European Space Components Conference **ESCCON 2016** ESA/ESTEC

The ECSS -Q-ST-60-13C
Approach to Commercial EEE Components
The concept and key requirements

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CONTENT

Objective of the presentation : to explain the ECSS requirements on PEMS

☞See also the associated presentation : First experiences with ECSS-Q-ST-60-13C use in CNES projects

1. ORIGIN

- 1995 : Starting point, R&D studies, analysis, surveys
- In parallel Microsat (Myriade) development, need for COTS
- Context change :
    - Better, faster & cheaper
    - Best in class
    - QML
    - Manufacturers improvement in reliability
- Projects pressure & needs
- 2004 : First CNES several standards & handbooks, case by case oriented
- 2010 : Consolidation : partnership with French industry
- JAXA associated to the final spec
- 2013 : European building : **ECSS**-Q-ST-60-13

2. SPECIFICITIES

Integrated circuits	Space	MIL	Commercial
Technology	Dedicated or not		commercial
Manufacturing	Dedicated	dedicated, off shore	
Qualification Specification	Agency	Agency/manufacturer	manufacturer
Tests	screening, lot tests		manufacturer
Temperature range	-55/125°C		-55/125 ; -40/85 ; 0/70
Package, terminations	Hermetic, majority Sn/Pb		Hermetic, Plastic, Pb free
Life cycle	Many years		Several year(s)

- Purchasing cost << cost of ownership which includes engineering tasks, additional tests, etc.
- The question is not "COTS authorised or not“ but authorisation with which conditions (i.e. with which additional tests).

3. BASICS (1/3)

- Perimeter limited to active parts (VLSI, discrets)
- Pretailoring included as per 3 risk classes (same as ECSS-Q-ST-60)
- Written by delta with the existing ECSS on 3^E parts requirement (ECSS-Q-ST-60C) : to highlight specificities
- Requirements categories :
  - Management (DCL, Parts Control Board)
  - **Selection**
  - Procurement
  - Inspection
  - Quality
- For performance access, cost motivation at a lesser extent
- Preference to space qualified components

3. BASICS (2/3)

- **Consider specificities :**
  - Pure tin terminations
  - Temperature range
  - Non hermetic packages : storage, humidity test & moisture sensitivity
  - Traceability at trace-code level
  - Need for Manufacturer data collect

Trace code : Unique Manufacturer identifier to label and trace a quantity of components with a common manufacturing history and thereby common characteristics.

Several trace codes can be part of a same delivery from the manufacturer or the distributor.

It is possible to have several diffusion lots in the same trace code.

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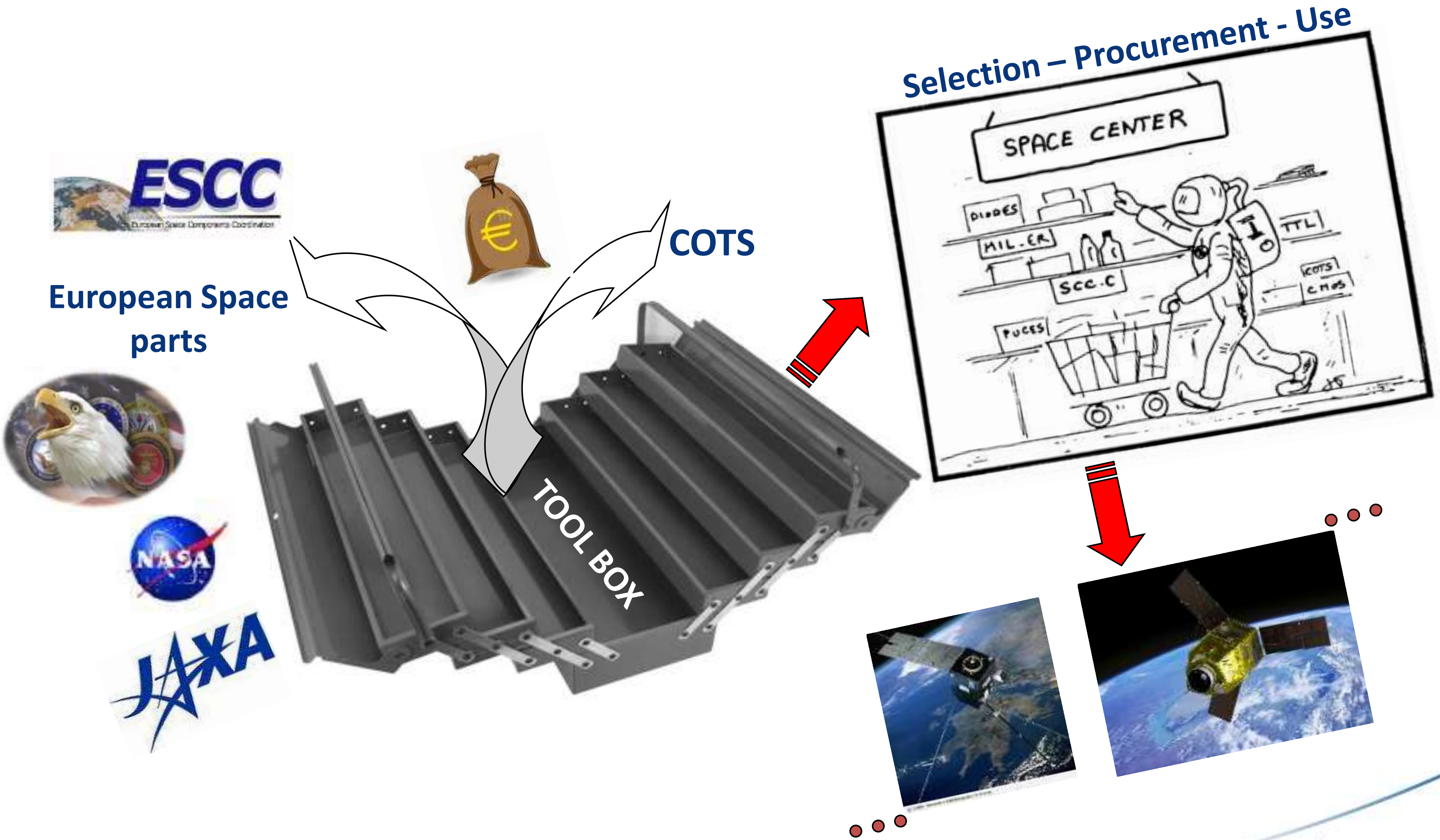
- **No specificity for :**
  - Declared components list
  - Parts Control Board
  - Radiation Hardness Assurance

3. BASICS (3/3)



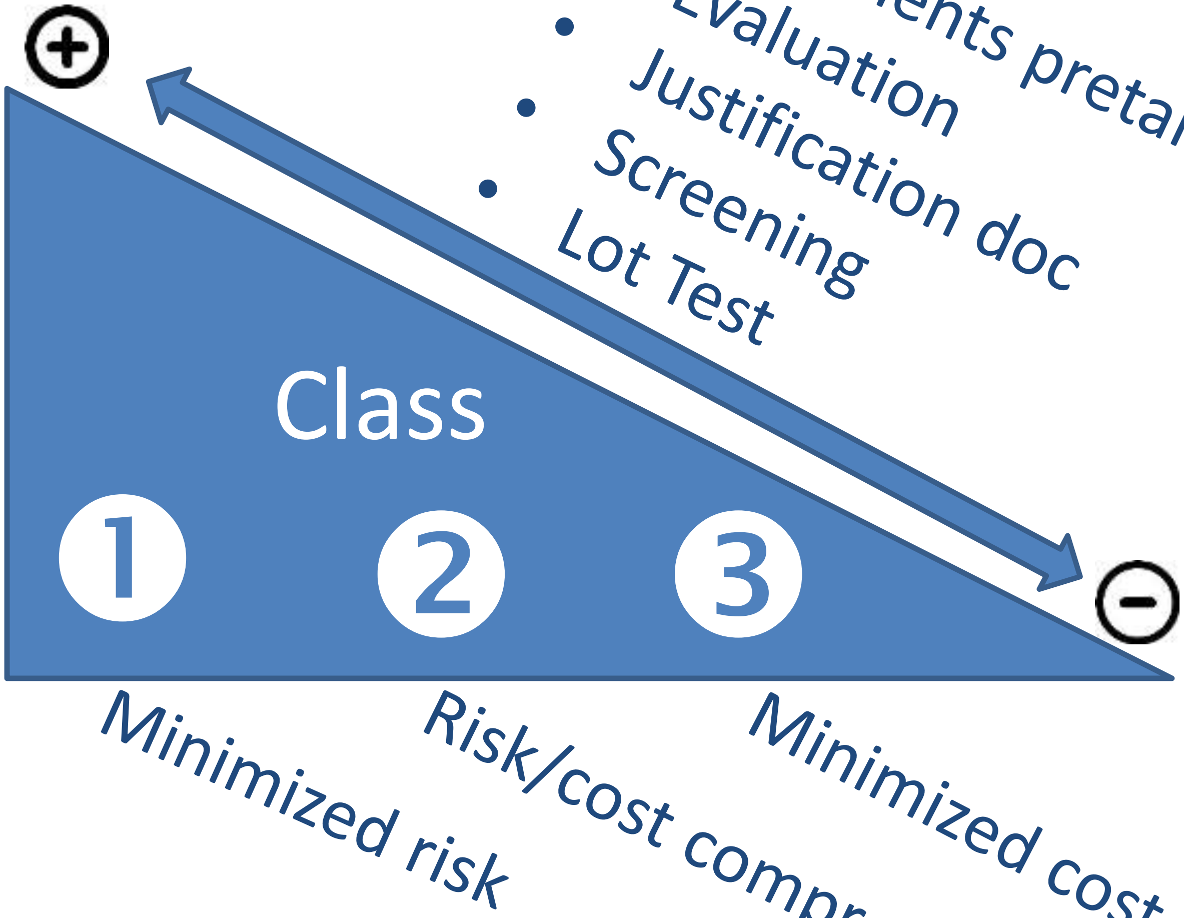
European Space parts

COTS

TOOL BOX

Selection – Procurement - Use

4. CONCEPT (1/2)



Requirements pretailoring:

- Evaluation
- Justification doc
- Screening
- Lot Test

4. CONCEPT (2/2)

	Class 1	Class 2	Class 3
Eval.	CA Elect. charact. HAST 96h or THB 1000h LT 2000h @ 125°C+DPA 500 T/C -55/+125°C	CA Elect. charact. HAST 96h or THB 1000h LT 2000h @ 125°C+DPA 500 T/C -55/+125°C	CA
Doc.	JD	JD	JD
Screening	10T/C -55/+125°C Burn in 240h @ 125°C	10T/C -55/+125°C Burn in 160h @ 125°C	
LAT on screenned parts (TC, LT, rad)	CA HAST 96h or THB 1000h LT 2000h @ 125°C 100T/C -55/+125°C	CA HAST 96h or THB 1000h LT 1000h @ 125°C 100T/C -55/+125°C	CA HAST 96h or THB 1000h LT 1000h @125°C 100T/C -55/+125°C

Only PEDs considered
Radiation not included

🟩 ***Required***
▢ ***Case by case***

5. CONTENT (1/3)

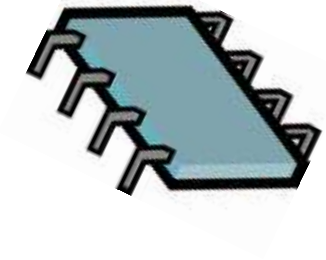
Temperature :

- Commercial EEE part to be selected in its highest temperature range.
- No usage outside temperature range (!)
- Minimum 10°C margin between maximum manufacturer temperature range and the application (including worst case).
- If margin below 10°C, electrical characterization up to using temperature + 10°C.

5. CONTENT (2/3)

Pure tin :

- Class 1 : Sn/Pb solder dip with a qualified process, before screening & Lot test



- Class 2 & 3 : Sn/Pb solder dip or risk analysis & mitigation based on collected data + application

Storage for Plastic encapsulated devices :

- Dry Nitrogen
- Dry and ionised air with RH in a range of 15% to 20%
- Dry pack as specified in J-STD-033 for dry pack inspection and control

5. CONTENT (3/3)

Justification Document = data collection including :

- Justification need /trade-off wrt space qualified solution
- Manufacturer max rating
- Data sheet
- Process/techno Changes Notofication services
- Life cycle, maturity : (emerging/maturity/decline)
- Lead finish
- Manufacturer qualification, reliability, lot & screening tests, Early Failure Rate
- Manufacturer part traceability: *tracecode, datecode assembly plant, wafer fab, diffusion lot)*

+ Eval, additional test (screening, Lot test) at user level

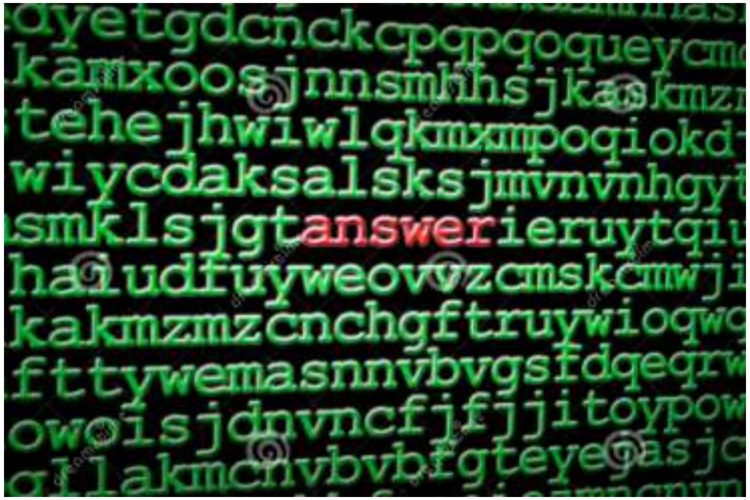
For approval

6. IMPLEMENTATION DIFFICULTIES

- Tradeoff with High Rel parts vs preference to High Rel parts
- Engineering resources, focus on the selection step
- Engineering arbitration : to decide when no test is acceptable
- Similarity approach
- A standard not optimized vs case by case approach
- Real cost of ownership/true prices & costs. Debate about the cost reduction drivers :
  - Electrical architecture (design to cost & COTS vs pin to pin replacement)
  - Industrial organisation complexity & interfaces
- Perimeter limited to PEMS

7. CONCLUSION

- COTS Standard, necessary, useful, progressively implemented & experienced



- … And very positive lessons learned ☞ see next presentation “First experiences with ECSS-Q-ST-60-13C use in CNES projects” …