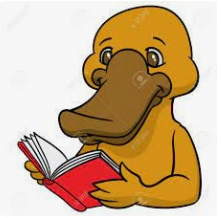
CTB: now and then

Jean-Louis Cazaux, CTB Chairman

What is the CTB?



- **CTB: Component Technology Board**

- An ESCC body, subordinate to the SCSB *(Space Components Steering Board)*, along with PSWG *(Policy & Standard Working Group)* and MPTB *(Materials & Processes Technology Board)*

- (New) CTB created in **2002** according to ESCC Charter 00000, Defined by ESCC 10400
  - *The CTB is charged with **the formulation of strategic programmes and work plans for technology research and development** in the area of **European EEE space components**.*
  - *It **harmonises** the collectively funded component research, development, evaluation, qualification, standardisation and quality assurance activities.*

Membership

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Components Technology Board

1) Space Agencies:

esa
cnes
DLR
European Commission
agenzia spaziale italiana
UK SPACE AGENCY

2) Equipement Manufacturers:

ASD-EUROSPACE
The Space group in ASD
ThalesAlenia Space
a Thales / Leonardo company
AIRBUS
DEFENCE AND SPACE
OHB
beyond gravity
ALTER TECHNOLOGY

3) Component Suppliers:

life.augmented
MICROCHIP
UMS
United Monolithic Semiconductors
infineon
Radiall
TELEDYNE e2v
Everywhereyoulook
3plusD
a HEICO Company
ISABELLENHÜTTE

+ Observers:

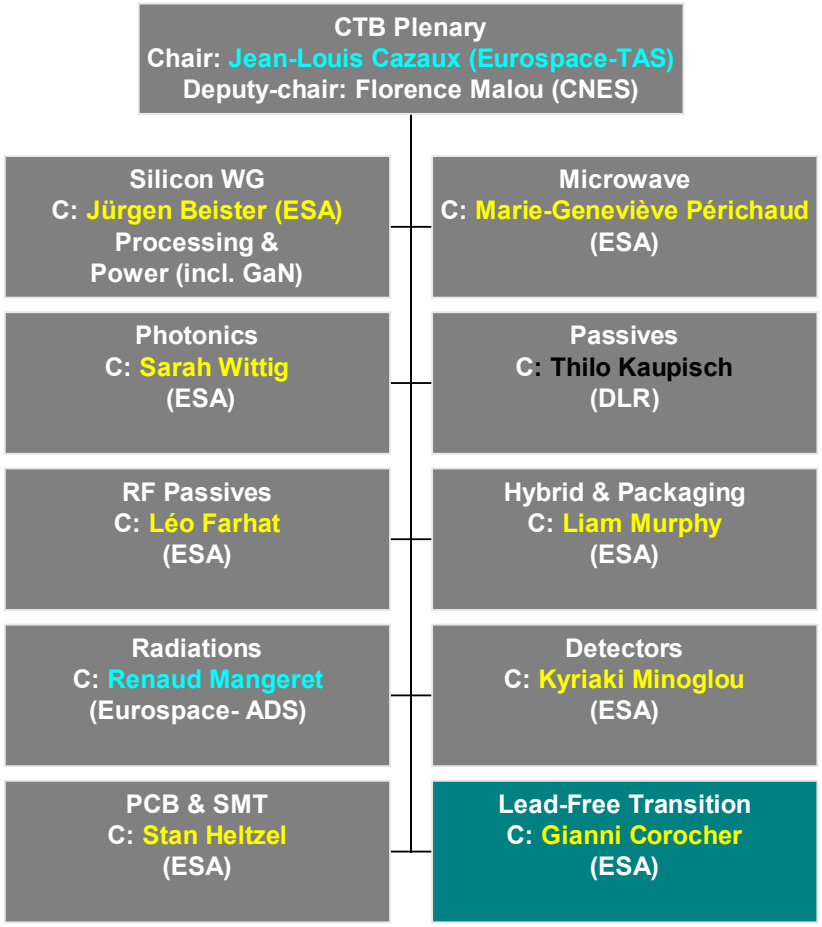
imec
EUROPEAN DEFENCE AGENCY

Internal Organization

9 permanent thematic Working Groups (WG) reporting to the "CTB Plenary"

+ Lead-Free Transition Working Group reporting to CTB and MPTB

In total, and as for today, CTB WGs involve about **250** individuals from **80** different organizations



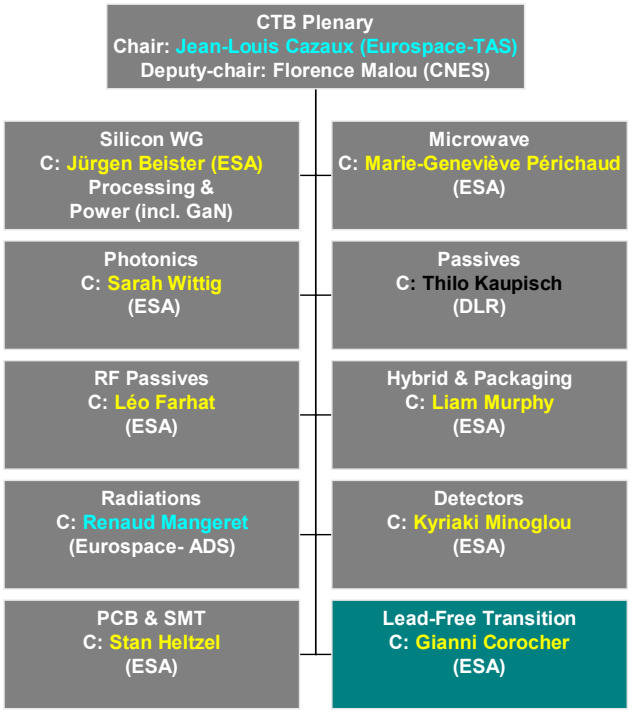
Voice of the WGs

Verbatim and messages from:

- Photonic WG
- Detectors WG
- Radiation WG
- Silicon WG
- Passive and RF Passive WGs
- Hybrid & Packaging WG

See also dedicated presentations at this ESCCON2023:

- Lead-Free Transistion WG
- PCB/SMT WG



Photonics WG-1

- Major on-going actions / programs
  - Exchange on running R&D activities
  - Consolidating photonics topics to address via EEE Sovereignty Initiative
  - ESA Technology Harmonisation: Photonics, LIDARs, Optical Comms, Time and Frequency
- What is at stake
  - **Photonics can offer improved performances (e.g. higher datarates) as well as 'unlock' completely new possibilities (e.g. gravity wave detection, quantum communications)**
- Current difficulties
  - Photonics are increasingly used in space payloads, but rely heavily on COTS
    - Dynamic and rapidly evolving domain driven by terrestrial telecom applications
    - Only few parts developed specifically for space
- Successes to be enlighted…

Photonics WG-2

- Challenges for next and coming years
  - To meet the demand for photonic components in space applications; notably including
    - Laser communications terminals for constellations using inter-satellite optical communications
    - High datarate transceivers for intra-satellite communications
    - Not to neglect the low-volume custom parts fundamental to many instruments performance (e.g. custom wavelength calibration sources for EO instruments, fast and low jitter APDs for quantum communications…)
  - How to ensure reliable operation of photonics considering;
    - Constantly evolving landscape of supply chain, not driven by space needs
    - Very few ESCC standards addressing photonics; how to ensure common 'best practices' for using COTS or custom photonics parts

- What are the priorities?
  - To have **common approach** how to qualify photonics for space (and new-space) applications
  - To establish/secure supply chains within Europe and ensure accessibility to the high-volume and high-return parts (to be addressed by EEE Sovereignty initiative; photonics lines)
  - To enable the custom and 'niche' applications relying on key photonics parts for specific mission applications

- Important messages, announcements, warnings, …

Detectors WG-1

- Major on-going actions / programs
- **European CMOS Image Sensor Technology Development Plan → on-going**
  - Two phase programme aimed at investigating and supporting European CMOS foundry interest and capability for development of high performance image sensors. (EUROCIS-TDP-01032011MZ-NN)
- **ESA Technology Harmonisation → published in Oct 2022**
  - ESA/Industry approved roadmap of Technologies for Optical Detectors (ESA/IPC/THAG(2022)5). Rev. 4.2
- **Proposed ESCC guideline ETP for cooled IR detectors**
  - Currently to be submited to PSWG (Policy Standard Working Group) for approval
- **New TRL guidelines specifically addressing Detectors**
  - To be added as Annex in the ECSS TRL Guideline

- What is at stake
- **Detectors are critical for European independence, expensive developments and play instrumental role in all space missions!**
- **Lack of coordination between stakeholders will result in slowing down on-going and new developments of detector technologies.**

Detectors WG-2

• Current difficulties

- **Space market/needs are not always aligned with commercial/defence trends**
- **It is challenging to play a rôle in the formation of the business strategy of detector manufactures**

• Successes to be enlighted

- **Major participation also for face-to-face meetings**
  - Example: more than 50 people in Nov 2022, 3 Agencies presenting, all Primes and all major manufactures

- **Interactions and coordination between Agencies and EC has reached an excellent level**
  - Example: EC 2023 call "space technologies for European non-dependence and competitiveness" for the "enhanced performance and space qualified detectors – IR range" is fuly aligned with the Harmonization Roadmap → higly appreciated by Industry

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Detectors WG-3

- Challenges for next and coming years
  - **further improve the detectors performance**
  - **develop new disruptive technologies**
  - **support the use of COTS and**
  - **sustain the European supply chain**

- What are the priorities?

encourage synergies and coordination among European institutions and agencies

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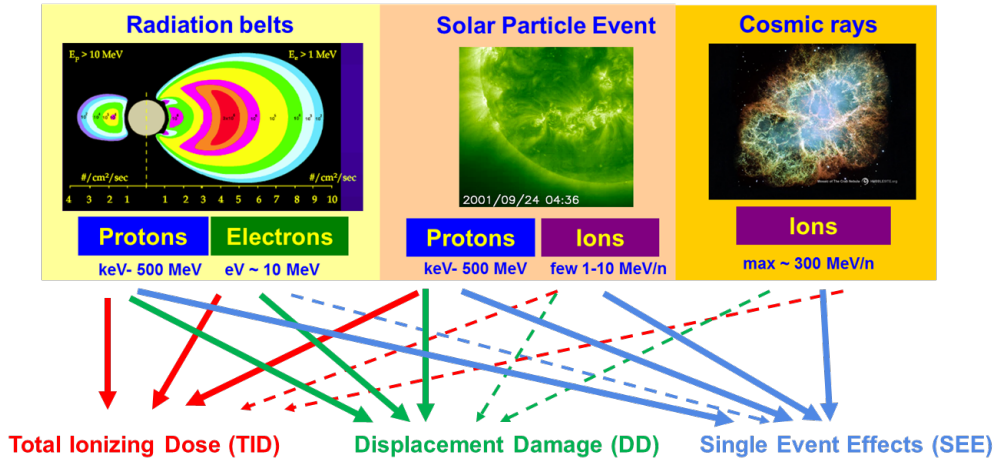
Detectors WG-4

- Important messages, announcements, warnings…
- **Now that TDE and GSTP Workplans are completed, Roadmap discussions will resume in the next Detector working Group**

- **Conferences / Workshops / Meetings**
  - **Image Sensors Europe :** March 15 – 16 2023 in London
  - **45th Freiburg Infrared Colloquium:** May 16 – 17 2023
  - **IISW :** 22-25 May 2023 in Scotland
  - **Infrared Detector Workshop :** 7-9 June 2023 in Toulouse
  - **Detector Working Group** : 6 June 2023 in Toulouse
  - **RADOPT :** Nov. 2023

Radiation WG-1

- Main role
  - To broaden and enhance the current knowledge in the radiation domain
  - To reduce European dependence on foreign supplies in particular for certain strategically important models, data and testing facilities
  - To establish a common radiation hardness process that optimizes design margins



- Major on-going actions / programs
  - Update of ECSS-Q-ST-60-15C “Radiation Hardness Assurance - EEE components”
  - Radiation HDBK writing: Testing Digital and Power Management Devices for Single Event Effect – Radiation Testing at Device or Board Level

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Radiation WG-2

- Challenges for next and coming years
  - Large use of Commercial Of The Shelf (COTS) in space programs
  - Single Event Effect testing & test facilities (e.g. high energy heavy ions)
  - Development of a European set of trapped particle belts radiation models
- Current difficulties
  - Despite escalation to CTB of major R&D topics, those not systematically funded
- What are the priorities?
  - Treat hot topics – issue recommendations
  - Ensure the link between EEE manufacturers, agencies and space industries eco-systems
  - Maintain/improve/enrich European radiation standards (ECSS, ESCC)

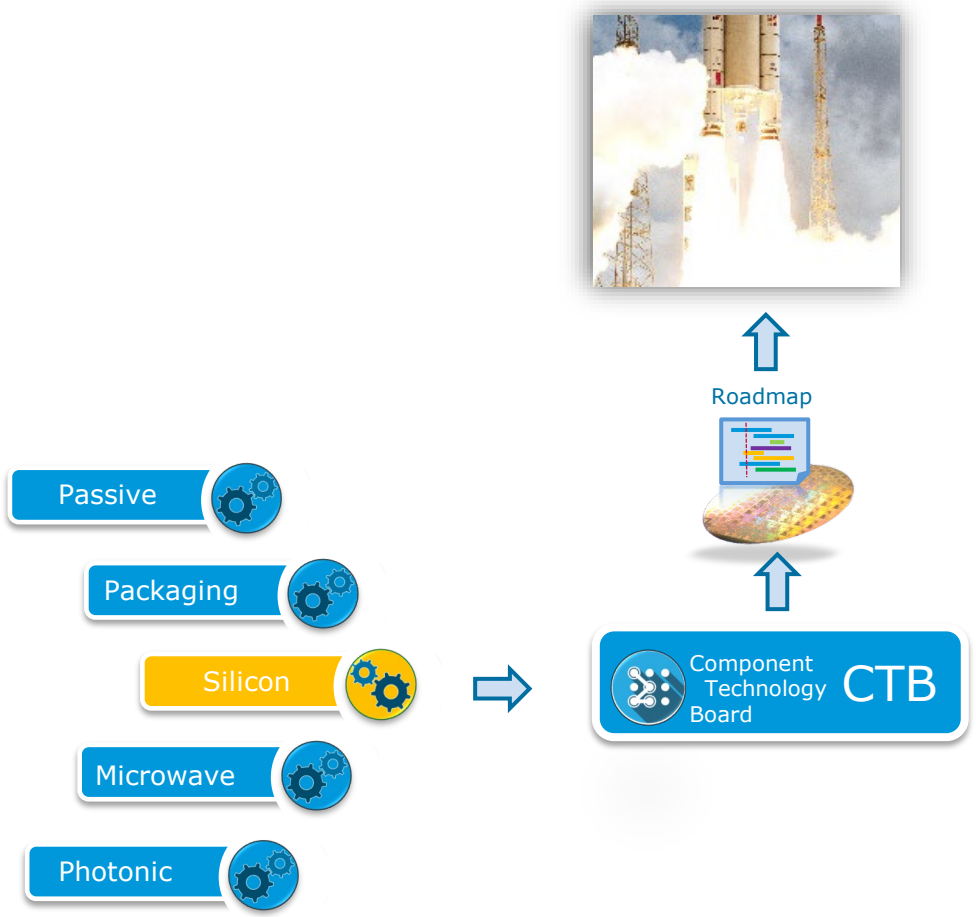
Silicon WG-1

Roadmap building activities

- The specific domain working groups give inputs/ recommendations to the CTB from which the ESCC Component Roadmap is built.

- The Silicon WG in special
  - tries to identify future demand for Silicon-based microelectronic components: Power MOSFETs, ADCs, DACs, FPGAs, ASICs, …
  - Prioritizes according to criticality
  - Collects user needs from space industry to determines in which Technology ESA / Europe should invest

- Challenges
  - versatile group, many members working in very different domains & confidentiality constraints make coherent roadmap building difficult
  - Low funding availability after ECI discontinuation lead to low number of activities that could be initiated



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Silicon WG-2

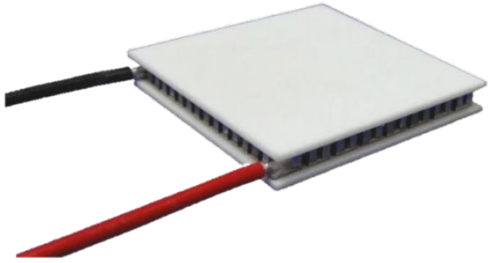
Networking

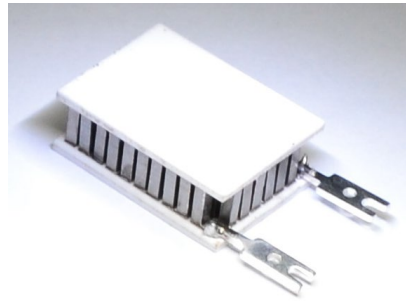
- Bringing space component user community (Satellite Primes, Agencies), Semiconductor manufacturers, Design Houses and Foundries involved in ESA projects together

- Update of current component development activities from Agencies and Industry
- Initiating new collaborations
- Opportunity for informal exchange/ **Networking**

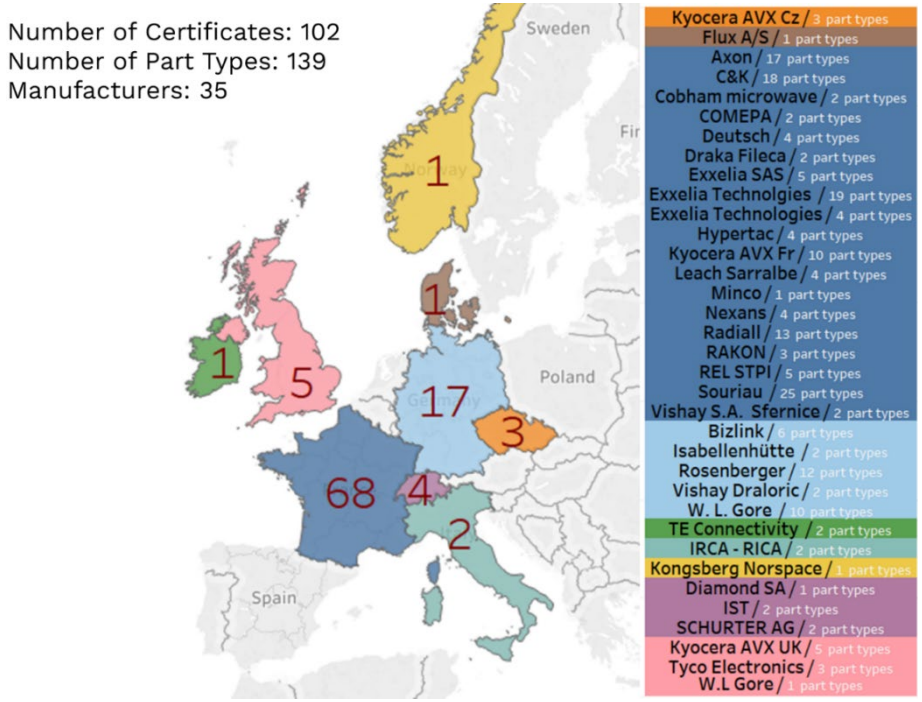
- **Guest presentations welcome!** email to: Juergen.Beister@esa.int

Passive WG-1





- Major on-going actions / programs
  - Add mounting recommendations for shock testing for magnetic parts
  - To study a move to a silver minimum required thickness for wires protection to 1µm
  - Development of new qualifications
  - Development of new mountings (micro-coils), testing of COTS parts, development of resonators in SMD package, evaluation of press-fit connectors
  - Lead-free transition
  - Update of connectors generic specifications
- What is at stake
  - The advance of the passive parts industry.
  - The development of new products for the market
- Current difficulties
  - To agree in the idoneity to reduce the silver layer on ESCC cables
  - To assess mounting conditions of transformers and inductors for users
- Successes to be enlighted…
  - Reduction of faliures on shock and vibration tests due to homogeneity on mounting conditions
  - Reduction of cost of cable manufacturing
  - Development of more efficient solutions for connecting systems
  - Development of new oscillator solutions



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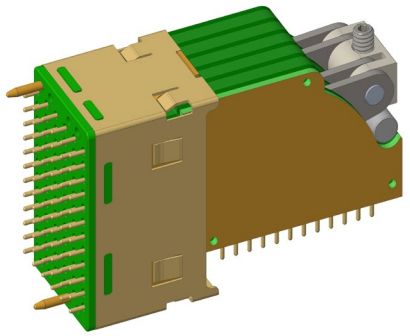
Passive WG-2

- Challenges for next and coming years
  - To develop more efficient solutions from the performance vs footprint point of view
  - To further develop the European manufacturing capabilities, including thermoelectric coolers
- What are the priorities?
  - Development of European market
  - High Data Rate connector
  - Lead-free transition
  - Development of more efficient solution

Amphenol



PERFORMANCE INTERCONNECT

SPCD
SPACE PASSIVE COMPONENT DAYS

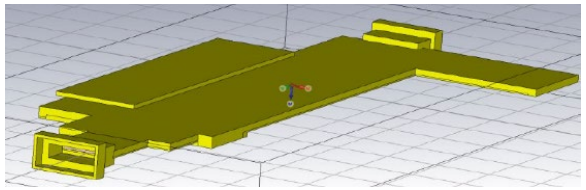
5TH SPACE PASSIVE COMPONENT DAYS - SPCD 2024
15-18 October 2024 | ESA/ESTEC
Noordwijk, The Netherlands

RF Passive WG-1

Major on-going activities

- **PECS** (Plan for European Cooperating States) activities with **ECLIPTIC DS (CY)**, in order to design, manufacture and test:
  - **UCOMBS** (on-going): Ultra-Low Loss Ku- and Ka-Band SIW COMBiners, to combine the powers from two High Power Amplifiers at board level.
  - **INKAIDUS** (on-going): a high-power, integrated isolator and divider with SIW technology at Ka-Band telecom satellite downlink 17.3 GHz-20.2 GHz.
  - **SELFeiS** (to be started): RF switch SIW-based Embedded Latching Ferrite Switch at Ka-Band for use in Beam Hopping applications (SELFeiS)
  - **MINICOIS** (to be started): Ku IMUX (MINICOIS) Ku-Band Compact Input Multiplexer (IMUX) channels with integrated SIW circulator/isolator

Ecliptic Defence and Space
Boundless technological capabilities in defence and space



- TDE **Highly Integrated SIW (Substrate Integrated Waveguide) -** HARP, VTT(FI)
  Design, manufacture and test W-band SIW circulators and isolators

- TDE **Fast-locking RF connector up to W band** -RADIALL, AXON (F)
  Design, manufacture and assess the reliability of an open RF interface for connectors and cable assemblies allowing a robust fast-locking mechanism and frequency operating up to W band.

RF Passive WG-2

What is at stake

- **ROADMAP**: Miniaturised self-biased circulators/isolators for GaN applications (coming activity)
- **EEE Sovereignity**: RF passives with high thermal conductivity are required for high power applications:
  - Aluminium Nitride (AlN) and Beryllium Oxide (BeO) are produced in Europe
  - However, Chemical Vapor Deposition (CVD) Diamond is not produced in Europe.
  - Targeted activity: "**Development and evaluation of diamond-based RF chip load for high power applications**"

Success

- Radiall switches: surface mount Ka-band relays for redundancy ring

Challenges for next and coming years

- Increased power handling: high power (360W L band, 360W S band, 280W C band coaxial and waveguide RF)
- Moving to higher frequencies (Q-, V- and W-band): SIW, Microstrip LTCC/Hexaferrite

Priorities

- Stay competitive and allow the European Space Industry to reach the same level of improvement in their next generation microwave equipment, as it will be the case for the US competitors. In particular, maintain competitiveness by:
  - Developing cost-efficient technologies
  - Improved performances and rise in frequency
  - Increase the competitiveness of established passive products by developing novel techniques and industrialisation. This shall include further effort in the development of low-cost technologies

Announcements

- 1st Space Microwave Week 8th-12th May 2023 ESA-ESTEC
- 5th SPCD Passive Component Days 15-18th October 2024 ESA-ESTEC

SPCD SPACE PASSIVE COMPONENT DAYS

5TH SPACE PASSIVE COMPONENT DAYS - SPCD 2024
15-18 October 2024 | ESA/ESTEC
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Hybrid & Packaging WG-1

- Major on-going actions / programs
  - ARTES – Skylight actvities in Photonics packaging, GSTP – Photonics packaging, TDE – die bumping, lead free, tin whisker investigation,
  - EEE Soveriegnty initiative activities
- What is at stake
  - Future availability of flight quality EEE components manufactured within member states
- Current difficulties
  - New, evolving high performance systems requiring divergence from « traditional » solutions. Very few suppliers or manufactures for new leading edge packaging solutions. Qualification methods and documentation evolution.
- Successes to be enlighted…

Hybrid & Packaging WG-2

- Challenges for next and coming years
- Establishment, development & qualification of new (for space) packaging technologies for SiP, UDSM/FPGA, Wide Band Gap, Microwave & Photonics devices
- What are the priorities?
- Establish technology requirements & supply chains for manufacturing new generation components
- Important messages, announcements, warnings, …
- Anticipated that solutions are not new – but selected developments beyond commercial and automotive. Numbers are against us. Identified sectors manufacture 10,000s or 100,000s Not 10s or 100s of components

(more) Priorities

- **UDSM:** towards few nm, FDSOI, FinFET, GaaFET, …
- **Packaging:** SiP with heterogeneous dice, Chiplets
- **PCB/SMT:** don't forget it! See Eurospace/CTB White Paper just released
- **mW:** better effiency and thermal behaviour for GaN, higher freqs, more power density. Move from GaAs to Silicon continues and accelerates.
- **Power:** convergence towards GaN Normally-Off transistors. Need a European supply chain, evolution towards Power ICs
- **Passives and RF-passives:** broad domain, strategical. *Citius, Altius, Fortius!*

General agreement on those priorities

- ESA (EEE Space Component Sovereignty for Europe),
- CNES (Composants Stratégiques), DLR, ASI,
- European Commission (EU Critical Space Technologies for European non dependence),
- EDA (TCM Captech),
- Eurospace (cf. ODIN workshop on Critical Non Dependence)

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So …

Are you happy?

Well, YES and NO

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S.W.O.T.

STRENGTHS:

- Groups with experts from a variety of actors (institutions / industry / manufacturers / and more)
- Culture of open and pragmatic exchanges. People know each other well
- Structured with thematic groups covering a large perimeter

WEAKNESSES:

- Internal organization could be improved
- Too pyramidal, lack of transverse actions
- Key people not well missioned, they do not have enough time
- COTS issues are scattered, lack of global vision
- Lack of resources
- Lack of efficient tools (database, communication)

OPPORTUNITIES:

- Capability of monitoring developments, of mapping/road-mapping action plans
- A brake against duplications
- A source of inspiration, pulling up industry and manufacturers
- A reference for stakeholders when drafting their plans

THREATS:

- Based on good wills only >> turn over is always at risk
- Centric policies from each institution
- Centrifugal forces from the working groups

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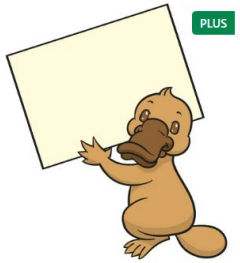
Take-overs

- CTB is based on ESCC Charters elaborated in 2002. The World has changed in more than 20 years.
- LSI and component manufacturers and Integrators need a strong and efficient co-ordination from the stake-holders
- CTB may help!

Proposal for CTB 4.0



What could be imagined?

- CTB could be a link between ESCC and the JTF, in connection with related plans and programmes (GSTP, TDE, HzEu Space, Fr RCS, It, Ger, UK, Captech,…)
- CTB could become a body with its own budget, supporting its governance / structure / internal activities (meetings, workshops, …)
- Governed with revised rules, team spirit, rolling positions, neutrality and independence by commitment of the members, …
- Backed with modern tools for mapping/roadmapping, communication, helped by a consultant?
- Have a special working group for technical issues related to COTS
- Its perimeter to be aligned with institutional initiatives: w or w/o solar cells, materials?

New missions? Ex: Proposing activities from the roadmap; assisting proposal evaluations; providing experts for reviewing

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Clap your hands

THANK YOU FOR YOUR ATTENTION

ENJOY TOULOUSE!