TÜV NORD AEROSPACE

ALTER TECHNOLOGY
Member of TÜV NORD

THE CHALLENGE OF ENSURING QUALITY IN A NON-INTEGRATED SUPPLY CHAIN

top ARBEITGEBER 2011 INGENIEURE
AWARDED BY THE CRF INSTITUTE

FAIR COMPANY
Die bessere Chance für Absolventinnen
Eine Initiative von Junge Karriere

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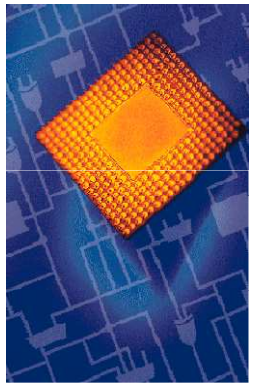
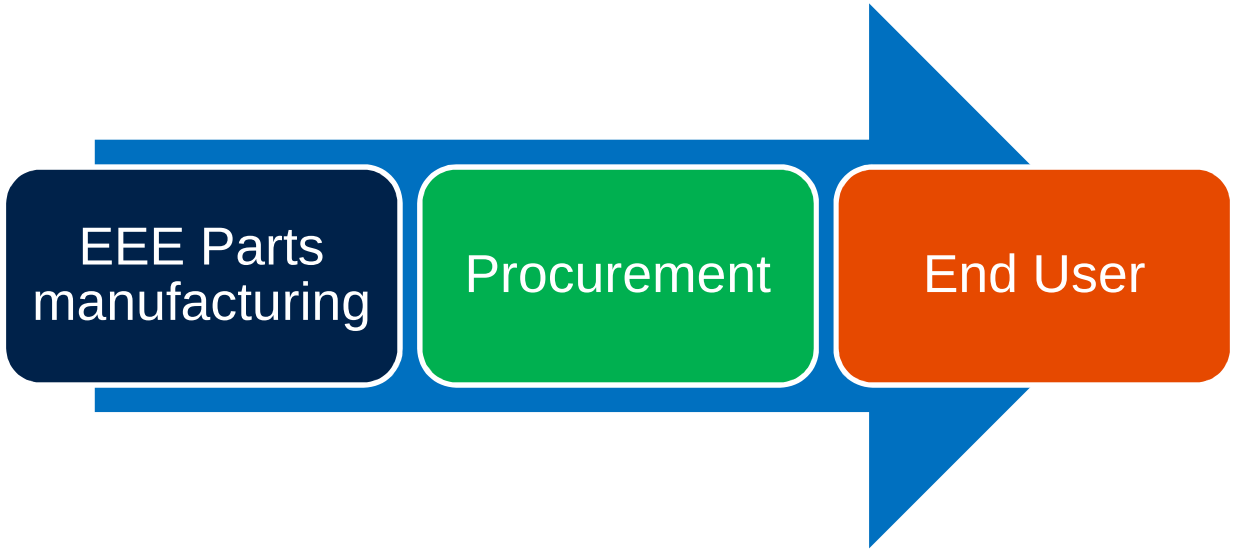
INTEGRATED SUPPLY CHAIN

The complete supply chain for a EEE part links the Manufacturer to the End User



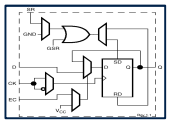


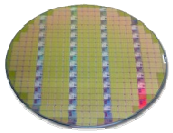
The Quality Assurance function must be implemented along the entire supply chain process, from the electronic functionality identification stage till the EEE component is installed and operating in the final hardware / application

SUPPLY CHAIN

Each step of the supply chain requires specific Quality Assurance steps to be considered and the proper data transfer between all the different elements

- *This integrated process is well established and known by the Space community*.

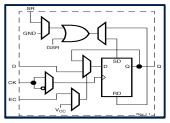




EEE PARTS MANUFACTURING	PROCUREMENT	FINAL USE
Design Verification	Selection	Equipment manufacturing
Wafer fabrication	Purchase	Validation
Assembly	Incoming procedures	
Testing	Logistics	
Qualification Industrialization		

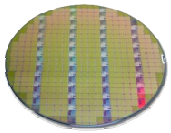
EEE PARTS MANUFACTURING STEPS

Most manufacturing steps are managed / controlled
by a single interface, with a deep technical knowledge of the overall process



Design Verification

Dedicated Design Rules for Space: spacing, layout …
Design aligned with PVT/Radiation performance target,
NPE & NPI checklists, Design For Quality, DFM etc…



Wafer fabrication

Total control on wafer fabs and technologies (SPC)
Probe test: BIST, Highest Test coverage, Maverick lots

Assembly

Validated and controlled processes
Defined rules in accordance with existing standards

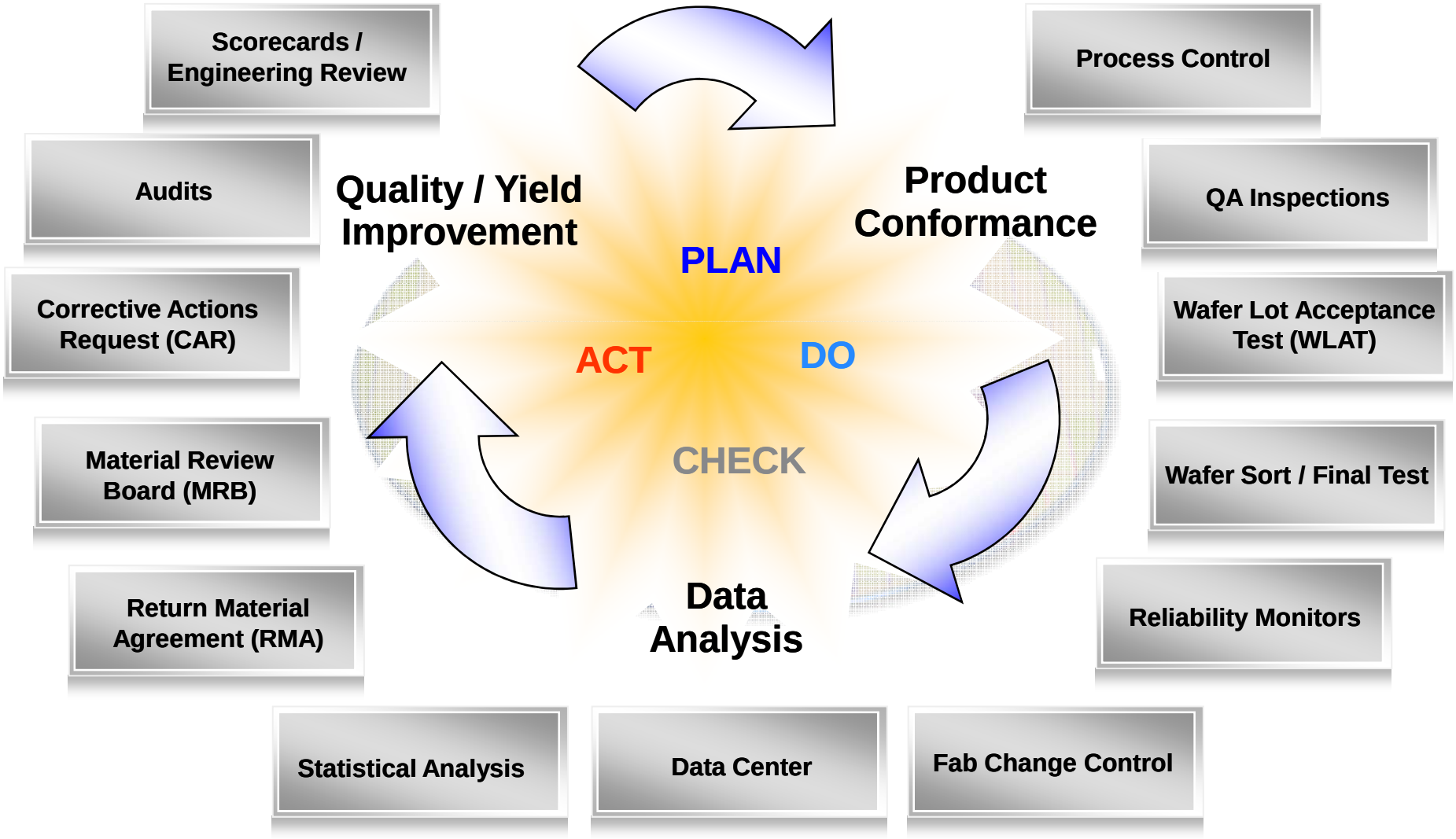
Testing

Maximum Test coverage: target 100%
Manufacturability (> min Test yield),
Defined rules in accordance with existing standards

Qualification Industrialization

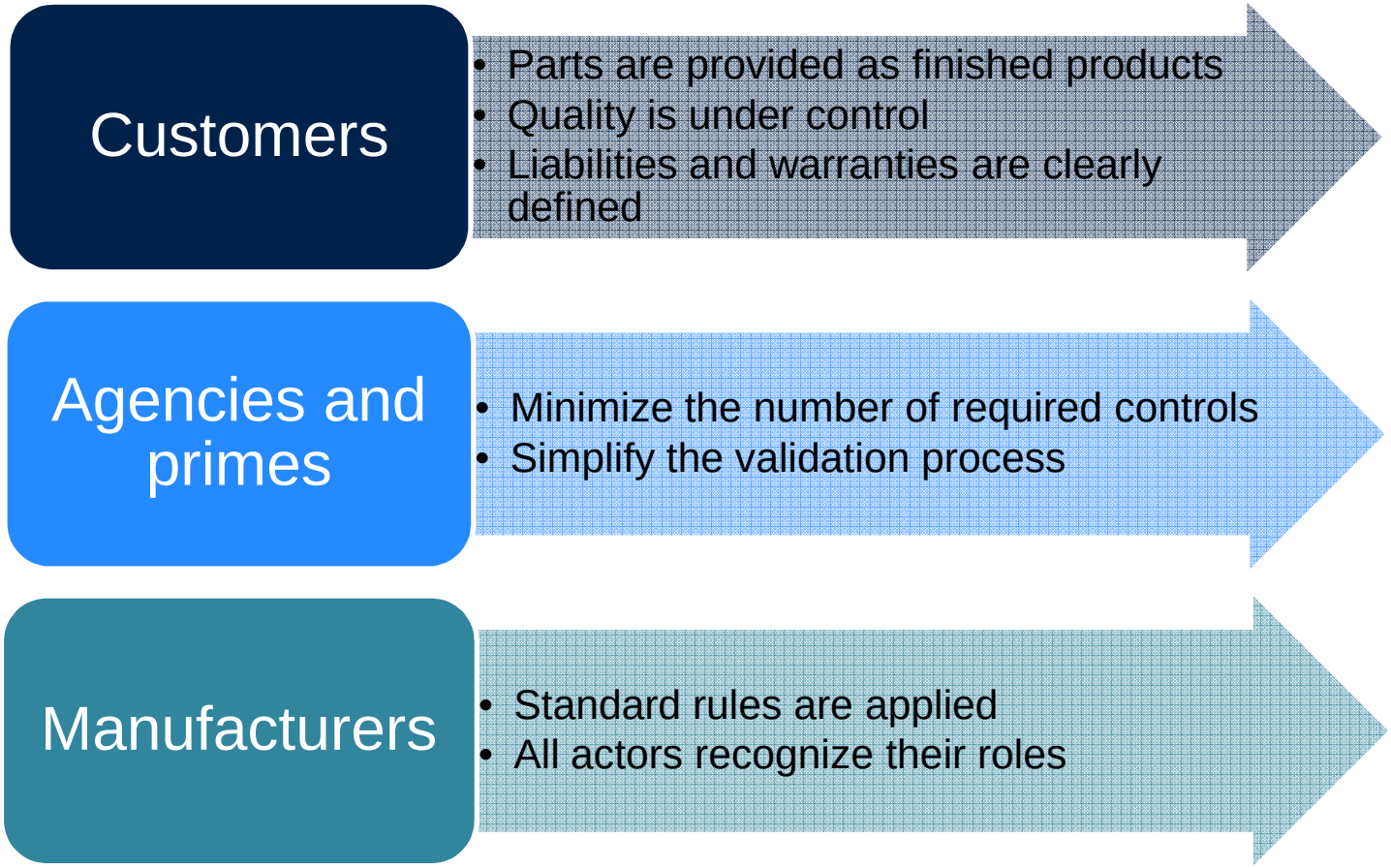
Product Qualification: HTOL, TC, THB, ESD, Latch-up...
Reliability / Radiation monitoring
Unique point of contact for technical and logistic needs

Example: EEE part Mfr Quality Systems



SINGLE INTERFACE FOR MANUFACTURING

This approach generates obvious advantages being all Quality Assurance requirements properly defined and controlled.



THE SPACE TRANSFORMATION

- **Today's Space platforms must be**
  - *Precision guided,*
  - *Rapidly deployable,*
  - *Joint service,*
  - *Modular,*
  - *and Secure.*

- **So, Space System engineers are looking for**
  - *Flexible and re-useable platforms,*
  - *Integrating complex signal processing algorithms on-board,*
  - *System On Chip (SoC) capabilities (feeds SWaP-C)*
  - *Time to Market (TTM),*
  - *Security of HW vs SW.*

SWAP-C

- SWaP-C
  - ***Stands for Size, Weight and Power + Cost***
    (Budget sensitive)

- Systems must be
  - ***Smaller***
  - ***Lighter***
  - ***Using small batteries***
- Systems must fit with limited budget
  - ***Generic platforms***
  - ***Re-useable platforms***
  - ***Longer life cycle***

NEW REQUIREMENTS

These requirements might render the existing Integrated Supply Chain *insufficient* to provide *the required response* to the current market demands

In a Non Integrated EEE Component supply chain, the final product is generated by a number of different entities, specialised in specific disciplines, who contribute to a portion of the final device process, but without a unique overall responsible.

NON INTEGRATED SUPPLY CHAIN

The answer to these demands can be found sometimes making use of a Non-Integrated Supply Chain for manufacturing

Among others, the most typical solutions will be:

1. *Space dice in special configurations*
2. *Specific developments*
3. *Commercial dice on hermetic or space compatible packages*
4. *Use of COTS*

Whenever these solutions are provided by a manufacturer as a «product», such product is considered as coming from an integrated supply chain, being that manufacturer the unique responsible for the final product

SPACE DICE IN SPECIAL CONFIGURATIONS

Design and wafer acceptance based on the manufacturer

Package and configuration are customized

How is assembly house selected?
How are performances guaranteed?

Testing

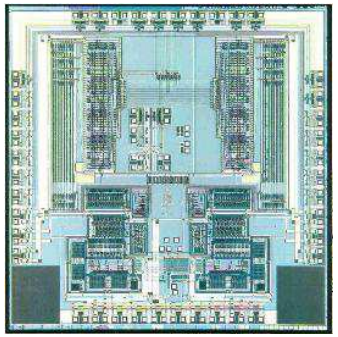
In accordance with which specification (DC / AC, 100%, Temp.range)?
In case of failure, is it die/Mfr or packaging/Assembly house related?

Industrialization

How is guarantee provided?
How is liability transferred from one step to the next?

NEW REQUIREMENTS 2

SPECIFIC DEVELOPMENTS



Custom Design (ASIC)

Experience on Radiation Tolerant design?
Liability on final product performance?

Package and configuration customized

How is assembly house selected?
How are performances guaranteed?

Testing

In accordance with which specification (DC/AC, 100%, Temp.range)?
In case of failure, is it die/Mfr or packaging/Assembly house related?

Industrialization

How is guarantee provided?
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NEW REQUIREMENTS 3

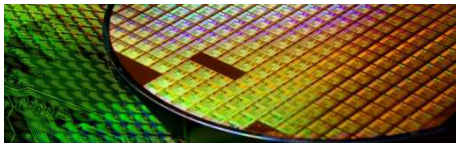
PACKAGING OF COMMERCIAL DICE

Commercial Design, not done in accordance with space rules

Wafer Lot Acceptance done on a custom basis

Die manufacturer accepts no liability on performance
Are standard WLAT rules applicable?

Package and configuration customized



How is assembly house selected?
How are performances guaranteed?

Testing

In accordance with which specification (DC/AC, 100%, Temps.range)?
In case of failure, is it die/Mfr or packaging/Assembly house related?

Industrialization

How is guarantee provided?
How is liability transferred from one step to the next?

USE OF COTS

Commercial Design / not done in accordance with Space rules

From which Waferfab location? With SPC? Die selection?

Testing

In accordance with which specification (DC/AC, 100%, Temp.range)?
In case of failure, is it die/Mfr or packaging/Assembly house related?

Industrialization

How is guarantee provided?
How is liability transferred from one step to the next?
Are results predictable and repeatable?

SUMMARY FROM NEW REQUIREMENTS

- The **Non-Integrated Supply Chain** for parts manufacturing might appear as the only feasible solution in certain circumstances.
- The fact that different uncoordinated actors are involved in the process increases the uncertainties, even if standards and space requirements are imposed.
- The overall process control requires a strong infrastructure from customers / primes / agencies, difficult to put in place.
- Lack of certifications and validations of actors involved in differents steps makes it difficult, the selection of reliable sources.
- Imposing a global control of the flow, ensuring all required steps are processed under controlled and approved procedures appears as the most efficient approach.
- Liability on final product performance appears as the most complex issue to be resolved.

PROCUREMENT 1

INTEGRATED CHAIN BY CUSTOMER	NON INTEGRATED CHAIN
Parts selection	External parts selection support
Direct purchasing from Manufacturer	Purchasing through buying channels
Follow-up and export control	Follow-up and export control linked to buying channel
Acceptance and validation	Incoming procedures subcontracted
Internal logistics	Logistics externalized

Both methodologies should live together to provide the users with the right options to cover their EEE Components demands.

PROCUREMENT 2

- Procurement of **Space level parts** requires additional steps, compared to standard parts purchasing
- There are **no** specific procedures and standards detailing many of the activities to be performed
- The **Lack** of certifications and validations of actors involved in the differents steps makes it difficult the selection of reliable sources
- These **drawbacks** are particularly evident during the acceptance and validation tests
- Non Conformance management (NCR) can be a **tremendously** time consuming activity.
- **Confidence** that all steps are properly covered requires prior and after activity controls

CONCLUSIONS

Current market demands require the ***adoption of new processes*** and ***activities.***

Space market requires ***normalized procedures*** sometimes difficult to apply to new activities and technologies

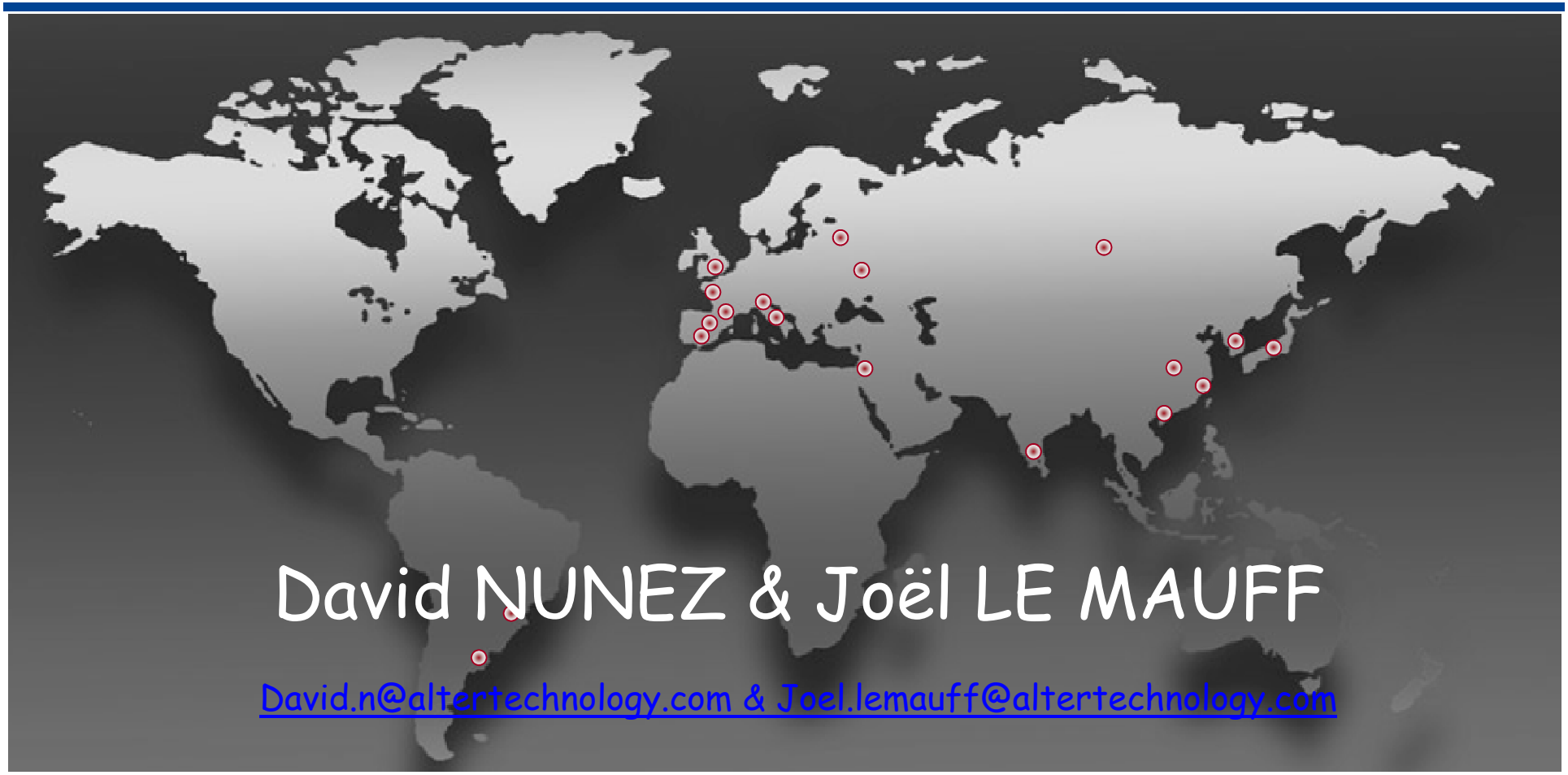
The ***lack of procedures, standards and certifications*** require additional steps to guarantee reliability of some of the solutions provided

Market needs are evolving ***faster*** than normalization procedures so we need to be ready to adapt our behaviour to the new environment

Reduction on Quality Assurance requirements ***cannot be a response*** to this demand

Liability and final results controls appear to be the ***weakest points*** of every solution provided

THANKS FOR YOUR ATTENTION



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ACRONYMS

ASIC	Application Specific Integrated Circuit
BIST	Built-In Self-Test
CAR	Corrective Actions review
COTS	Commercial On-The-Shelves
DFM	Design For Manufacturability
EEE	Electrical, Electromechanical and Electronic
ESD	Electro-Static Discharge
HTOL	High temperature Operating Life
MRB	Material review Board
NCR	Non-Conformance Review
NPE	New Product Evaluation
NPI	New Product Introduction
PVT	Process, Voltage and Temperature
RMA	Return Material Agreement
SOC	System On Chip
SPC	Statistical Process Control
SWAP	Size, Weight and Power
TC	Thermal Cycling
THB	Temperature Humidity Bias
TTM	Time-To Market
WLAT	Wafer Lot Acceptance Test