

Parts Requirements for a Global Space Equipment Market - An Equipment Manufacturer's Point of View

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Objective of the Presentation

- To show how EEE parts requirements affect the manufacture and sale of equipment manufactured by Tesat-Spacecom and sold to customers around the world
- Give some insight into the typical requirements of our various different customers in different geographical areas
- Give examples of problem areas and how they affect our business

Tesat-Spacecom as a Global Equipment Supplier: Portfolio

Key Figures

Location	Backnang, Germany
Core Business	Spacecom Satellite Payload Equipment & Subsystems
Employees 2012	1300
Turnover 2012	300 Mio Euro
Equipment Capacity	Up to 1500 Units per Year
Programs	Up to 75 per year
Homepage	www.tesat.de

Tesat Company Sectors

Amplifier Products

Passive Microwave Products

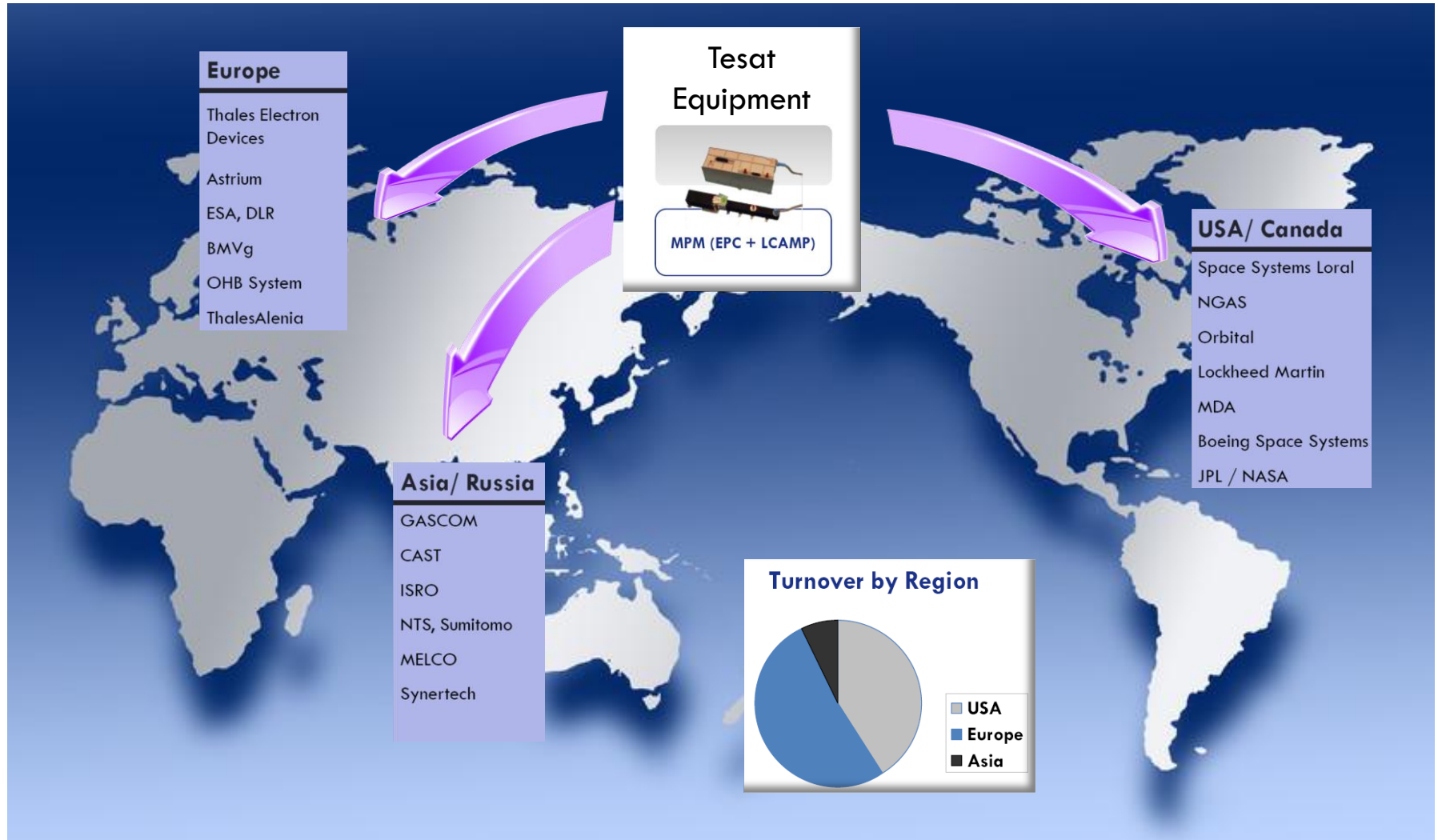
Datalink Products

Laser Products

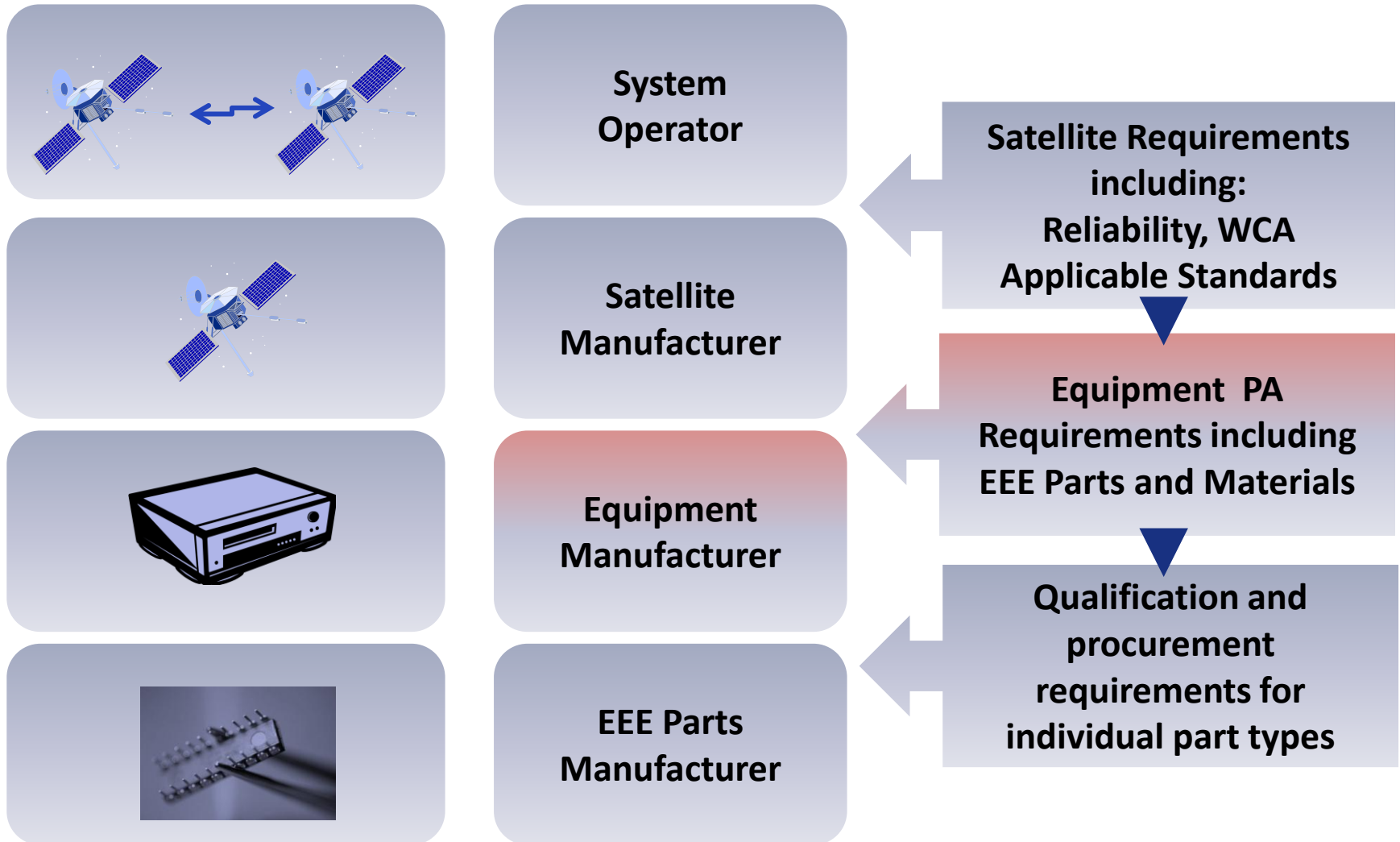
Communication Payloads

Parts Agent

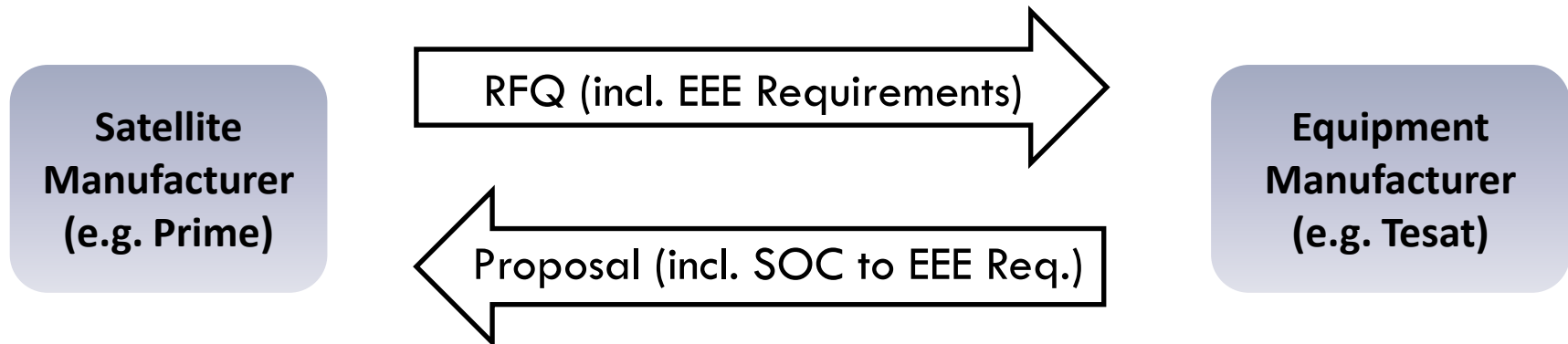
Tesat-Spacecom as a Global Equipment Supplier: Globalisation



Requirements Flow-Down



Typical RFQ Process



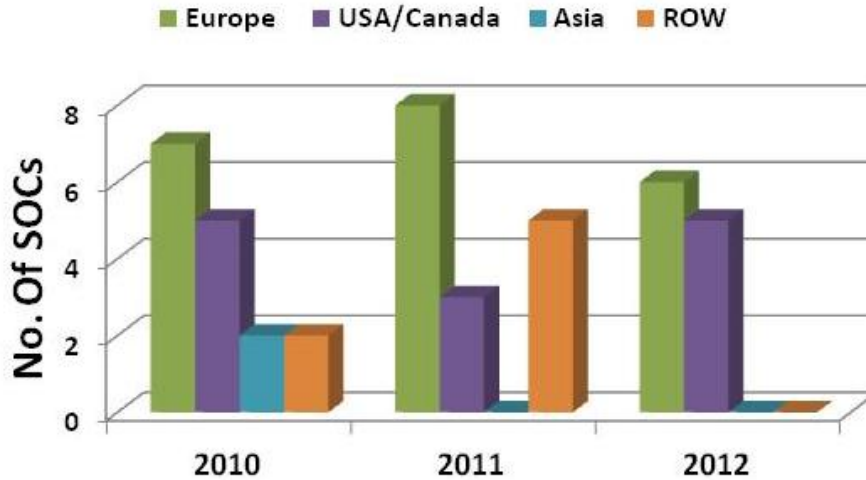
• For Tesat:

- Several hundred proposals per year
- SOC to EEE parts requirements usually available from previous proposals because customers use the same parts requirements documents (for Telecom Satellites, GEO and Mission Duration >15Y)
- Approximately 15 new SOC to EEE parts requirements generated each year

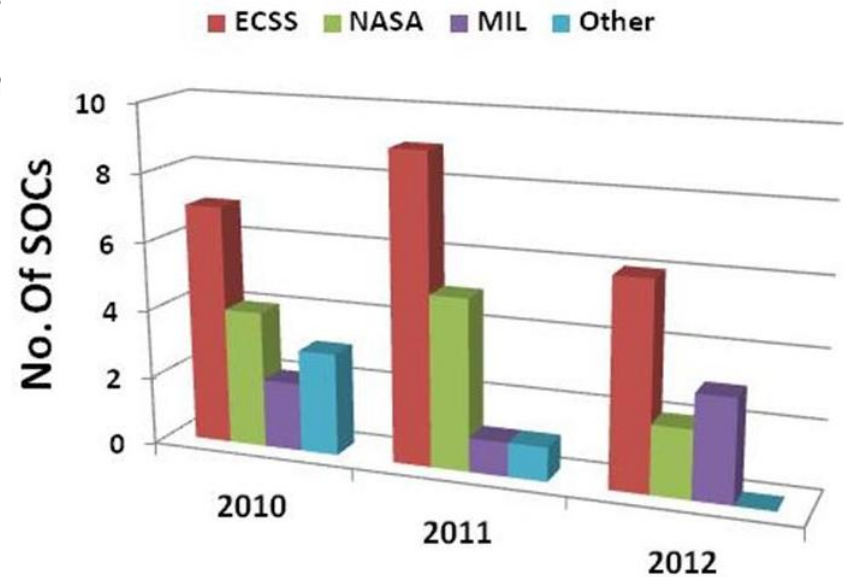
RFQ = Request For Quotation; SOC = Statement of Conformance

Tesat Statistics on SOCs

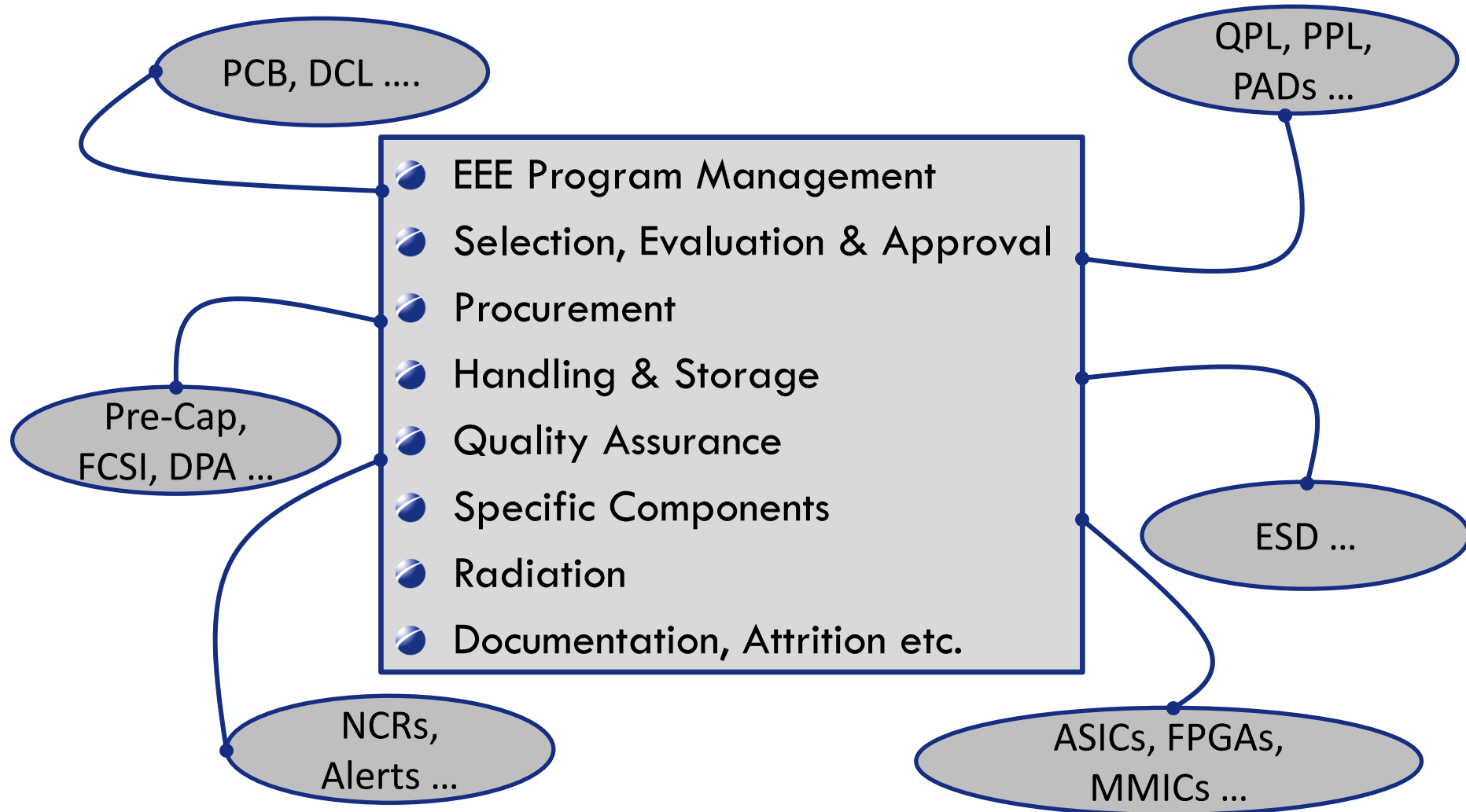
SOCs to EEE Parts Requirements



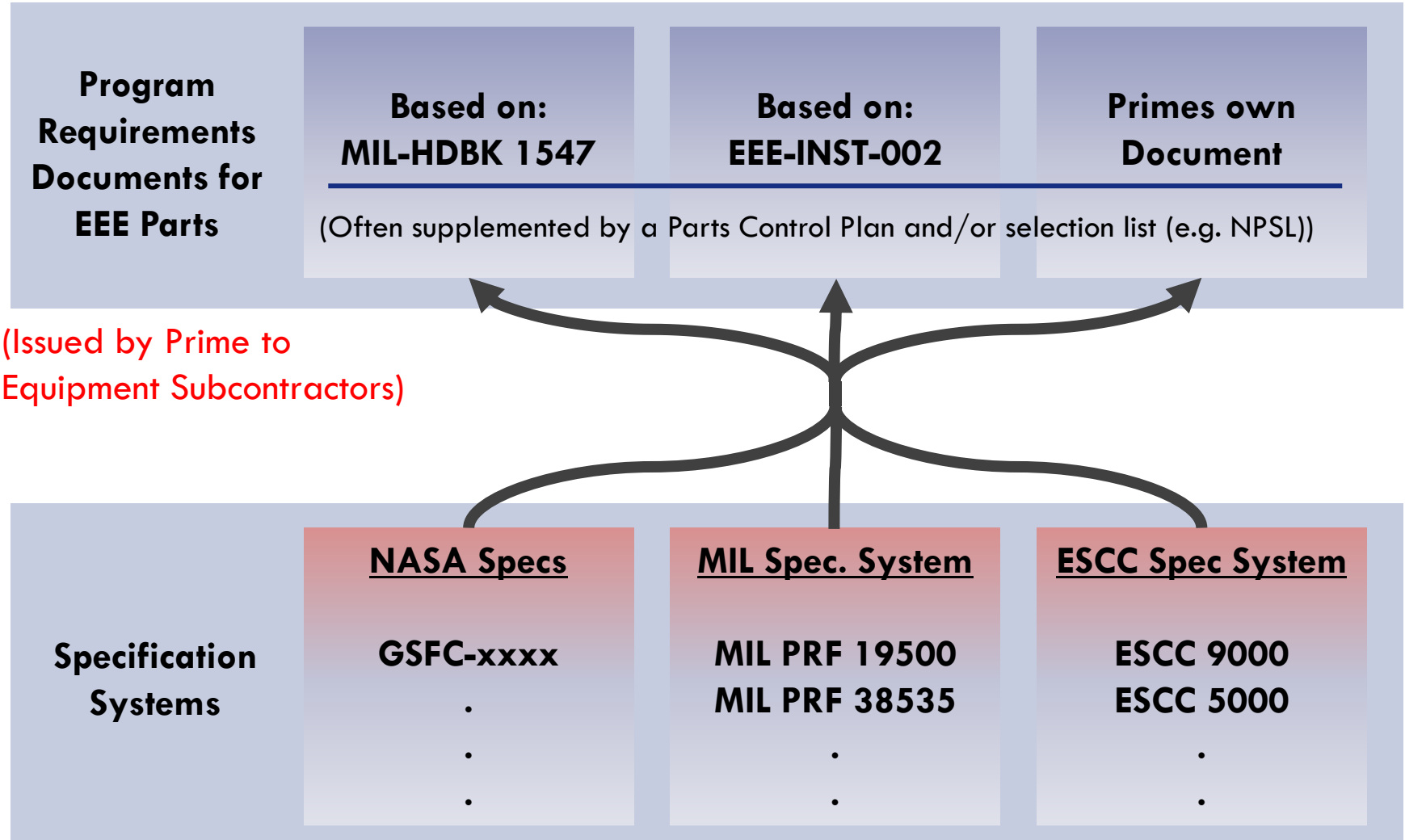
SOCs to EEE Parts Requirements



Typical EEE Requirements



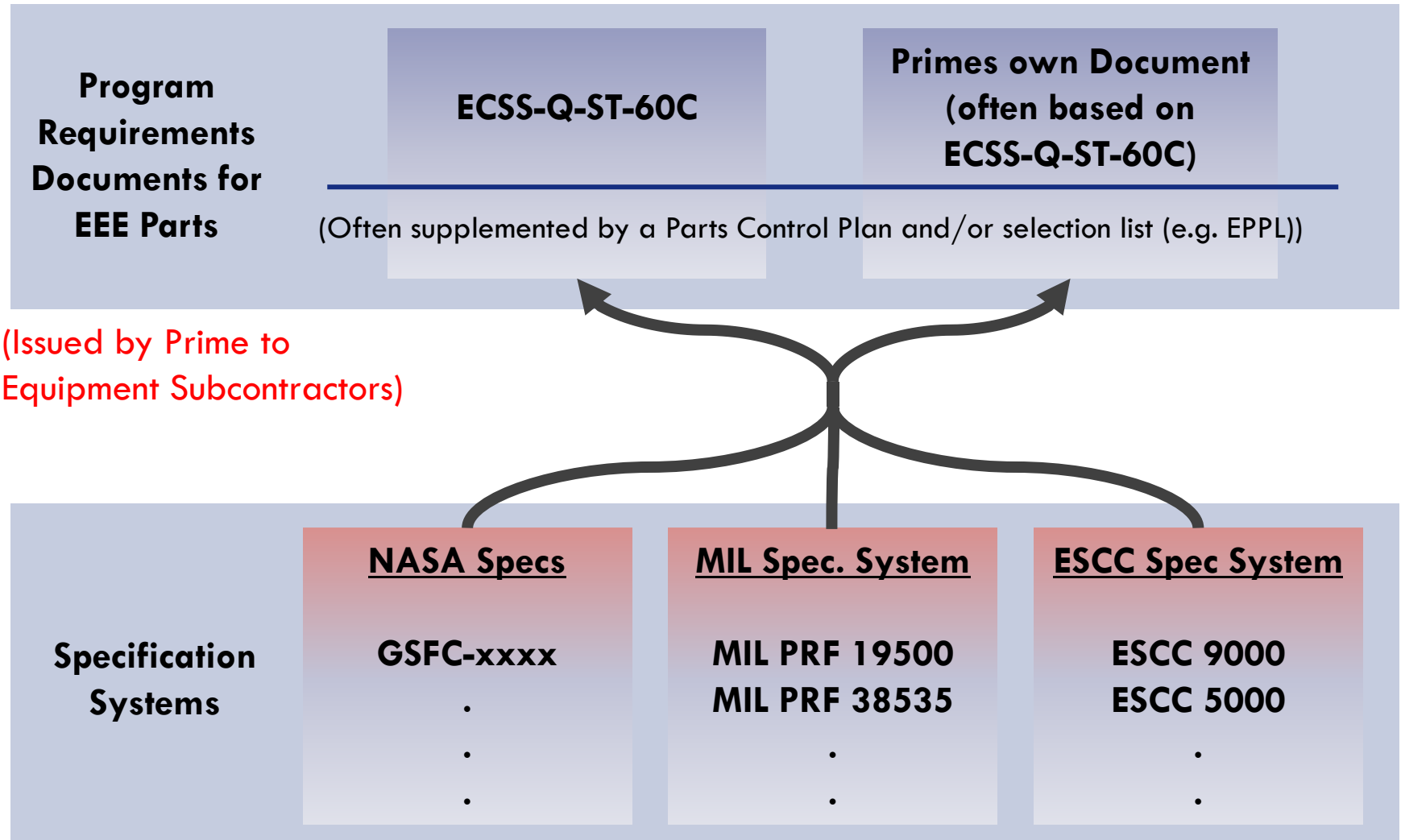
US Parts Requirements Documents



US Parts Requirements Documents

Based on:	Commercial Space programs	NASA programs	Military programs
MIL-HDBK 1547	Normally not	Normally not	Applicable
EEE-INST-002	Sometimes Applicable	Applicable	Normally not
Primes own Document	Sometimes (often based on EEE-INST-002)	Sometimes (often based on EEE-INST-002)	Sometimes (often based on MIL-HDBK 1547)

European Parts Requirements Documents



European Parts Requirements Documents

Based on:	Commercial Space programs	ESA programs	NSA & Military programs
ECSS Q60	Applicable	Applicable	Applicable
Primes own Document	Often (usually based on ECSS Q60)	Often (usually based on ECSS Q60)	Often (usually based on ECSS Q60)

NSA = National Space Agency of a European Country (e.g. DLR,CNES...)

Asia & ROW Parts Requirements

- Many Asian and ROW countries adopt the systems applied in the US and Europe and embed them in their own EEE parts requirements
- In some cases, notably Japan, the parts selection lists are supplemented by lists of Japanese parts that have been qualified by the country's space agency
- Some customers do not require the Parts Control Board system as usually implemented for US and European programmes
- Up to now, in all cases, self procurement of the parts for use in the equipment has been applied

Tesat Approach to Customer's EEE Parts Requirements

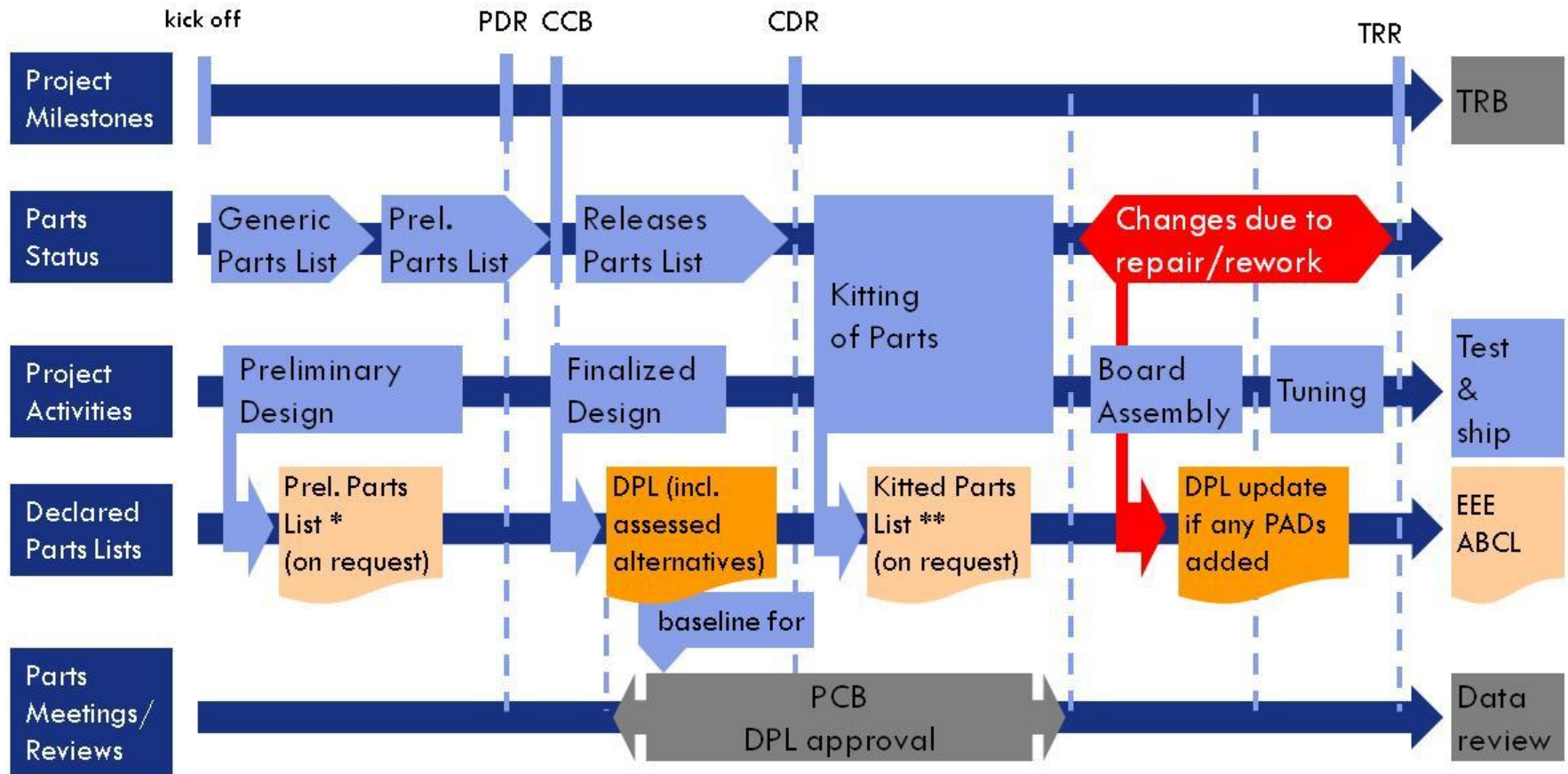
- General Approach:
 - Uncommitted procurement in advance
 - **Procurement according to a Tesat internal standard that covers all customer requirements**
 - Exchangeability of form fit function parts
 - Generic parts used for circuit design
- Advantages:
 - Meet customer project schedule
 - Design activities independent of the actually used parts
 - Procurement of form fit function equivalent parts independent of projects
 - Reduced risk of parts shortages
- Disadvantages
 - Predictability of parts t used in a project
 - Parts preferences of customers difficult to handle

A specific customer interface team takes care of:

- Tesat Quality Level
- Sales Support
- Review of customer requirements
- SOCs & DCLs
- PCBs
- EEE review meetings
- Subcontractor EEE parts

Tesat Approach to Customer's EEE Parts Requirements

Process to align EEE parts used with customers' requirements

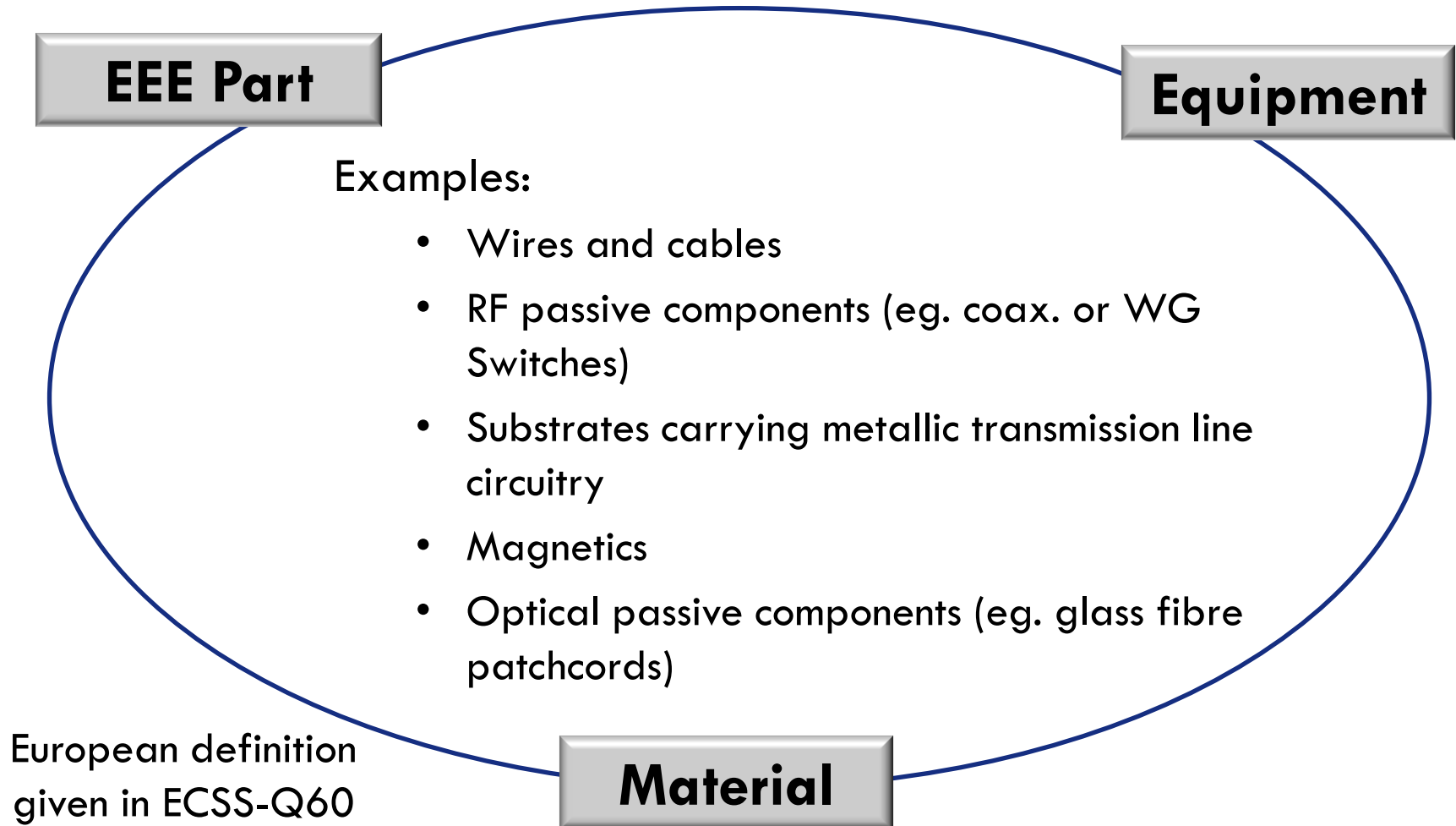


Problem Areas

- Definition of EEE Parts
 - Different for different customers and countries
- Procurement in Advance
 - Unavoidable due to the schedule requirements in most programmes
 - Procurement according to a standard satisfying all customers requirements
- Export Restrictions
 - Equipment designs using export restricted parts and equipment designs without export restricted parts
- Values, Ranges and Sizes
 - Differences between US and European systems must be accepted by the customer
- Storage and Relifing
 - ECSS relifing standard not accepted by all US customers and programmes
- Maintenance of Supply
 - The biggest problem of all

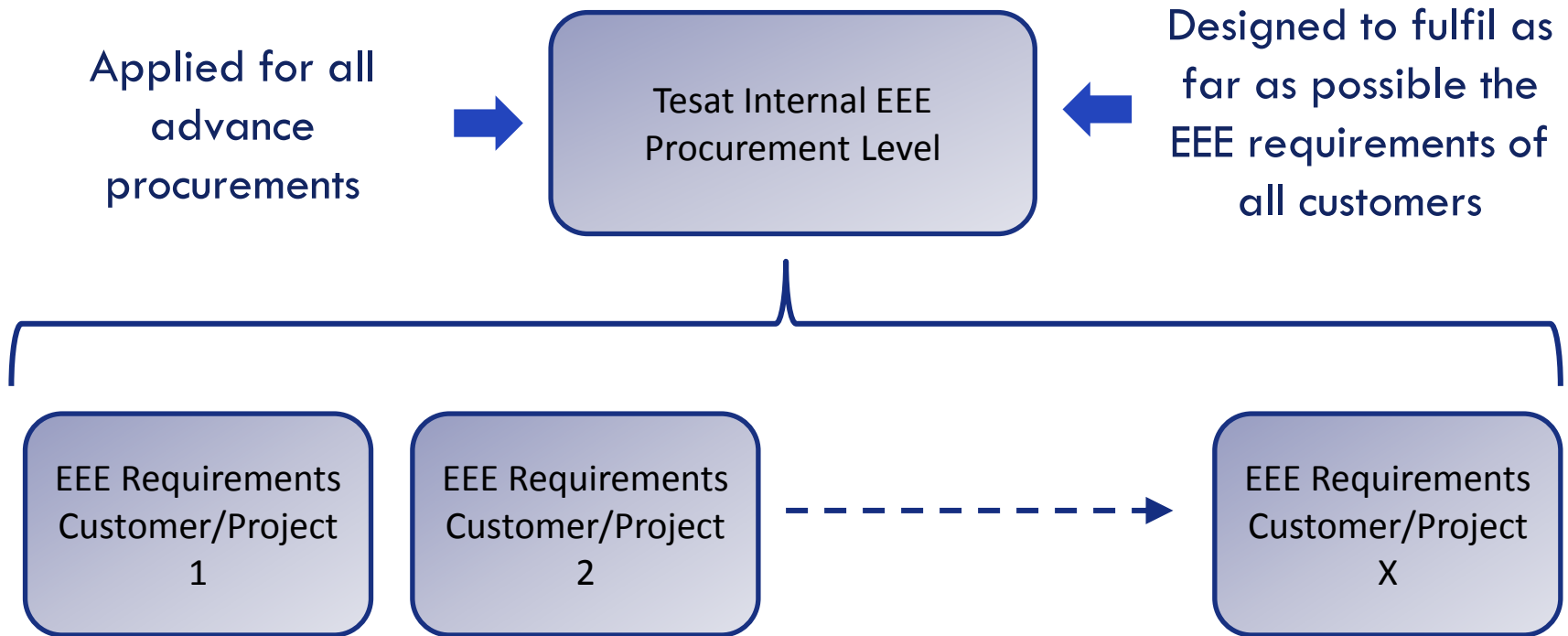
Problem Areas

Definition of EEE Parts



Problem Areas

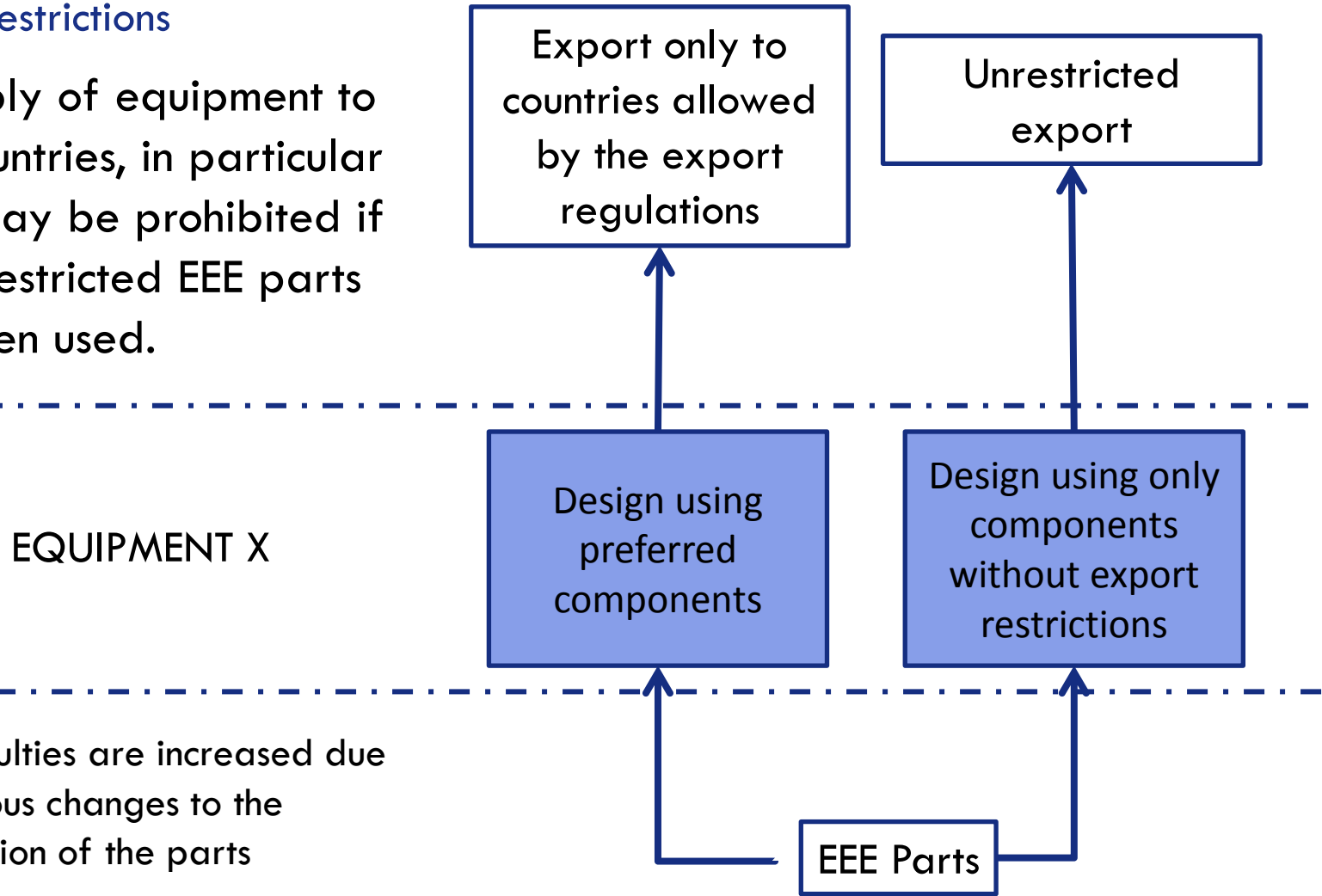
Procurement in Advance



Problem Areas

Export Restrictions

The supply of equipment to some countries, in particular China, may be prohibited if export restricted EEE parts have been used.



EQUIPMENT X

The difficulties are increased due to numerous changes to the classification of the parts (e.g. EAR99 => ITAR => EAR99)

Problem Areas

Values, Ranges and Sizes

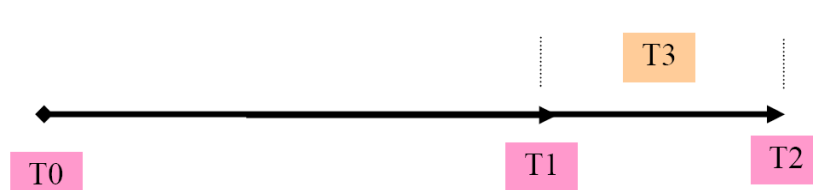
- Equipment designed using some passive part types (eg. Ceramic chip capacitors or stacked ceramic capacitors) cannot be easily modified to fulfil the requirements of the other system.
- Customers have to accept the parts selected by the equipment manufacturer
- Example: Sizes
 - European sizes based on the metric system, US sizes based on imperial measure (inches)
 - Examples:
 - EU CDR31.. and US CDR01.. (ceramic chip capacitors)
 - EU CH-Style and US SM-Style (stacked ceramic capacitors)

Size	MIL (inch)		MIL (metric)	Europ (metric)
	MIL-PRF -123	MIL-PRF -55681	MIL-PRF -55681	ESCC
0603				3009/038
0805		CDR01	CDR31	3009/008
1206			CDR32	3009/023
1210	CKS52		CDR33	3009/009
1805		CDR02		
1808	CKS53	CDR03		
1812		CDR04	CDR34	3009/010
1825		CDR05		
2220				3009/011
2225	CKS54	CDR06		
2518			CDR35	

Problem Areas

Storage and Relifing

ECSS-Q-ST-60-14C



T0 : Original date code

T1 : Maximum allowed storage period from T0 with no relifing control

T2 : Maximum duration between the original date code of part and its mounting

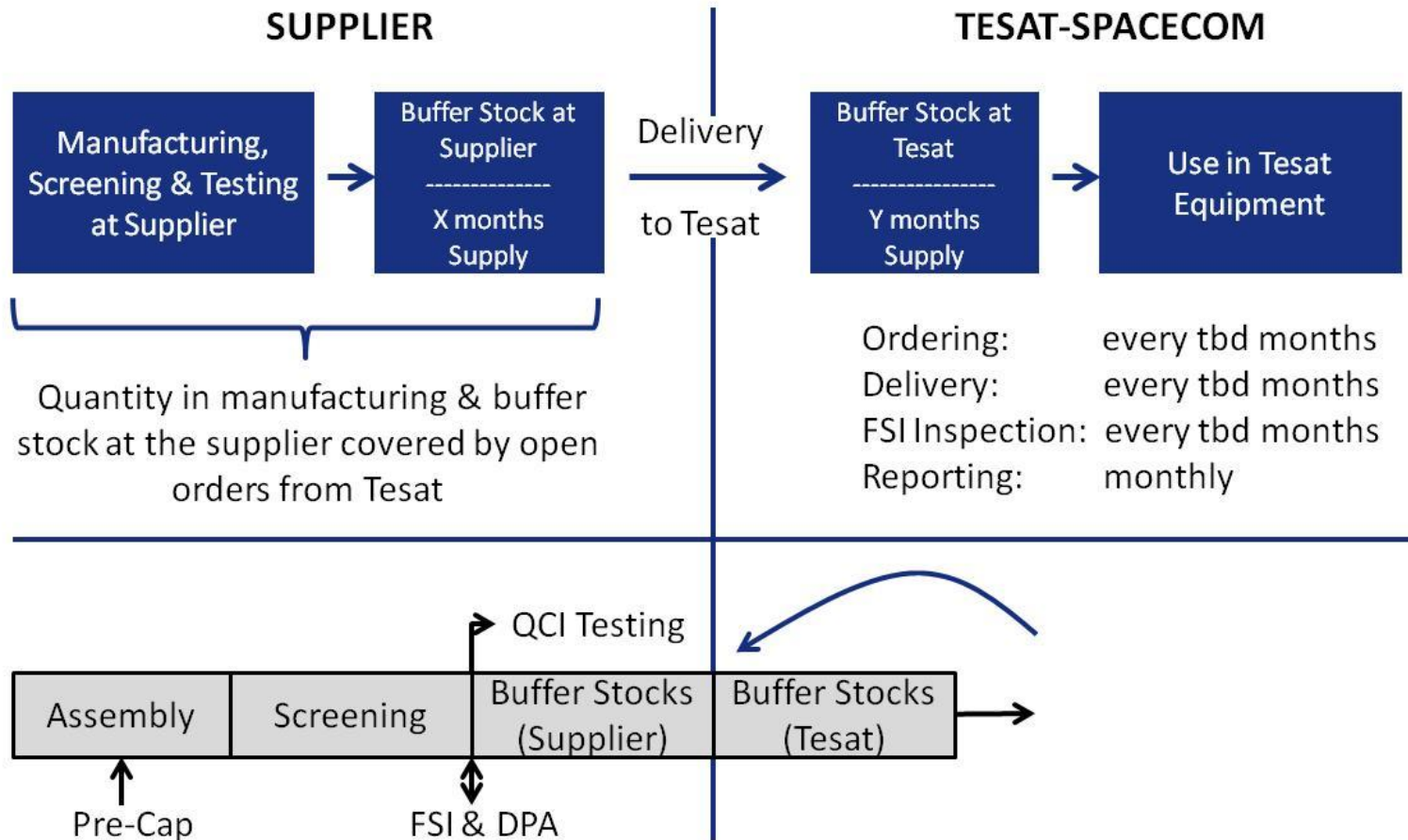
T3 : Maximum allowed storage period after a relifing control.

- Tesat carries out relifing according to ECSS-Q-ST-60-14C:
 - 7 years usable shelf-life
 - Further 3 years after relifing
- Particularly US customers regularly require deviations from the ECSS rules because they are different to the requirements defined in GSFC-EEE-INST-002:
 - Sometimes requiring shorter shelf-life (e.g. 5 years)
 - Sometimes excluding relifing
 - Sometimes different relifing test requirements

Problem Areas

Maintenance of Supply

EEE Parts Supply Model



Conclusions

- Countries starting space activities and procuring European equipment for use in their systems and satellites mostly make use of the existing EEE standards in the US and Europe
- Differences between the US MIL system and the European ECSS/ESCC system cause some problem for equipment manufacturers selling to the global market (Eg. Sizes and values of passive components)
- Tesat's own internal procurement quality level for EEE parts for Telecom applications generally fulfils globally the customers requirements and is accepted by them