

# Joint Working Group on Pb-free transition

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The European Space Sector can no longer avoid the need to plan and implement a managed transition to lead-free electronics. This stimulus comes from two fronts:

- Regulatory front
- Market pressures

# Regulatory Front

- In the Regulatory front while the Space Sector was out of scope of the RoHS Directive, a new front has recently opened with REACH. Lead (Pb) has now been included in the ECHA Registry of SVHC Intentions and in 2018 it has been included it in the REACH Candidate List of SVHC for Authorisation.
- While we cannot preclude the final outcome of the process, there is a clear risk for the Space Sector which may have to resort to future Requests for Authorisation to continue using lead.

## Market pressure (1)

- The Sector is also subjected to increasing Market pressures. On the one hand due to the overall transition of the Electronics Industry worldwide to a Pb-free realm, the Space Industry is more and more confronted with a situation where they cannot avoid using EEE parts with Pb-free coatings and they need to manage the associated risks.
- On the other hand, the growing use of commercial components (COTS) for the expanding market sector of constellations means that European Space Industry is already using large amount of components with lead-free terminations even when the equivalent leaded high-rel version is available.

# Commercial Pressure : COTS

- Strong Emergence of the Low Earth Orbit (LEO) markets.
- New ways of assessing/ taking risks with Venture Capital and Public-Private Partnerships.
- Mass production concepts emerging.
- Need to access fast the new technologies with increased performance.

ESA COTS Steering Committee Mandate

*Bring together all ESA stake holders related to COTS based development, COTS end users, testing facilities and standards/specification entities in order to manage the evolution of the use of COTS in an coordinated manner in ESA's current and future programmes, and in support to industrial requests*

## OUTPUT

- set of recommendations for the use of COTS in future Agency programmes/“new space”,
- a roadmap/ required next steps to achieve the above (Q2 2019).

## Market pressure (2)

- The REACH regulatory pressure may also result on difficult market availability of leaded solder paste which means going to lead-free soldering, an extensive and very expensive undertaking for the European space Industry.
- Under current Space standards, a change in solder means that each company has to requalify the mounting of all components used and that for each Assembly Line in the company.

## Commercial Pressure : Soldering

- What is the risk of supply chain disruption for leaded solders?
- Going to lead-free solders may negatively affect the management of Tin whiskers risk.
- Changing to lead-free soldering is not required for massive COTS introduction.
- Going to lead-free soldering is a two step process:
  - First the necessary R&D leading to the choice of the best candidates for Space Industry utilization. This R&D could be common and shared by all.
  - Second each company will have to qualify the new solder for each of their Assembly plants, a mammoth and costly undertaking.

# SCSB Decision

- Taking into account of all these, the SCSB agreed to launch a joint task force consisting of MPTB and CTB members. This decision is recorded in the minutes of the 52nd SCSB, and the actions were introduced in the 21st MPTB and 55th CTB
- Current composition of the task force is as follows:

## Members:

- Agustin Coello-Vera (REACHLaw) – *Facilitator*,
- Catherine Munier (ADS),
- Daniel Caterbow (DLR Technical Advisor),
- Jussi Hokka (ESA),
- Liam Murphy (ESA),
- Marc Lambert (TAS),
- Réka Simon-Bálint (RUAG),
- Thierry Battault (CNES)
- Hans-Dieter Herrmann (DLR)
- Thorsten Ziegler ArianeGroup

## Observers:

- Jean-Louis Cazaux, CTB Chairman
- Paavo Heiskanen, MPTB Chairman



# Mission

- The TF should set itself the necessary objectives in order to fulfill the following strategic goals:
  1. In the domain of EEE components, electronic assembly technologies and PCBs, ensure a successful industry-wide transition to a Pb-free technology while preserving or improving current level of quality and reliability, including but not limited to:
    - Tin-whisker mitigation and risk assessment
    - Lead-free solders and assembly processes
    - Accelerated tests for verification of Pb-free materials and processes and qualification of components
    - Acceptance criteria for Pb-free materials, processes and components
  2. In the domain of alloys containing Pb-metal, such as free cutting Cu-alloys, record the alternatives and the way forward for a successful industry-wide transition to a Pb-free technology while preserving or improving current level of quality and reliability.
  3. In the domain of solid lubrication achieved by Pb-metal, record the alternatives and the way forward for a successful industry-wide transition to a Pb-free technology while preserving or improving current level of quality and reliability.

# Objectives and Schedule (1)

- For the first strategic goal, EEE components, the first phase of the work should be the formation of a “Roadmap and Plan for Pb-free transition”, which shall include:
  1. Necessary activities and objectives to fulfill the before mentioned strategic goals,
  2. A lead-free transition plan composing of
    - a. Materials and EEE parts selection
    - b. Supplier compliance and guidelines for procurement
    - c. Changes in assembly processes
    - d. Reliability assessment and key reliability risks in lead-free electronics
- The first version of this roadmap and lead-free transition plan shall be presented no later than Q4/2019.

## Objectives and Schedule (2)

- For the second (alloys containing Pb-metal) and third (solid lubrication) strategic goals, the working group should record the way forward in completing the Pb-free transition, including:
  - Identifying the work being done elsewhere such as harmonization and non-space industry activities

## KO Meeting

- The KO Meeting was held on April 4th. It was used to try to establish the baseline of:
  - Where we are today
  - What needs to be done
- Key conclusions from the meeting were:
  - All industrial actors have already started mounting lead-free EEE components. The common approach is to work with their customers, on a project-by-project basis, to agree on acceptable risk mitigation solutions.
  - Current ECSS/ESCC assembly standards do not cover the new lead-free terminations
  - Very few have started actions towards lead-free solders. There was strong consensus that collaboration is the way to go forward on this.

A second meeting is scheduled this week (on Friday June 14th) to follow up on the actions agreed. These actions are grouped in four areas:

## Actions agreed (1)

- Assembly of lead-free EEE parts:
  - What is the complete list of the lead-free terminations that are of concern for the Space Sector
  - Which of those are the terminations for which there is a wide consensus that traditional SnPb solder can be used without a risk of whisker growth. (ESCC23500 needs to be updated).
  - Should the GEIA standard (0005-2), for Mitigating the Effects of Tin Whiskers in Aerospace and High Performance Electronic Systems, be adopted by the PSWG as is or rewritten.
  - What is the state-of-the-art on mitigation techniques. Is reprocessing/re-tinning a desirable mitigation technique
  - What is the state-of-the-art on tin whisker growth?, on accelerated tests?

## Actions agreed (2)

- Soldering:
  - Evaluation and qualification of most suitable Pb-free solders suitable for space use. SAC305 seems like a promising candidate but others, like SAC405, SAC105, could be better suited for niche applications (power,...)
  - Replacing Indium-Pb, used for optoelectronics, seems challenging. Do we need to start activities for this?
  - How to handle mixed (Pb / Pb-free) boards in manufacturing and testing
- PCBs:
  - Pb-free PCB Finishes, ESA Qualification, (ACB ENIG, TESAT ENIPIG)
  - Soldering on Pb-free PCBs, standards update (ESCC 1738, 1761), MEMO on ESCIES
- Specialty packages:
  - Pb-free columns for ceramic packages (no solutions identified), continue with SnPb?

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