Policy & Standards Working Group

Development of new standards for space components

- ESCC versus ECSS
- ECSS
- ESCC
- Achievements
- Coming soon

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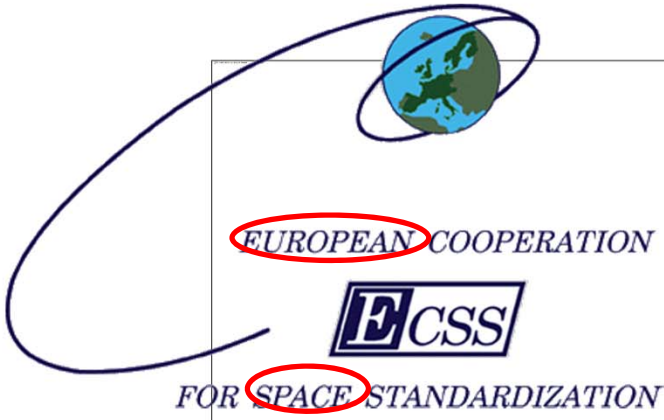
14th March 2013

ESCCON 2013, ESA/ESTEC

Difference between ECSS & ESCC



•ECSS : **http://www.ecss.nl/**

•European Cooperation for Space Standardization

•**Requirements (what to do) at Project / Equipment level**

•Membership : ESA, National Space Agencies, Industry

ESCC : **https://spacecomponents.org/**

•European Space Components Coordination

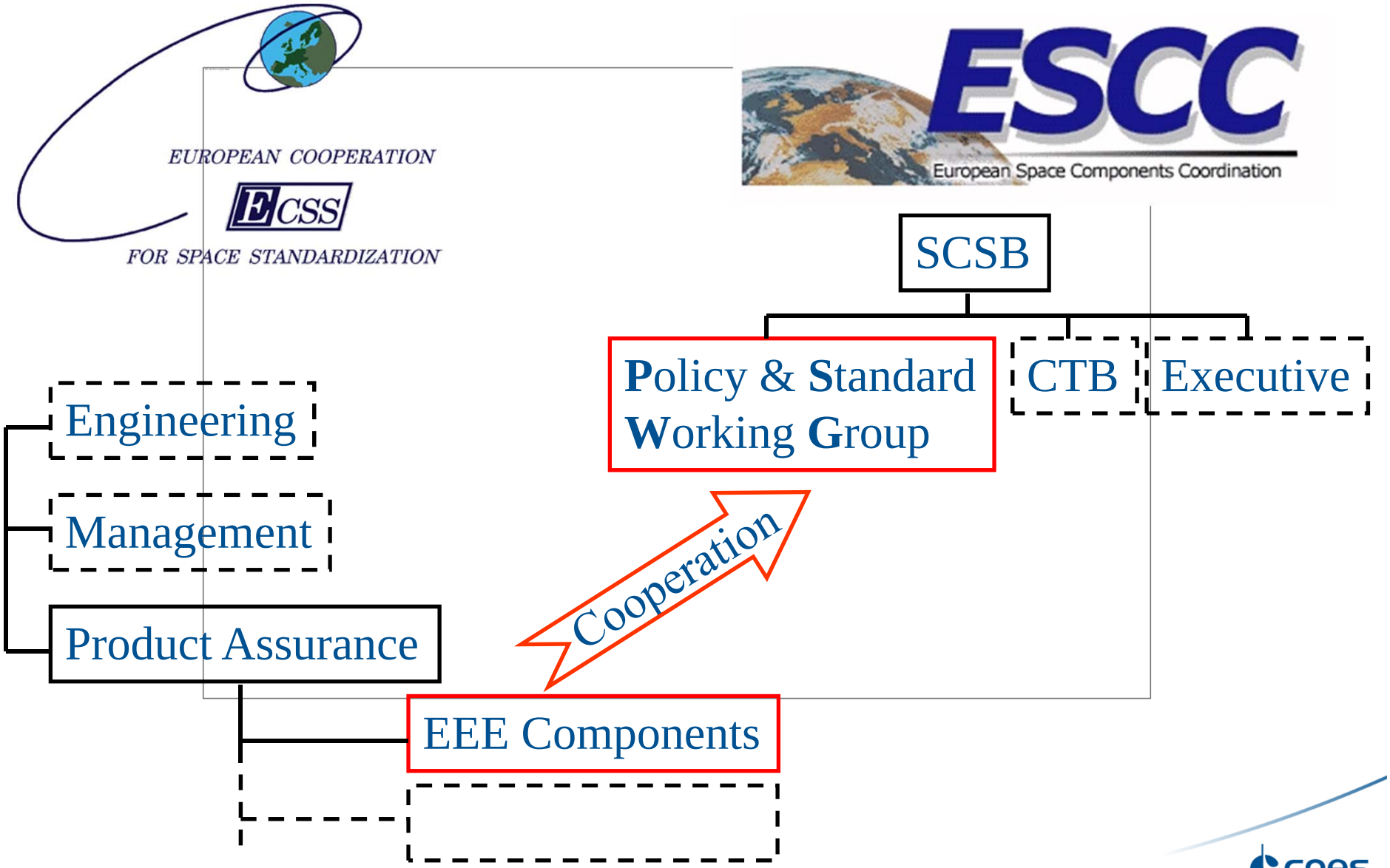
•**Components Qualification** system for space applications

•Membership : Agencies, Industry, **manufacturers**

*e.g. : ECSS-Q-ST-60: Requirements for **selection, control, procurement and usage** of EEE components at equipment level*

*Requirements for the **manufacture and qualification** of EEE components*

Links between ECSS & ESCC



ECSS : Principles

3 categories of ECSS documents Standard, Handbook, Technical Memorandum :

- **Standard**

  Normative document written specifically for direct use in invitation to tender and business agreements or implementing space related activities having its content strictly limited to the statement of verifiable customer **requirements**, supported by the minimum descriptive text necessary for understanding their context.

- **Handbook**

  non-normative document providing background information, e.g. orientation, guidelines, technical data, advice or recommendations, which contains information about how to implement space related activities.

  Note: Handbook contains data recognized as valid for use by the ECSS community.

- **Technical Memorandum**

  non-normative document providing useful information to the space community on a specific subject, prepared to record and present non-normative data which are not relevant for a Standard or for a handbook or not yet mature to be published as handbook or standard.

EUROPEAN COOPERATION
ECSS
FOR SPACE STANDARDIZATION

cnes

ECSS : Organisation

- Membership : ESA, National Space Agencies, Industry

European Space Agency

esa

European **Industry**, represented by Eurospace

EUROSPACE

Some organization have an Observer role on ECSS e.g. EUMETSAT, European Committee for Standardization, European Defence Agency

European **National Space Agencies**

agenzia spaziale italiana

UK SPACE AGENCY

cnes CENTRE NATIONAL D'ÉTUDES SPATIALES

CSA ASC

DLR

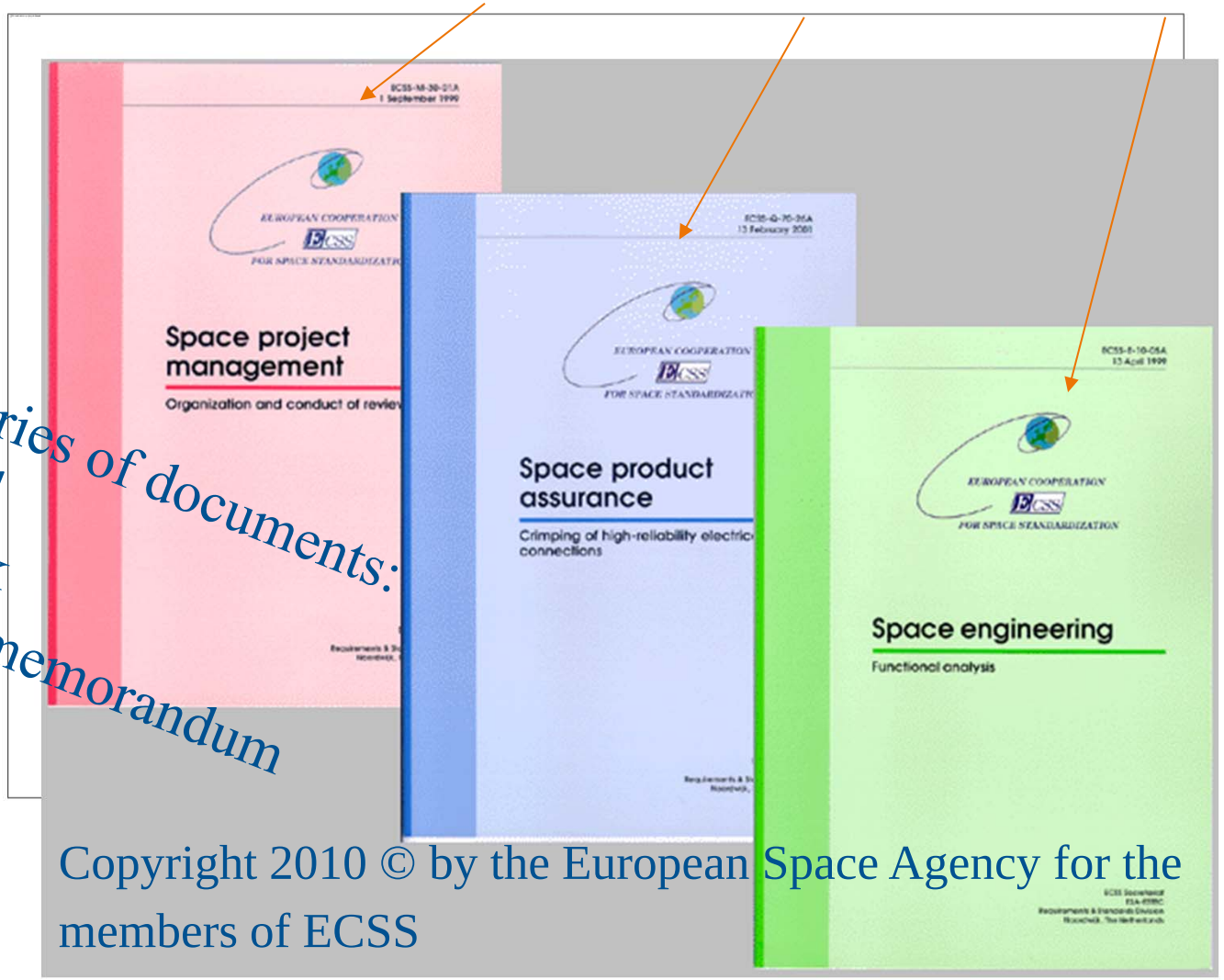
NIVR

Norsk Romsenter NORWEGIAN SPACE CENTRE

cnes

ECSS : Documentation architecture (1/2)

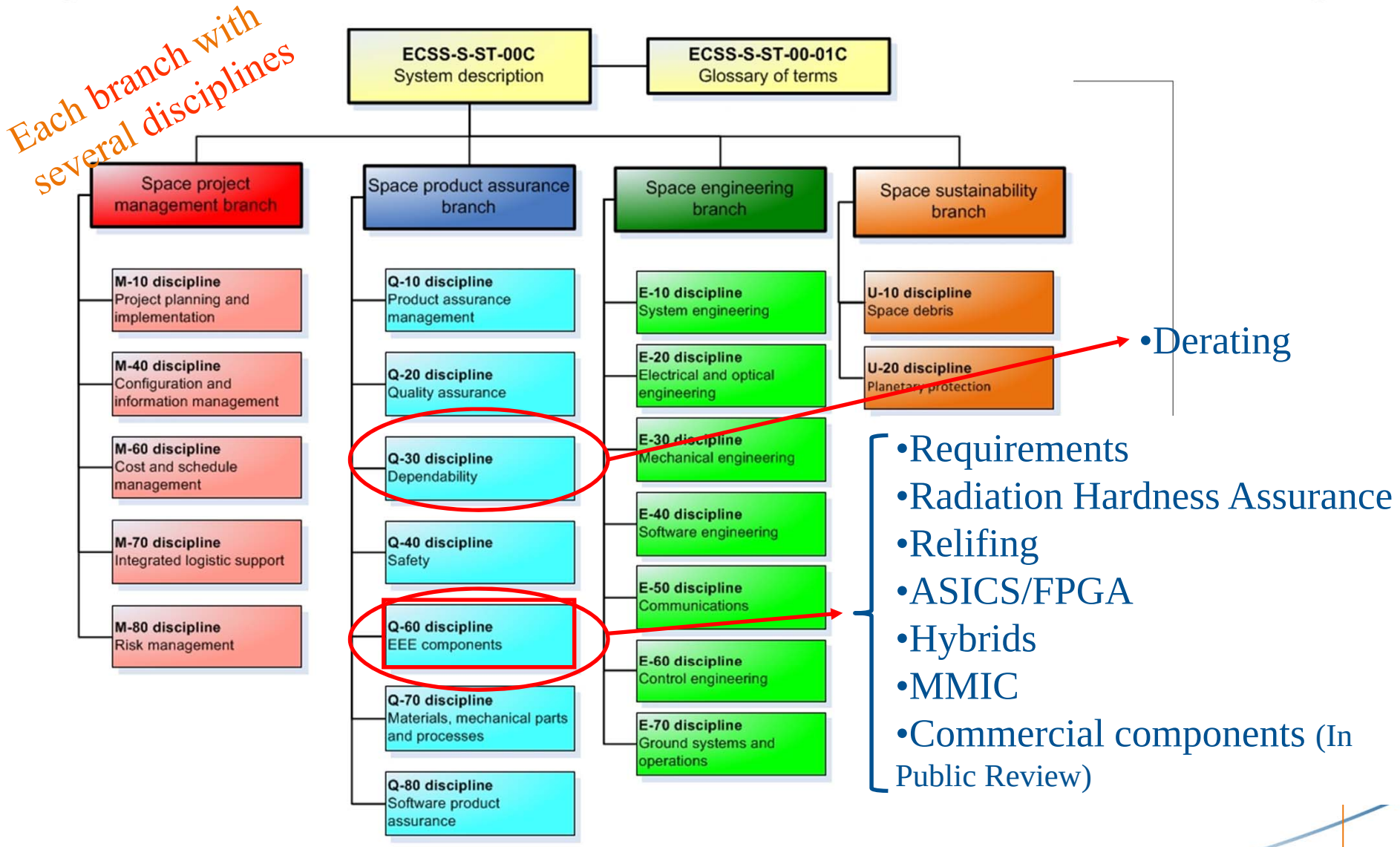
ECSS Architecture : **3 branches** :Management, **Product Assurance**, Engineering



3 categories of documents:

- Standard
- Handbook
- Technical memorandum

ECSS : Architecture (2/2)

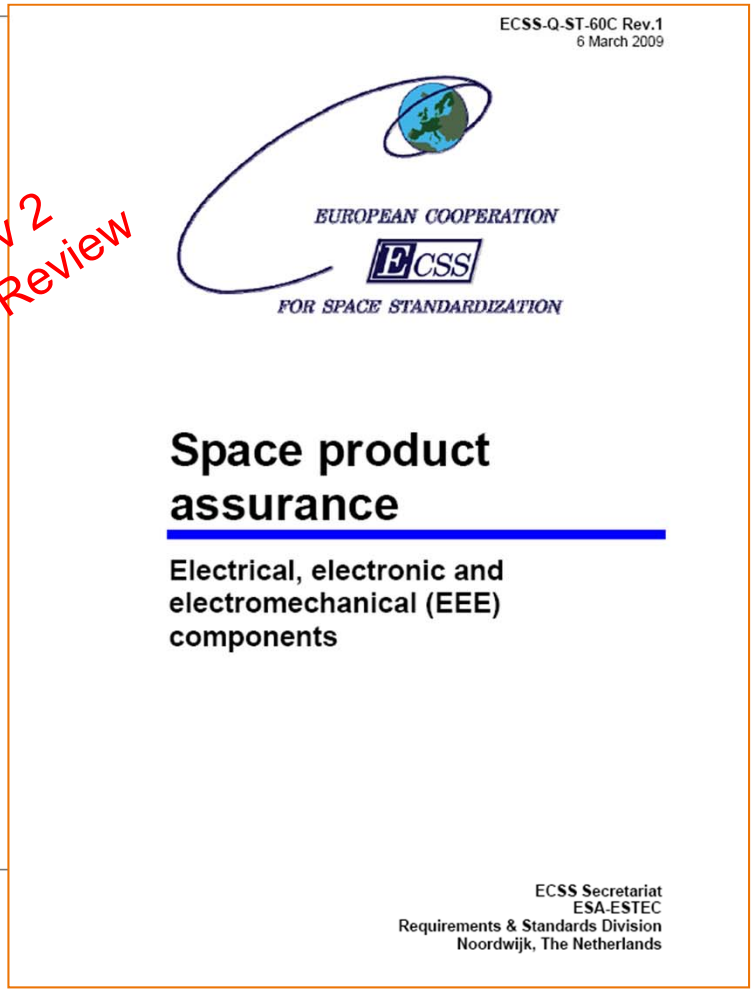


ECSS-Q-ST-60

☞ **3 classes of requirements** (assurance/risk trade-off)

- Typical requirements (non exhaustive)
  - Declared Components List
  - Parts/material restriction
  - Preferred sources
  - Parts Approval
  - Evaluation
  - Screening / Quality levels
  - Lot test
  - Final Customer Source Inspection
  - Incoming Inspection
  - Radiation
  - Destructive Physical Analysis
  - Relifing
  - Handling/ storage
  - Traceability
  - Alerts
  - Hybrids
  - Microwave monolithic integrated circuits
  - One time programmable devices

Edition C rev 2
under Public Review



ECSS-Q-ST-60-13 (commercial components)

- Based on and complementary to ECSS-Q-ST-60C
- Applicable to commercial encapsulated active monolithic parts (integrated circuits and discrete)
- 3 classes
- Public Review open (up to 12 April 2013)

	CLASS 1	CLASS 2	CLASS 3
EVALUATION	**COMPLETE** - Construction analysis - Electrical charact. (3T+10°C margin) - Meca shocks + Vib. + Const. Acc. *(for cavity package)* - Precond + HAST 96h or THB 1000h - Lifetest 2000h-125°C + DPA - Precond + 500T/C -55°C/+125°C - Radiation evaluation (TID, SEE)	**COMPLETE** - Construction analysis - Electrical charact. (3T+10°C margin) - Meca shocks + Vib. + Const. Acc. *(for cavity package)* - Precond + HAST 96h or THB 1000h - Lifetest 2000h-125°C + DPA - Precond + 500T/C -55°C/+125°C - Radiation evaluation (TID, SEE)	**LIMITED** - Construction analysis - Radiation evaluation (TID, SEE)
JD (Justification Doc)	**DATA COLLECTION** - Component manufacturer data - Approval status - Evaluation tests - Procurement inspection and test - Lot acceptance tests - Radiation hardness data and RVT	**DATA COLLECTION** - Component manufacturer data - Approval status - Evaluation tests - Procurement inspection and test - Lot acceptance tests - Radiation hardness data and RVT **DATA COLLECTED** *(EFR, lifetest, thermal cycling)* used for screening reduction	**DATA COLLECTION** - Component manufacturer data - Approval status - Evaluation tests - Procurement inspection and tests - Lot acceptance tests - Radiation hardness data and RVT **DATA COLLECTED** *(lifetest, HAST, thermal cycling)* used for lot test reduction
CUSTOMER PRECAP	no	no	no
SCREENING	**COMPLETE** - X-rays - Serialisation - 10T/C -55°C/+125°C - PIND test (if applicable) - Initial electrical test @ 25°C - Dynamic burn-in 240h-125°C - Final electrical test @ 3T° - PDA (5%) - Hermeticity (if applicable) - External visual inspection	**LIMITED (if data collected)** - PIND test (if applicable) - Hermeticity (if applicable) **+ if no data collected (see JD)** - Serialisation - 10T/C -55°C/+125°C - Initial electrical test @ 25°C - Dynamic burn-in 160h-125°C - Final electrical test @ 3T° - PDA (5%) - External visual inspection	**LIMITED** - PIND test (if applicable) - Hermeticity (if applicable)
LOT TEST **(on screened parts)** **(when applicable)**	**COMPLETE** - Construction analysis - Meca shocks + Vib. + Const. Acc. *(for cavity package)* - Precond + HAST 96h or THB 1000h - Lifetest 2000h-125°C - Precond + 100T/C -55°C/+125°C - RVT (Radiation Verification test)	**COMPLETE (but LT 1000h)** - Construction analysis - Meca shocks + Vib. + Const. Acc. *(for cavity package)* - Precond + HAST 96h or THB 1000h - Lifetest 1000h-125°C - Precond + 100T/C -55°C/+125°C *(may be waived i.a.w. application)* - RVT (Radiation Verification test)	**LIMITED (if data collected)** - Construction analysis - RVT (Radiation Verification test) **+ if no data collected (see JD)** - Precond + HAST 96h or THB 1000h - Lifetest 1000h-125°C - Precond + 100T/C -55°C/+125°C
CUSTOMER BUY-OFF	no (replaced by incoming)	no (replaced by incoming)	no (replaced by incoming)
INCOMING	yes	yes	yes

ECSS-Q-ST-60-14 (relifing)

Relifing = storing, controlling during storage and de-storing

The Relifing tests are performed to check the absence of degradation during the storage (e.g. pollution, corrosion, ageing)

The relifing is a lot quality control and not an up screening or up grading test sequences

Typical tests are: Visual inspection, solderability, hermeticity, electrical tests, Destructive Physical Analysis

Eligibility criteria are:

- Adequate storage conditions: 22° C +/- 5° C, Relative Humidity 55% +/- 10%
- Quality level in accordance with the Project requirements
- Lot homogeneity, traceability and data documentation (e.g. CoC, data package)
- No open alert or Non Conformity
- Parts ~~not older than 10 years~~ (t0= **Date-code**)

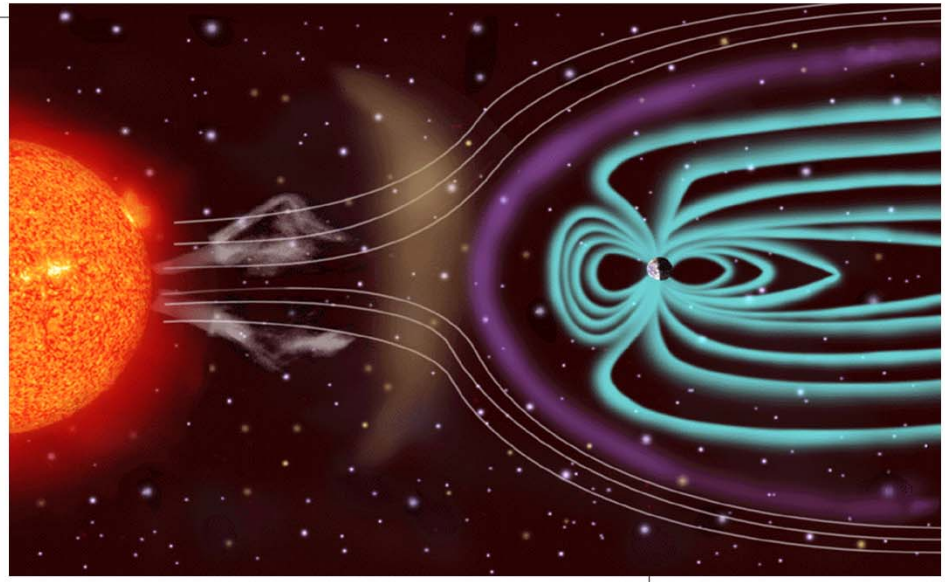
➢ **After a maximum storage period of 7 years, the relifing tests extend it to 3 years**

Only the period before mounting is considered, the long term storage of a satellite is not considered and must be specifically addressed

ECSS-Q-ST-60-15 (Radiation Hardness Assurance)

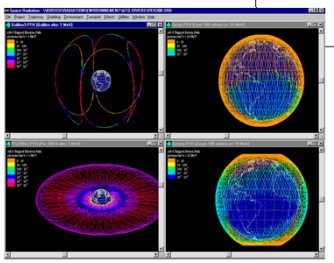
Total Ionizing Dose, Total Non Ionizing Dose, Single Event Effects (SEU, SET, SEL, SEB, SEGR)

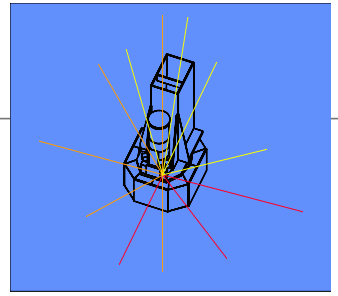
- Test methods, sampling, data
- Criteria (functional, parametric),
- Worst case/statistical
- Margin policy
- Radiation Verification Test



ECSS-E-10-04
Space environment

ECSS-E-10-12
Radiation calculation





ESCC : principles

•ESCC = **E**uropean **S**pace **C**omponents **C**oordination

•The ESCC System is applicable to **E**lectrical **E**lectronic **E**lectromechanical (EEE) Components

- Electronic : ICs (LSI, VLSI), transistors, diodes …
- Electrical : resistors, capacitors, connectors, cables, crystals, thermistors, fuses …
- Electromechanical : relays, switches …

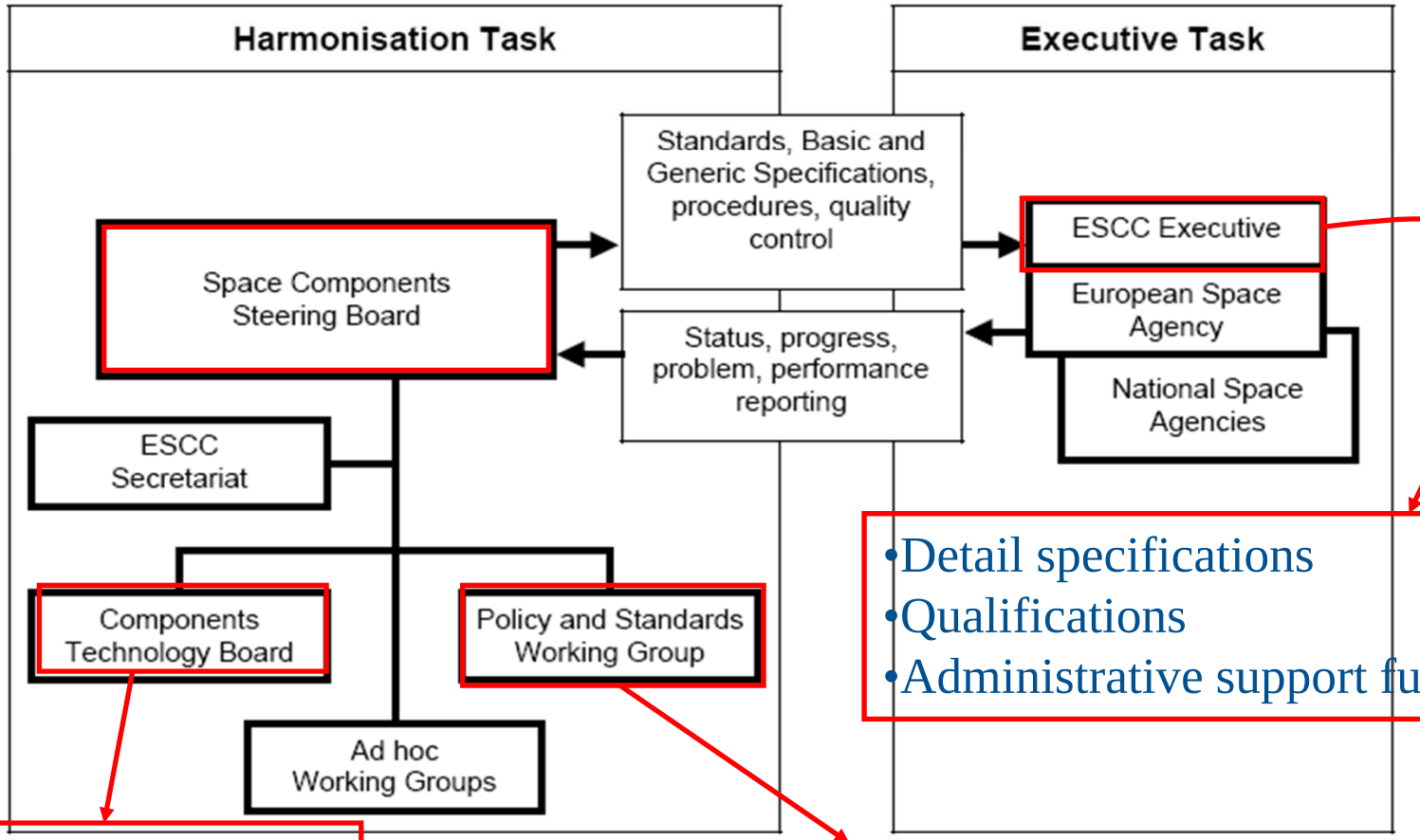
•ESCC = set of requirements to **evaluate**, **qualify**, **procure** (screening, lot test) European EEE components

➢QPL = **Q**ualified **P**arts **L**ist , QML = **Q**ualified **M**anufacturers **L**ist

➢EPPL = **E**uropean **P**referred **P**arts **L**ist includes European & non European parts, not only qualified ones

•3 ways to qualify : component qualification, capability approval, technology flow qualification.

ESCC : Organisation

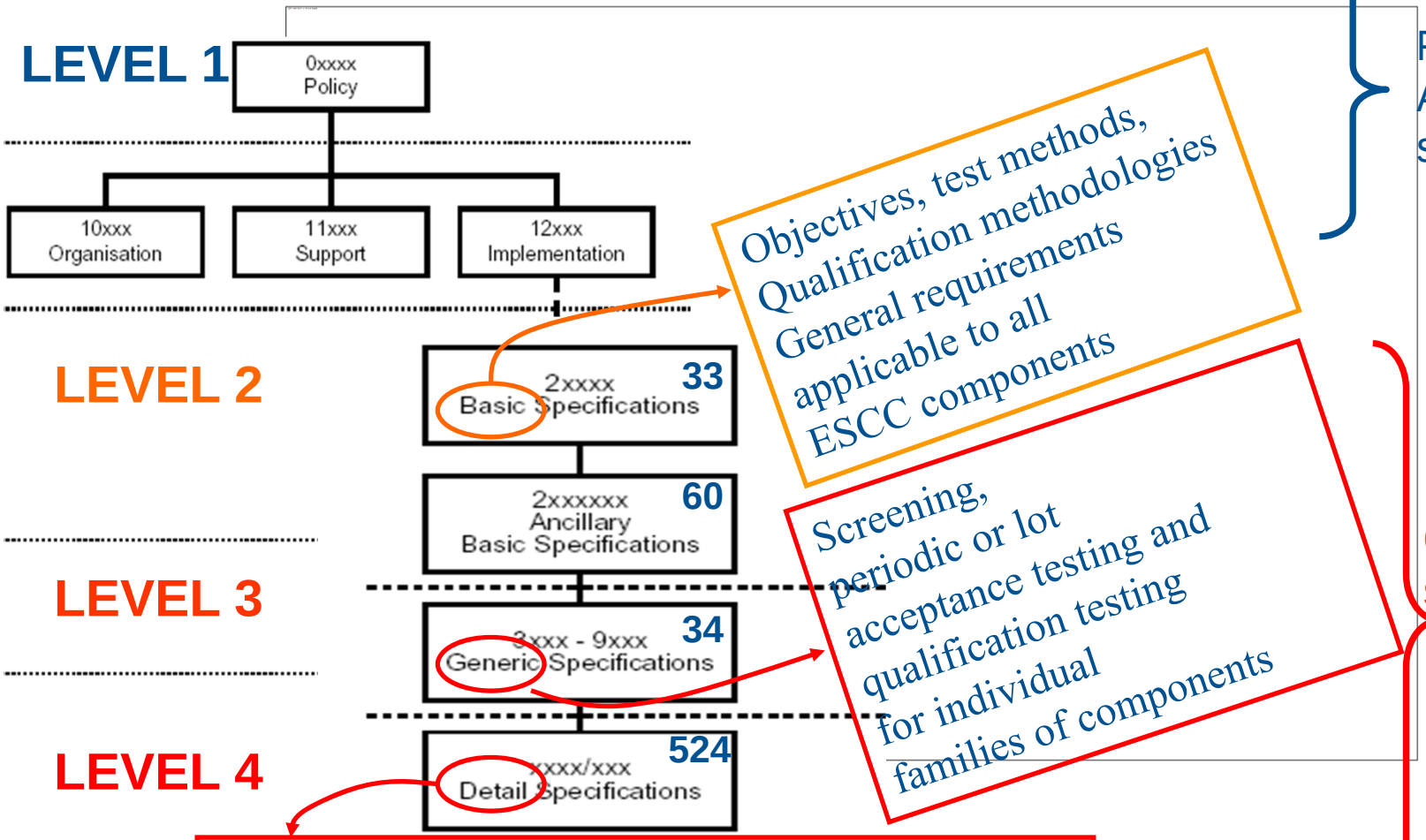


- Detail specifications
- Qualifications
- Administrative support function

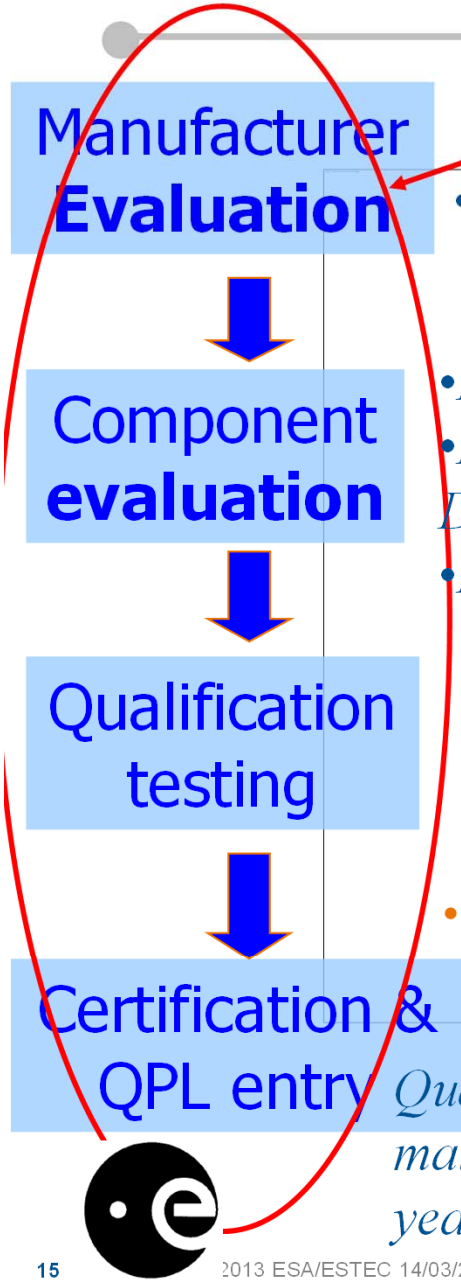
- Annual qual. programme
- 5 years R&D strategy
- Trend analysis
- Studies and research
- Evaluations

- EEE ECSS Standards
- Generic/Basic spec.
- Policy matters
- Promotion

ESCC : Documentation architecture



ESCC : Qualification



Manufacturer Evaluation

- *Audit*

Component evaluation

- *Evaluation Test Program*
- *Process Identification Document (PID)*
- *Detail spec*

Qualification testing

- *Component's design configuration*
- *Materials used in manufacture*
- *Manufacturing processes and controls*
- *Inspections and tests*

Certification & QPL entry

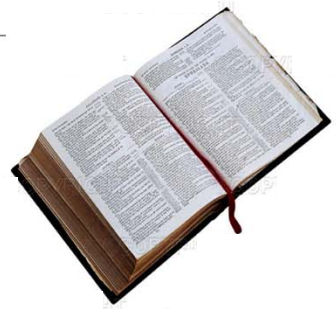
Qualification maintenance/ 2 years

- Component Qualification :
  - for one EEE component type or a family
- Capability Approval :
  - customized or application specific components
- Technology Flow Qual.:
  - stable and reliable manufacturing technology

For Capability Approval & technology Flow Qualification, similar approach including respectively Capability domain, Technology Flow & Quality Management program

ESCC : some specific requirements (non exhaustive)

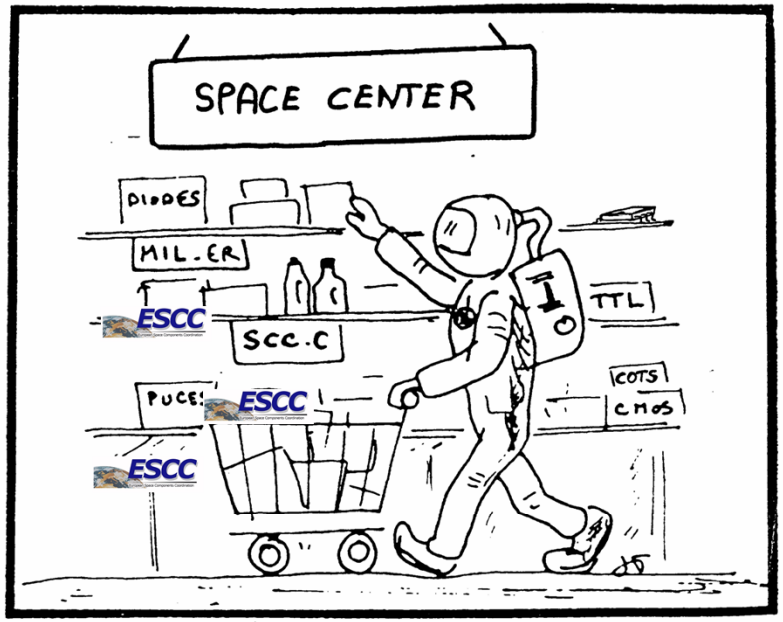
- Change control program
- Chief Inspector : Manufacturer's point of contact
- Non Conformance system
- Traceability
- Customer requirements
- Control/inspection procedures
- Management of sub-contractors and suppliers
- Incoming inspection and storage of raw material/piece parts
- Training & certification
- Failure analysis capability
- Calibration



ESCC : some achievements

List of published ESCC specifications: refer to REP001.

- QPL/QML 1 edition/month, (36 manufacturers)
- EPPL (41 manufacturers) 2 editions/year
- Training course (1-2 sessions /year)
- ESCC specifications referenced (Google®)



ESCC, ECSS : Coming soon (extract)

- QPL management (update)
- Pure tin inspection (in finalisation)
- Process Capability Approval (under construction)
- Hybrid capability Approval (under construction)
- Opto (Laser diodes, optical fibers) (under construction)
- EPPL Management (update) (under construction)
- Cable assemblies (under construction)
- Test methods : Total Dose ; Single events (under construction)
- ECSS :
  - ECSS-Q-ST-60C rev 2 (In Public Review)
  - ECSS-Q-ST-60-13C (In Public Review)