



COTS and automotive EEE parts in Space Programs: Thales Alenia Space Return of Experience

"Mission Needs, Trends and Opportunities Session" - ESA High End Digital Technology Workshop on 01-Oct.-2018

ThalesAlenia
a Thales / Leonardo company **Space**



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THALES ALENIA SPACE OPEN

Thales Alenia Space COTS REX

➤ 2012 - CONSTELLATIONS, First approach for Automotive parts (as commercial parts)

- ✓ Data collection from manufacturer through JD (Justification Document) or PSS form (Product Selection Sheet)
- ✓ Qualification @ components level (per lot, if needed)
 - ✓ For units SUPPLIERS
 - ✓ Approach chosen by the suppliers validated by Thales Alenia Space
 - ✓ Data review by Thales Alenia Space
- ✓ Systematic screening @ unit level (Burn in and thermal cycling)

➤ 2016 – NANOSAT

- ✓ AEC-Q/ Commercial parts

➤ 2018 - NEW RULES for Commercial parts use, covered by new Thales Alenia Space EEE quality standard including automotive parts



Iridium Next COTS HERITAGE

- 150 COTS references used on IN satellites(active and passive)
- some electronic units built with more than 400 parts count of the same reference
- Proven in flight heritage with million of hours x devices operation
- COTS Lot failures during Qualification (Life test, HAST, C-SAM, Temperature cycling, VRT, etc...), units production / testing and flight operation
 - ✓ For TAS = None
 - ✓ For Sub-Contractors = None reported



TAS Standards for COTS

➤ STANDARDS and ORGANISATION:

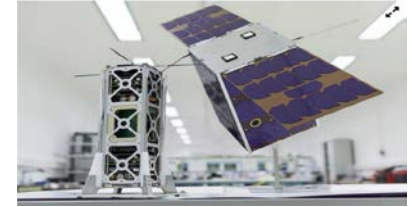
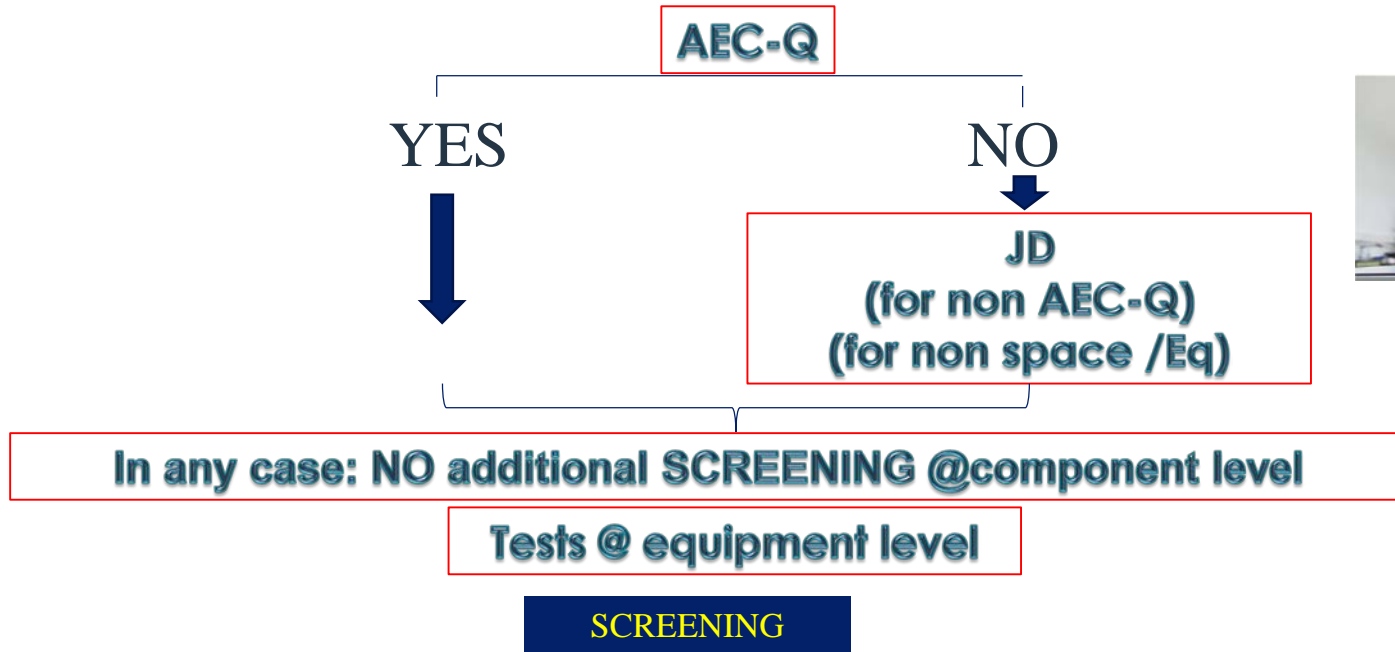
- ✓ TAS heritage combined with ECSS-Q-ST-60-13, AEC-Q, NASA requirements for COTS
- ✓ Qualification and specific screening according to TAS standards for COTS

➤ COTS SELECTION :

- ✓ COTS from Thales Group Preferred Parts Database: Availability of 3000+ parts references on active components and 11000+ parts references on passive components => COTS from major parts manufacturers with high volume production
- ✓ Justification dossier including risk mitigation provided for each candidate



TAS NANOSAT APPROACH for AEC-Q



Burn in @HighT@Tjmax /Temp. Cycling

LAT (EQM)

Temp. Cycling/ Life test/Rad/ Vibration/ mounting qualification ...



COTS vs Reliability

➤ TAS guidelines for reliability predictions

- ✓ Once a part is authorized by project EEE & RAD QA, the best quality factor and FIT figure is considered in reliability predictions
- ✓ These parts will not affect the satellite lifetime

Best in class & QA Go Ahead



Space class reliability FIT figures

But !

Full Justification Dossier

is required



MAIN RADIATION CHALLENGES FOR COTS



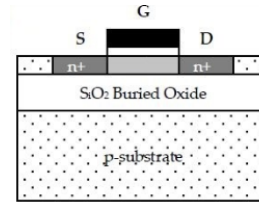
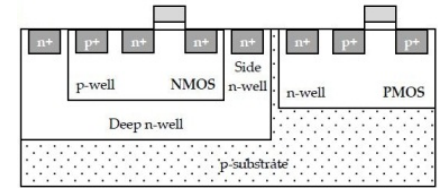
COTS

versus

SPACE QUALIFIED

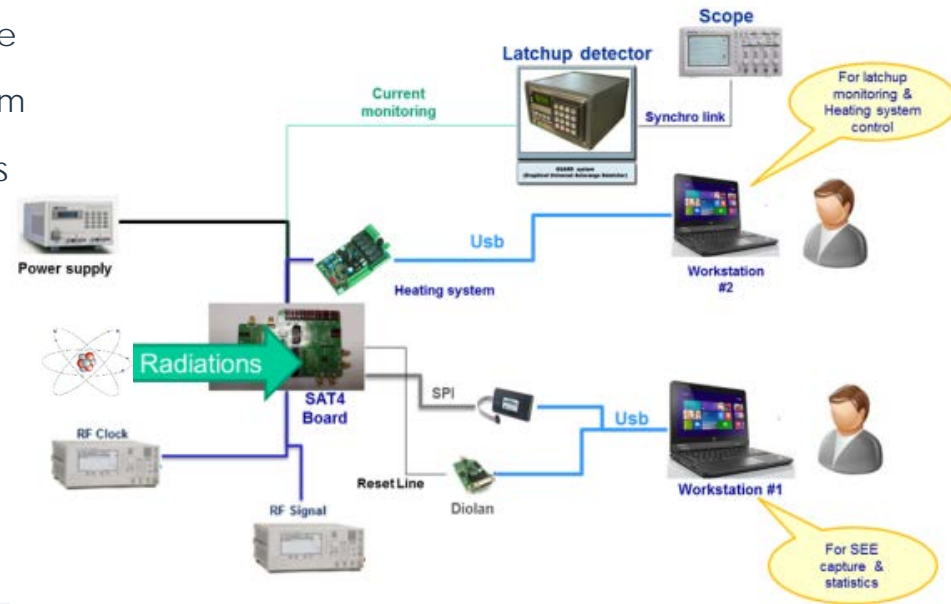


- COTS : not necessary radiation sensitive
- The challenges : radiation data available, traceability, and lot to lot variability
 - ✓ Traceability : solved by TAS with COTS Thales Group Preferred Parts Database support
 - ✓ Lot to lot variability : procurement strategy to minimize the number of diffusion lots
 - ✓ **No suitable radiation data => Radiation Evaluation Testing to be done**
- Method for identifying the best candidates per function
 - ✓ Which process is the best ?
 - ✓ Data available in Radiation Database
 - ✓ First screening : Preliminary Tests to withstand the minimum Radiation Levels for the mission



MAIN RADIATION CHALLENGES FOR COTS

- Accurate Radiation Characterization of pre-selected COTS for risk assesment
- Strong skills in radiation Testing
 - Ability to perform our own Radiation Testing on complex VLSI (internal state machine)
 - ✓ Signature of radiation effects,
 - ✓ Mitigation Technics : hardware & software
 - ✓ validation of mitigated design under beam
- Partnership with Radiation Test Laboratories
 - ✓ Best in class Test Laboratories
 - ✓ High volume in short time



TAS Experience in Radiation & COTS

- COTS Radiation Hardness Assurance Plan has been implemented for Iridium Next
 - ✓ Low TID level but Strong proton & Cosmic Rays induced Single Event Phenomena
- Large COTS radiation evaluation performed in order to select key functions
 - ✓ In TAS : 90 different part numbers tested to obtain 25 successful
 - ✓ Subcontractors : strong involvement to follow their radiation testing / Centralized at Prime Level
- TAS COTS & Radiation process already validated :
 - ✓ In orbit heritage : No SEE radiation failure on Iridium Next in more than 16000 cumulated days (45 years)
 - ✓ Many Functions already tested with success by TAS-JV : Microprocessor, DDR2, SRAM, configurable FPGA, complex Digital ASIC, optical transceivers, ADC, DAC, Analog Multiplexer, Line Drivers, optocouplers, MOSFETs, Logic Ics, Bipolar Junction Transistors, Analog Ics.....

