5th Electronic Materials, Processes and Packaging for Space (EMPPS) Workshop

Opening Speech

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Background

- Electronic Materials and Processes for Space (EMPS) Workshop has been organised since 2010
- Yearly workshop that is typically organised at the site of an ESA-Approved Skills Training School
- Workshop promotes the development and awareness of materials and manufacturing processes utilised for space applications
- For 2014, packaging aspects have been included to the workshop programme in order to bring it to the next level
    - Strong ESA internal coordination of PCB, SMT and Packaging domains
    - Reflecting the structure of CTB and its SMT/PCB and Hybrids and Packaging Working Groups and ECSS M&P Working Group.

Objectives of the Workshop

- To promote information exchange and discussion on PCB, SMT and Packaging R&D within the European space industry
- To gain an overview of current level of maturity, major developments and achievements in the fields
- To report status of ongoing ESA and industrial activities and technologies
- To identify key work priorities and actions to be considered for future development programs

Workshop Programme

- Nine technical sessions (38 presentations)
  - PCB Standards and Roadmaps
  - Packaging Technology Development
  - SMT Reliability
  - Bonding Reliability
  - PCB Evaluation and Testing
  - Emerging Technologies
  - RF and High-power PCBs
  - SMT Assembly Verification
  - Packaging and Reliability Challenges

Packaging: Drivers for Technology Development

1. Future anticipated & emerging technologies include:
   - Higher Performance & capability digital devices :
     - Deep Sub Micron Technologies – 65nm.
   - High pin count ≥ 625 I/O.
   - Higher power dissipation (both RF & Digital).
     - GaN transistors.
     - Hi power ASICs.

2. Conventional packaging technologies are insufficient to accommodate:
   - Wire bonding limiting performance.
   - Thermal management of current technologies at maximum.
   - BGA/CGA technology capability insufficient for High I/O.
   - Conventional packaging becoming obsolete in commercial market place.

3. New technologies require new solutions (photonics-MEMS today… tomorrow printed electronics and 3D printed assemblies?).

4. Standard platform and product based solutions require a new approach in terms of testing and verification.

5. COTS-based technologies are considered for future space projects (e.g. non-hermetic and plastic packaging).

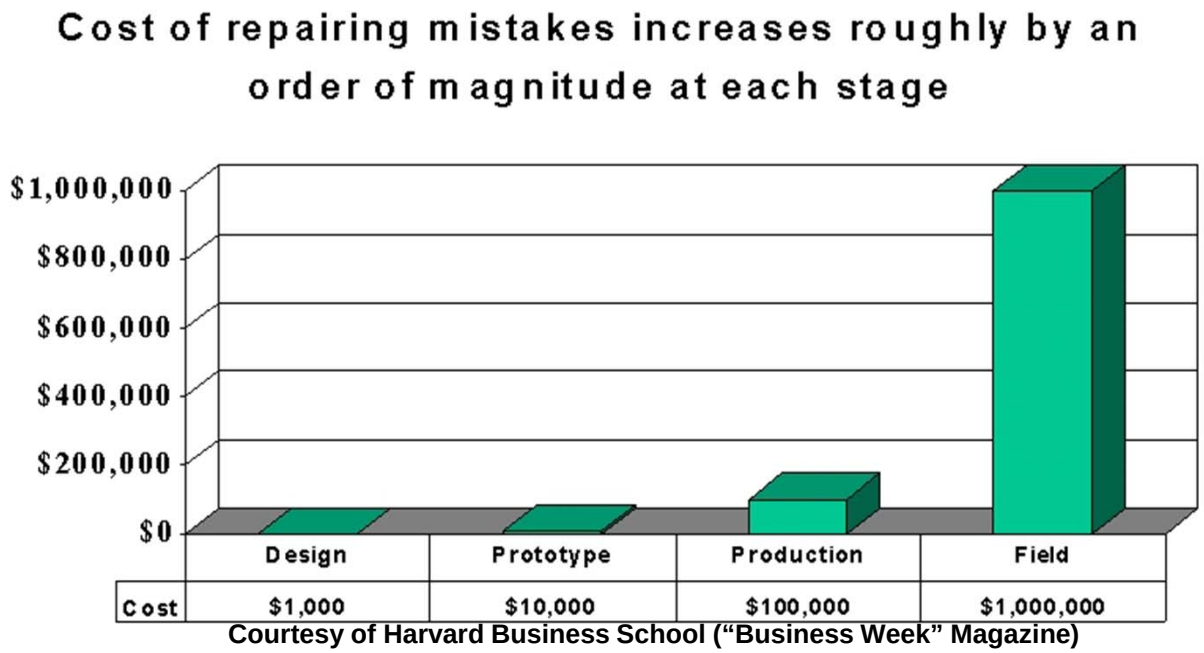
6. Supply chain is becoming more complex to manage.

Focus on Developing Solutions

Europe is investing heavily to new technologies both at chip, packaging and electronic assembly level.

1. High thermal dissipation packaging materials and methods:
   - Including die mounting & associated processing methods
2. Hi I/O interconnection technologies
   - Flip chip & underfil application, mounting, processing & controls
3. Non Hermetic packaging methods
   - Class Y means of compliance
   - Encapsulation methods and materials
   - Pre packaged and possibly chip and wire (Dam and Fill)
4. Test & verification methods
5. New standards for new technologies (performance, reliability, qualification and certification)
6. International & Environmental limitations, controls and directives (& effects on supply chains)
7. Activity focused on developing & maintaining European lead and capabilities

Cost of Ownership Is the Key!



Courtesy of Harvard Business School ("Business Week" Magazine)

- PCBs are expected to be cheap, produced fast AND perform in a reliable way
  - Price of PCB ~ 2 k€
- Current nonconformance's on PCB require a high effort and cost for projects, the current qualification scheme is outdated.
- More intense inspection regime and more state-of-the-art production equipment are necessary and will be addressed in the revision of the new ECSS standards.
- This will drive the price of PCBs in the future but lower the cost of ownership of the technology.

Focus on Proactive Measures

ECSS Standards are a key in defining an even basis for the spacecraft procurement in the field of electronic assemblies

- PCB qualification philosophy to be modified when revision of ECSS-Q-ST-70-10 is issued (Kickoff June 2014)
- PCB design spec ECSS-Q-ST-70-12 will be issued in June 2014
- Working group to update the ECSS-Q-ST-70-38C ongoing
- ECSS-Q-ST-70-08 WG will be reopened after -38 work is completed

Workmanship is one of the key drivers of the end product quality

- 6 ESA skills training schools maintain the training and certification of inspectors, instructors and electronic assembly operators
- Over 1000 certificates issued yearly

SMT verification scheme plays a fundamental role in maintaining a solid European supply chain for electronic assemblies

- List of approved companies available at the ESCIES website

Summary

1. Europe will be investing extensively during the past 5 year to EEE-component technologies and this investment is seen to continue for the coming years.

2. Space requires long-term investment, product cycles a slow when compared to the consumer market. Financial crisis has impacted the industrial structure, a continuous dialogue with all layers of the supply chain is required to maintain the industrial capabilities.

3. Major challenges in establishing full supply chain for space including chip technology, packaging, assembly, testing and workmanship at all levels.

4. Roles and responsibilities in the electronic assembly supply chain need to be redefined with a focus on cost of ownership of the technology.

5. Major restructuring is on-going in the field during 2014-2015 through the revision of all key ECSS standards.

6. Electronic Materials and Processes for Space (EMPS) Workshop is one of the key events to facilitate the discussion and definition of future solutions in the domain.