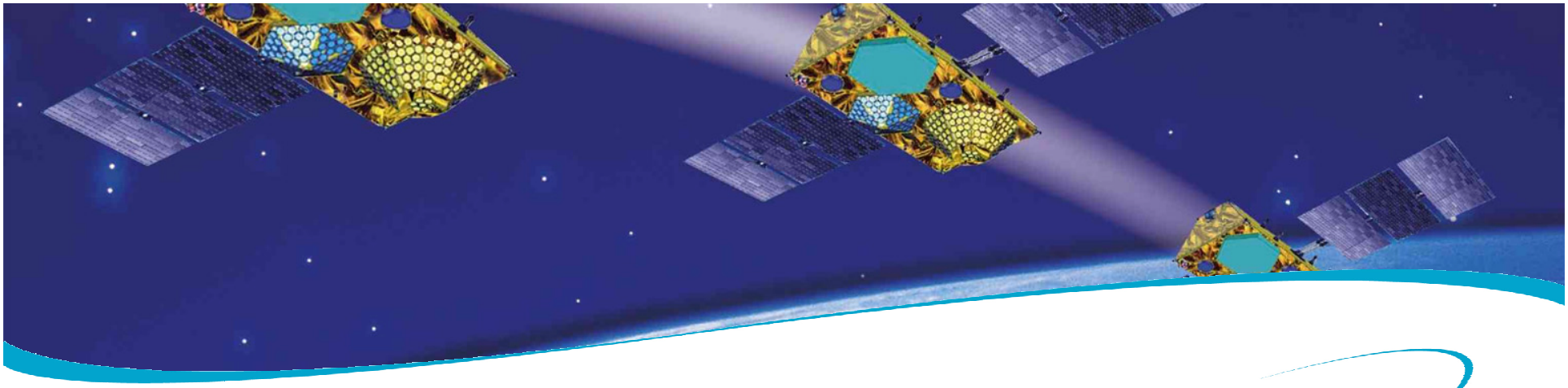


ThalesAlenia Space
A Thales / Finmeccanica Company

Challenges and Opportunities for EEE parts in Constellations,

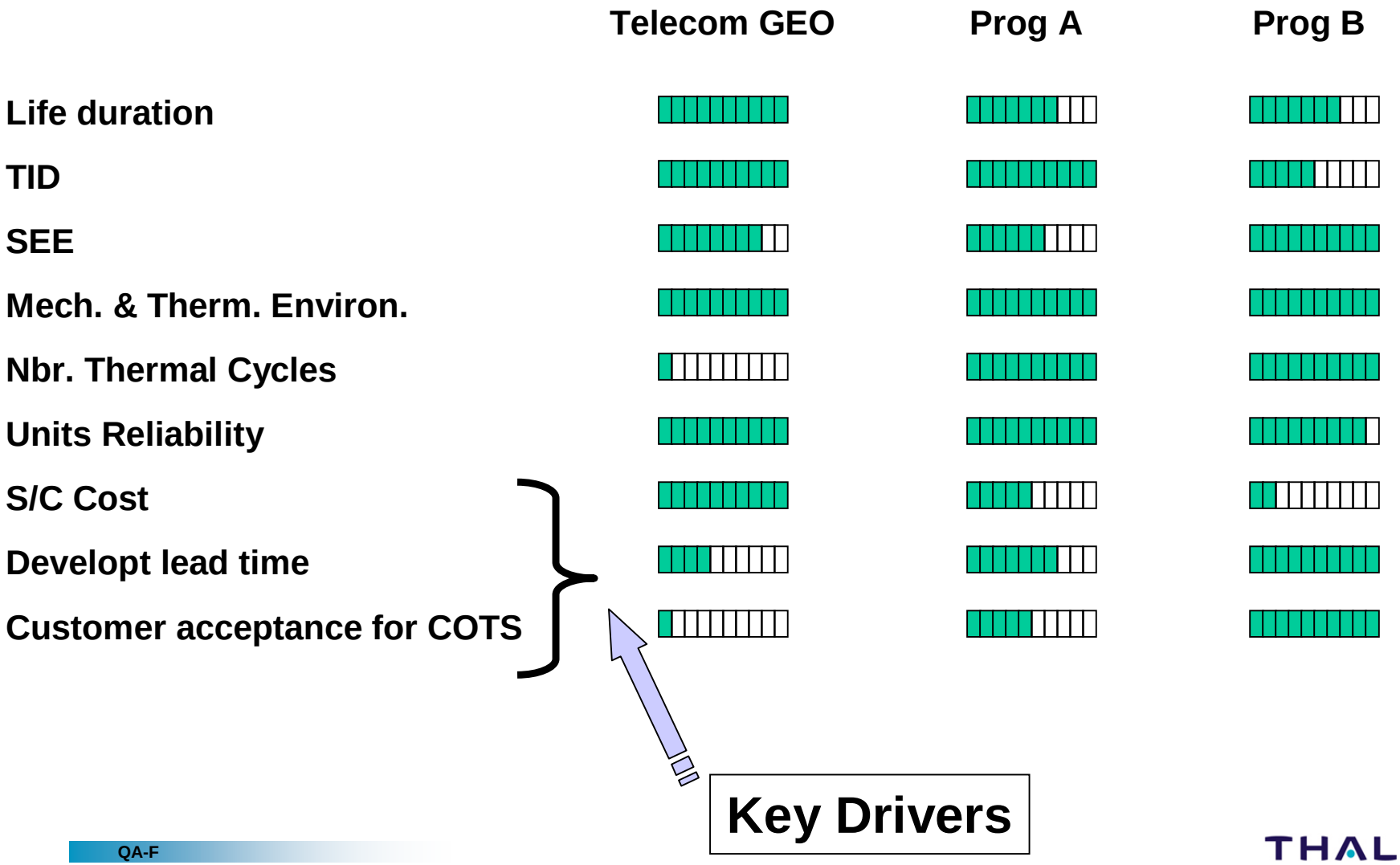
O. Rémondière, Y. Folco – ESCCON 2011, 15-17/03/2011 @ ESTEC

Template reference : 100181703F-EN

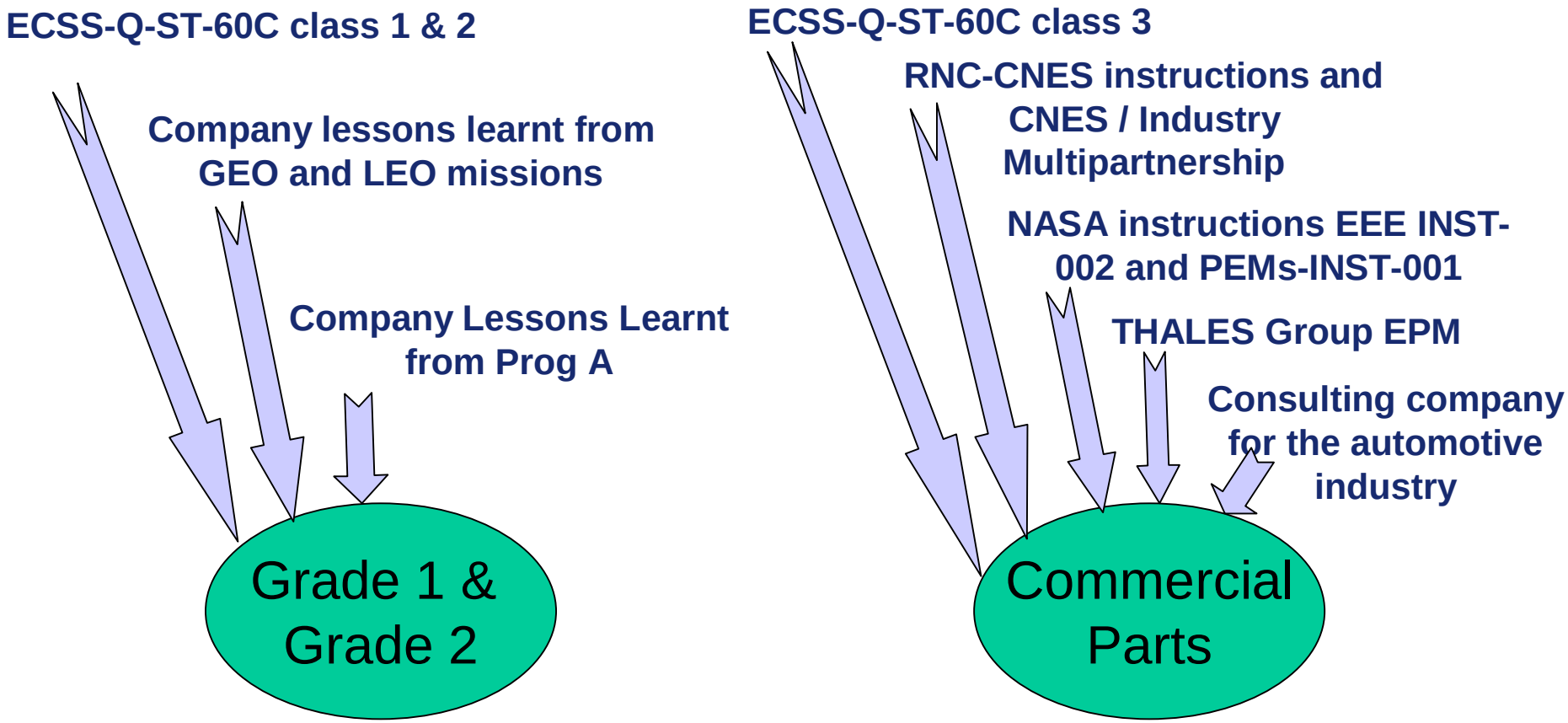
THALES

- Drivers for EEE parts policy
- ThalèsAleniaSpace EEE parts policy for Constellations
- Consequences
- Risks
- Conclusions

Drivers for EEE parts policy



Where is it coming from ?



TAS EEE parts Policy

Telecom GEO	PROG A	PROG B
Parts Management Process : Per ECSS-Q-60 class 1	Parts Management Process: Per ECSS-Q-60 class 1 & 2 equivalent	Parts Management Process per ECSS-Q-60 class 2 & 3 equivalent
Class 1 / Grade 1, mandatory for : ALL PARTS	Class 1 / Grade 1, Mandatory for : Crystal Oscillators, Crystals, Hybrids from non space qual line, EMI filters Electromagnetics Relays, Tantalum chips capacitors, Stacked ceramic chips capacitors, Cermet Fuses , Connectors at equipement interfaces	Class 1 / Grade 1, Mandatory for: Crystal Oscillators, Crystals, Hybrids from non space qual line, EMI filters, Electromagnetics Relays, Tantalum chips capacitors, Stacked ceramic chips capacitors,, Cermet Fuses, Connectors at equipement interfaces
Grade 2: NO PARTS	Grade 2 minimum : Microcircuits , RF active devices , Rectifier, Zener, Signal Diodes, Bipolar transistors, arrays, FET, JFET, Power MOSFET, Opto-couplers, Hybrids from MIL QPL, Some passive parts (Interesting for re-use of existing design , originally populated with Grade 1 parts)	Grade 2 minimum : Thermistors, Connectors and Contacts, passive parts, Hybrids from space qual lines (an all other functions if Interesting for re-use of existing design , originally populated with Grade 1 parts)
COTS: NO PARTS	COTS allowed on case by case basis (performance): Few Microcircuits and RF active devices	COTS allowed as general policy : PEMs and PEDs (all functions): Packaged Microcircuits including MMICs; Rectifier, Zener, Signal Diodes; Low power Bipolar, FET, JFET, transistors arrays, Commercial I.R power MOSFET, Opto-couplers

General Policy

- To offer the best compromise between Risks, Quality and Cost
- To consider alternative policies applied on similar programs from sub-contractors
- To allow the use of grade 1, grade 2 and COTS
- Proposals with key components preliminary Parts List , Parts heritage and contractor policy for COTS screening

Evaluation and Qualification Policy for PEMs and PEDs

- The requirements provide - in base line - a qualification test flow (adapted from NASA / CNES flow)
- Alternative approaches such as Manufacturer qualification data or Sub-contractor proposal based on Internal parts policies for similar programs are acceptable. In both cases, two first Go / No Go criteria for lot acceptability are:
  - Successful Radiation tests or data
  - Constructional analysis.

Screening Policy for COTS

- The requirements provide 3 options regarding youth defect parts elimination
  - 100% Screening. When feasible, Test flow and sensitive parameter tables are provided
  - Justification based on Manufacturer SPC data
  - Burn-In and/or Cycling tests at PCB assembly or at Equipment level
- Alternative proposals from sub-contractor for similar programs are acceptable

Pure Tin issues with COTS

- PEMs and PEDs comes from RoHs fabrication lines (Pure tin terminals)
  - Tin whiskers can develop and create short circuits
  - The Contractor shall propose mitigation strategies to prevent whiskers induced failures
  - The requirements provide Guide lines for Pure Tin risk mitigation

Commercial Parts Procurement and Obsolescence management

- The requirements provide cost oriented guide lines
  - Procurement in single lot preferably → One test campaign
  - Procurement for the total needs of the program → COTS life cycle is incompatible with the program duration
  - Huge quantities needed . (More than 40 000 for one PEM for example)

Consequences

Consistency of all PA requirements is key to enable the use of COTS

- **Reliability and Failure rate predictions have to be adapted to take benefit from COTS**
  - Unit and Parts life time demonstration is a matter of evaluation and qualification
  - Unit Failure Rate is a matter of prediction
    - Based preferably on TAS tailoring of MIL-HDBK-217 from Lessons Learnt
    - Or on Sub-Contractor proposed approach
- **Mounting processes Qualifications have to be adapted and complemented for PEMs**
  - Storage, mounting, rework and repair (IPC/JEDEC J-STD-020A)
  - Mounting process validation per Lot
  - Tin whiskers mitigation at PBA level
  - Demonstration of Inspection efficiency and / or Process Control for Grid Arrays
  - Specific validation for Glob Top technologies / 3D technologies

Risks

Risks	Mitigation
Lack of experience related to COTS selection and management	Support from Thales Group EPM . Thales PPL Access Mapping of COTS selection from contractors versus Thales PPL entries and current status (Qual, EOL, etc) Contractor heritage and running programs with COTS
Lack of Engineering support to review and approve Justification Files	To ensure enough resources at Prime and Contractors level early in the Program
Late « showstopper » during part validation wrt Unit developement	To approve very early the parts selection in order to allow early unique batch procurement and validation before freezing the design
Support from Manufacturers in case of problems	Early and full validation of the lots allowing back-up strategies in case of issues
COTS Obsolescence	Procurement for the entire program and improved storage conditions
Tin Whiskers	State-of-the art risk mitigation guidelines included in the requirements
100% reliable traceability	To procure as far as possible from OEM. To get from the supplier all the available traceability elements

Conclusion

Good feedback from the market during PROG B RFPs for Units

- **Requirements are understood**
- **Positive Feed-back from equipment manufacturers involved on previous constellations program**
- **95% of proposals received with key components preliminary parts lists.**
- **When COTS are proposed, their management are fitting with expectations**
- **Generally, proposals are taking benefits from the requirements to offer high performance at low cost**