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ACCEDE COTS2019

SEVILLE – SPAIN 6-8 NOVEMBER

Space Equipment with COTS Parts - from design to product

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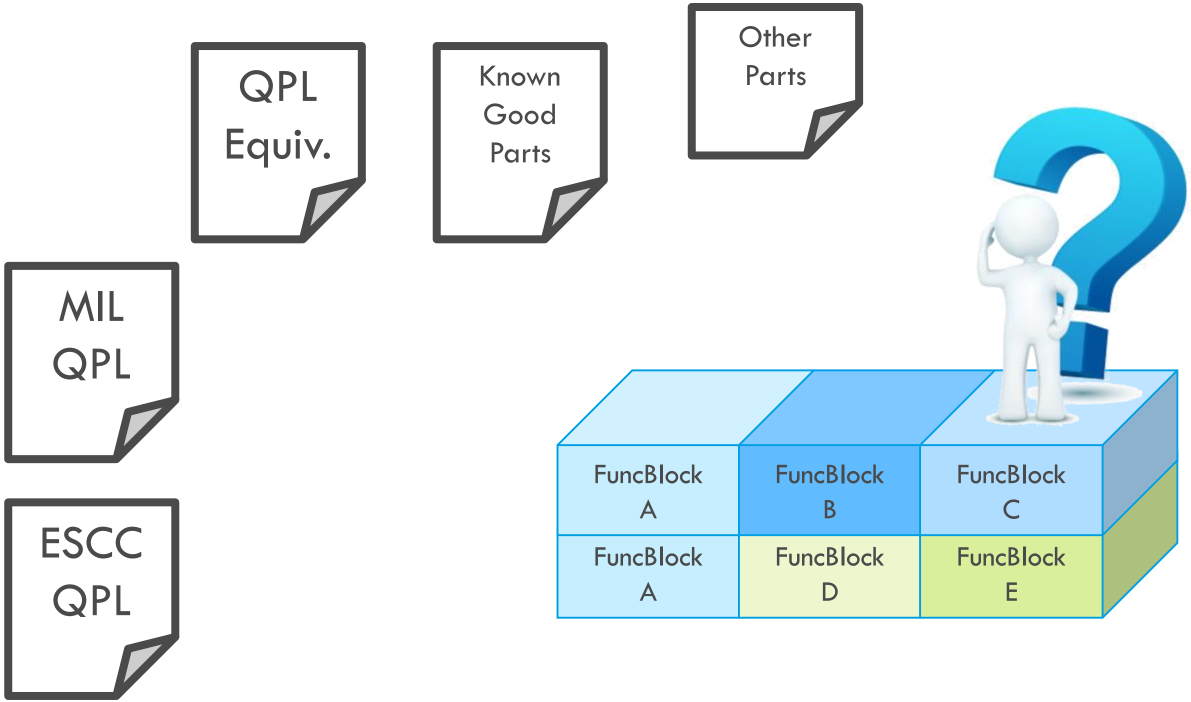
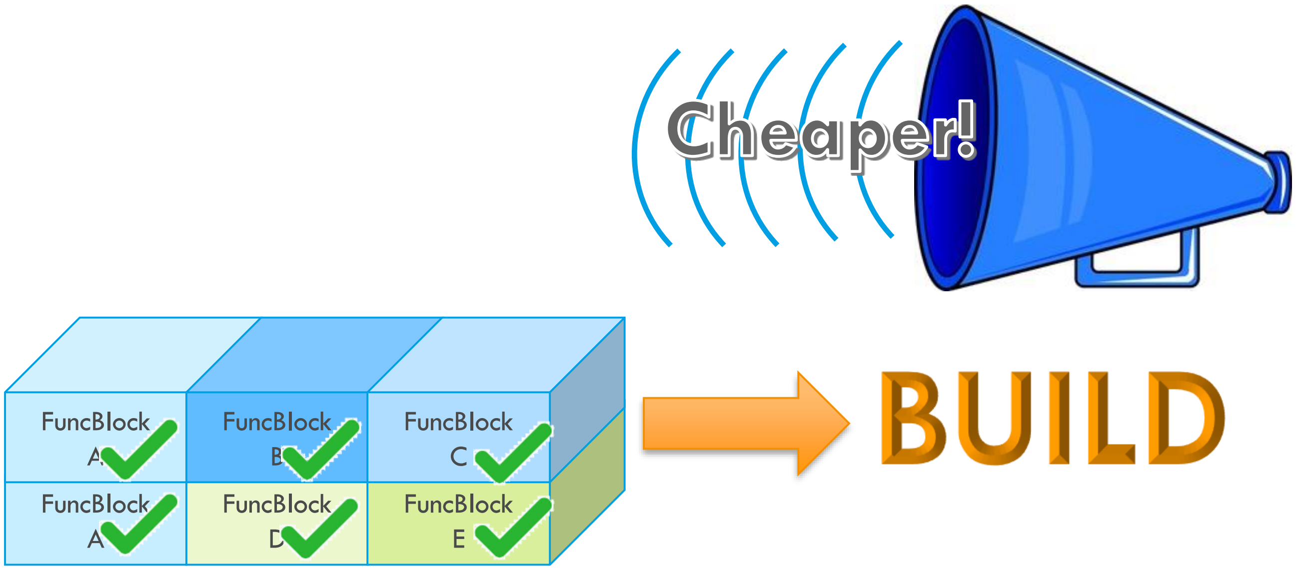
- » Equipment design with Classic Space
- » Equipment design with COTS
  - » Challenges
  - » Risk
- » Mitigation of Risks

The Classic Way



The Old Way


Cheaper!
FuncBlock A
FuncBlock B
FuncBlock C
FuncBlock A
FuncBlock D
FuncBlock E
BUILD

Basic Considerations

per Part

Lower Quality Level (less Screening/LAT)

- Automotive
- Industrial

Consequences:

- High Volume
- Big Lot Size
- Small Variety

per Lot

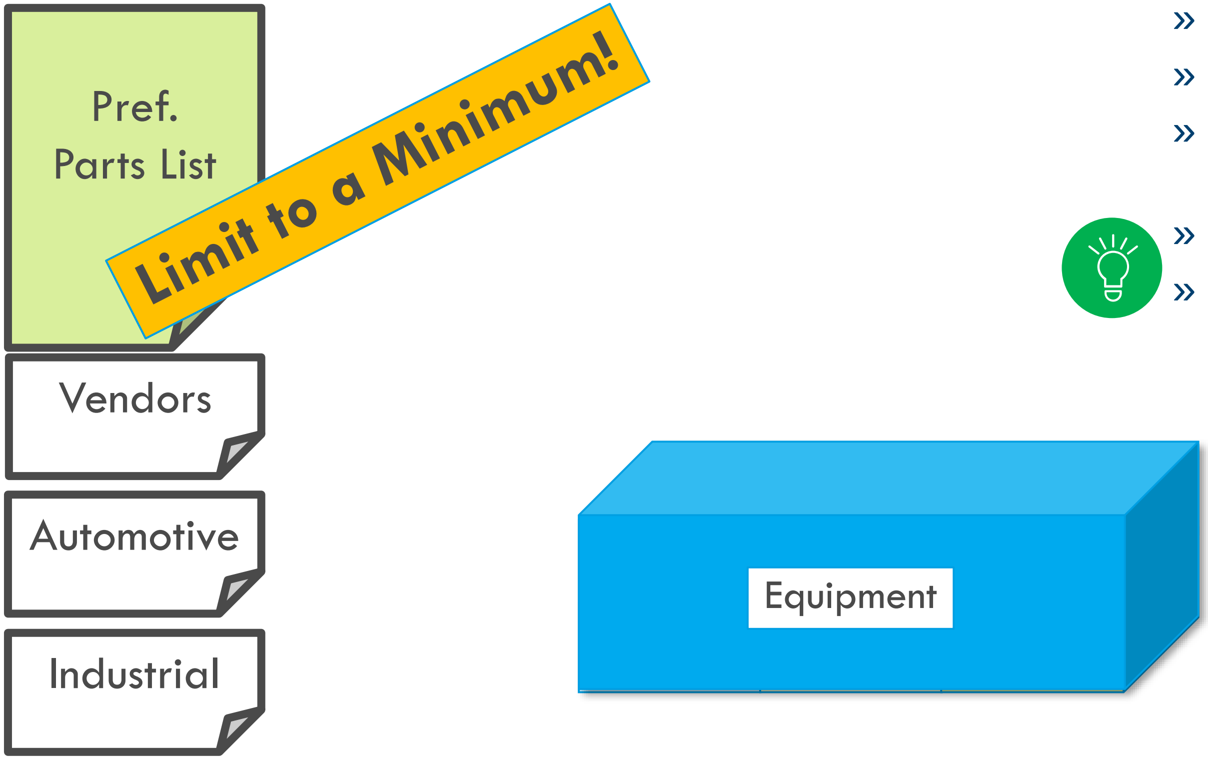
Typically Additional Tests needed

- Lot Acceptance
- Radiation
- Single Event Effect
- Screening

Risks:

- Traceability
- Tests may fail → Part not flight-worthy
- Waste of Money

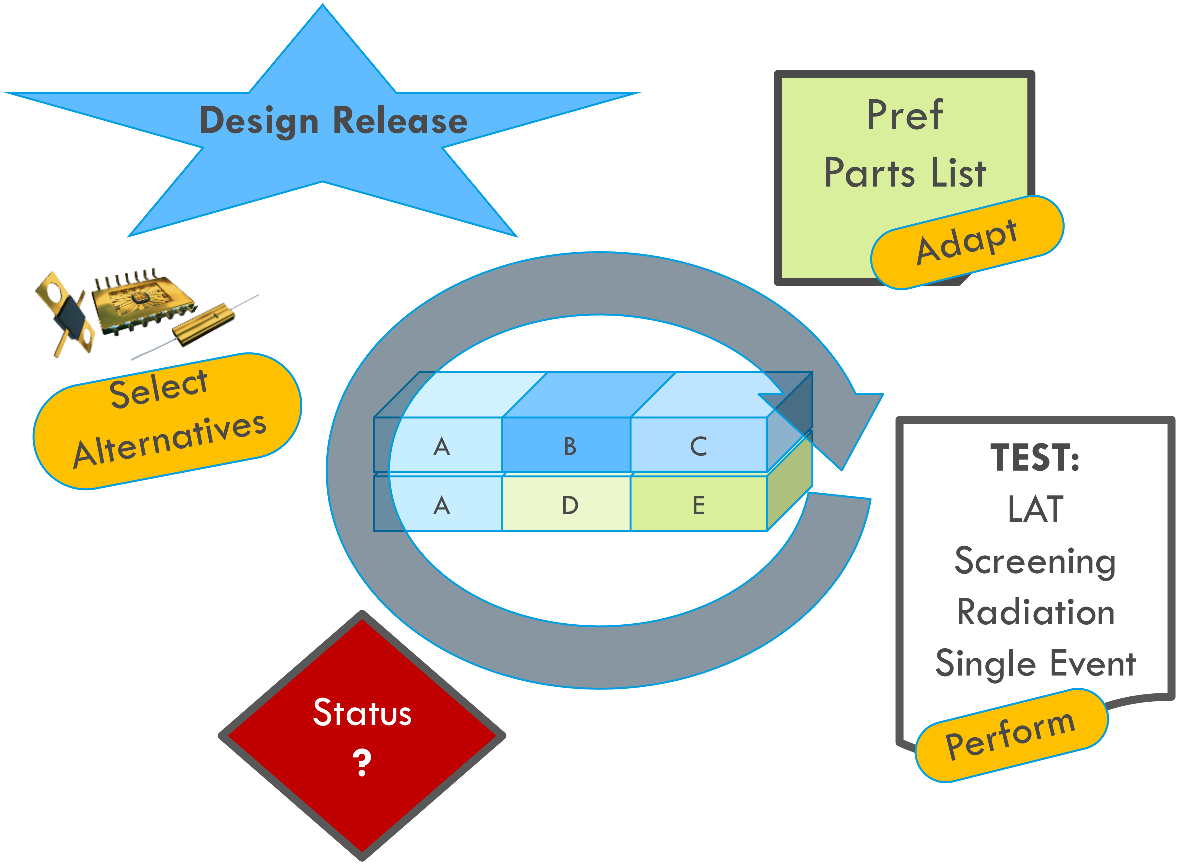
Equipment Development with COTS
Design Strategy



- Equipment function is given
- Identify building blocks
- Identify parts to create building block by function
- Collect part candidates information
- Pre-selection

Equipment Development with COTS

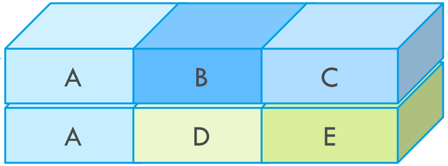
Design Strategy



- Equipment function is given
- Identify building blocks
- Identify parts to create building block by function
- Collect part candidates information
- Pre-selection

- Design release
- Adapt pre-selection
- Identify missing screening/LAT tests
- perform delta tests
- perform radiation test
- check status
- propose alternatives
- Design release...

Design Strategy



- Thermal cycling
- Radiation analysis
- Design Review

No Surprise!

- Equipment function is given
- Identify building blocks
- Identify parts to create building block by function
- Collect part candidates information
- Pre-selection

- Design release
- Adapt pre-selection
- Identify missing screening/LAT tests
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- propose alternatives
- Design release...

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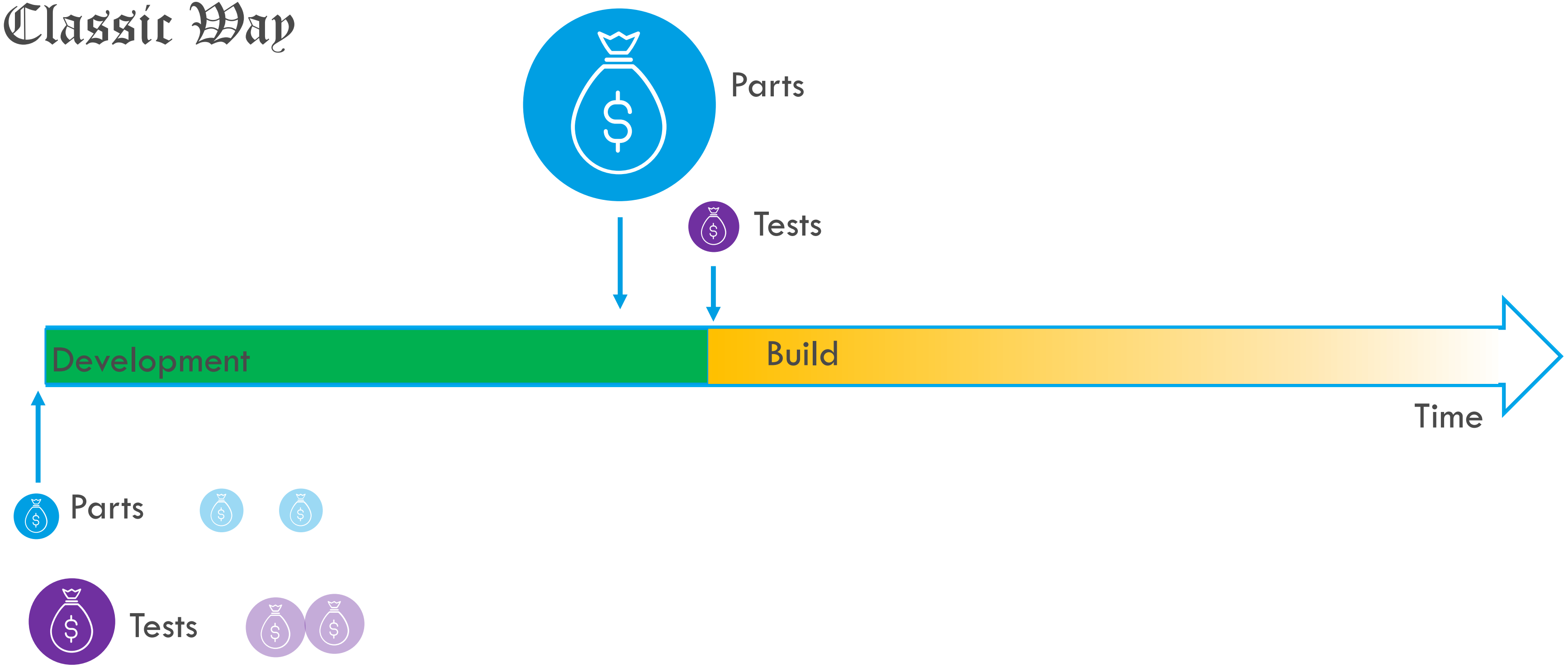
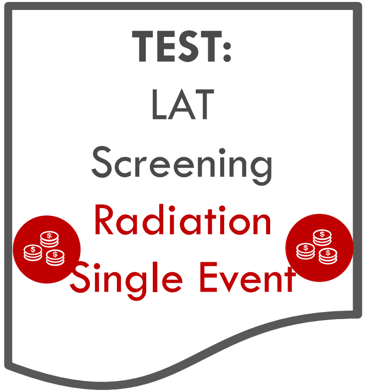
Classic Way



COTS Way

Risk Mitigation

Expensive Test Cost

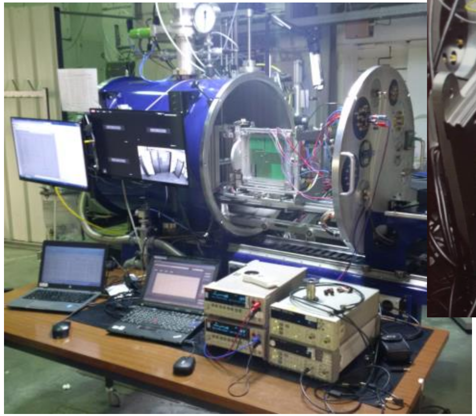


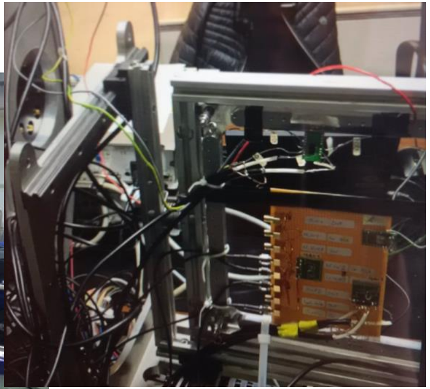
- Check availability of parts
- Check the technology (CMOS, BiCMOS, bipolar)
- Define critical effects for the given device type (N-MOSFETs, OpAmps, voltage ref., …)
- Check bias condition within application wrt. radiation sensitivity
- Reduce the number of different parts (e.g. MOSFETs)
- Define radiation source wrt. parts related critical parameters
  Examples:
  - MOSFET: Heavy ion
  - FPGA: Mitigation techniques and/or laser SEE testing
  - OpAmps: TID & SEE

- Open devices with JetEtcher, Laser, chemical ablation, …
- 1st step: Checking for destructive SEE by testing with Xe-ions (LET = 62.5 MeV/mg/cm²)
- Application conditions; not at (de-)rated bias voltage conditions
  - Regular coordination with development engineers
- Avoid to prepare detailed test plans
- Avoid extensive test board design
- Do not prepare test reports for failed parts

Target: Optimized thru-put time, fast results

- Test at UCL-HIF in Belgium
  - No transport issues
  - Pre booking initialized
  - Easy access to the device under test



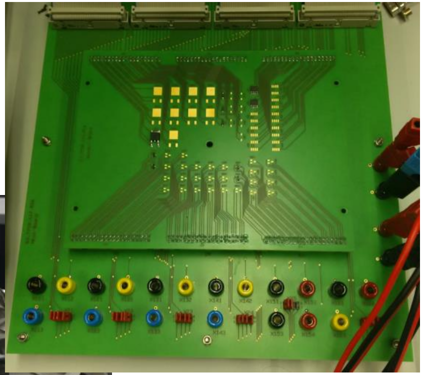


GENERAL: TID TESTING

- Fully automated measurement equipment developed to test different part types in parallel
- Generic mother-board and part-specific daughter-board
- Regular coordination with development engineers
  - Checking for relevant parameters
  - Apply application conditions
- Avoid to prepare detailed test plans and test reports
- Adapt daughter board for subsequent test campaigns

Target: Optimized thru-put time, fast results

- Test at F-INT in Euskirchen
  - No transport issues
  - Pre booking initialized
  - Test data will be provided w/o delay



Conclusion

- Use of COTS parts require early interaction:
  EEE Parts Engineer ⇔ Equipment Developer

- EEE Parts cost are low
  But: Test costs may eat up savings
  ➔ Change Equipment Development Process to mitigate risks and save costs

- Selection of parts & tests require experience
  - Save Test costs
  - Save development time (no redesign)

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Thanks for Your Attention

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