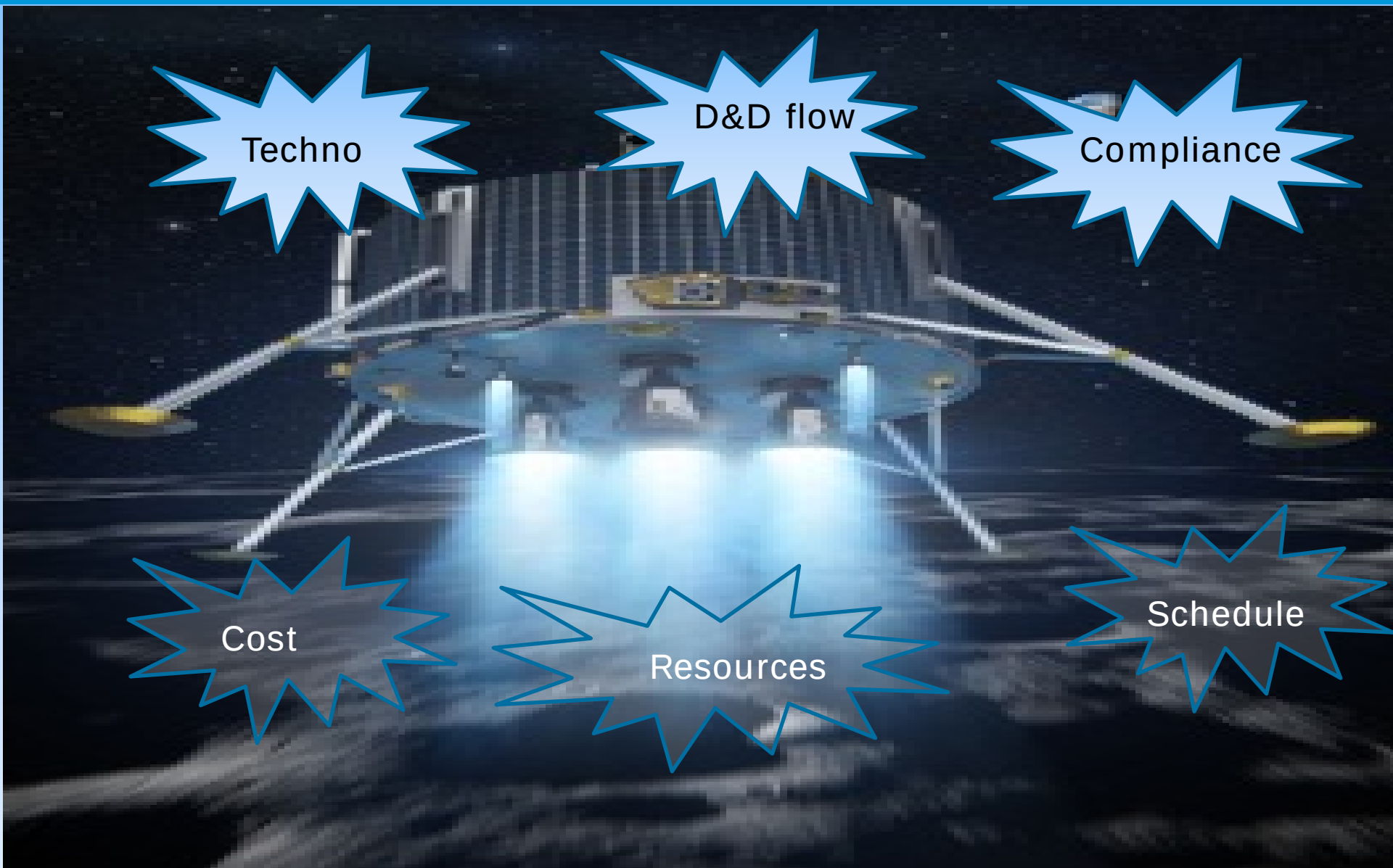
The ESCC system in relation to Mixed Signal ASICs and the future ESCC PCA Certification

22/08/2012

What makes an ASIC D&D project successful?



What makes an ASIC device flightworthy?

- Fit for purpose – in accordance with documented requirements (more than a procurement spec.) & compliant with intended application conditions (in a verifiable manner)
- Must have been designed and developed in a controlled set-up which allows reviews and access to design files (traceability)
- Must be manufactured and tested in a reproducible manner.
- Must pass tests at ASIC component level (100% of devices and also sample tests) as specified in the procurement specification.
- Must be able to withstand the assembly processes and application environment (to be verified too)
- Must pass tests at higher assembly levels (electrical, mechanical, environmental) at different stages of AIT.

How do standards help?

1. ECSS-Q-ST-60C Space Product Assurance – EEE components : covers Selection, Control, Procurement and Usage
2. ECSS-Q-ST-60-02 ASIC Design & Development : provides also a methodology for the development and prototype validation by test …
3. Individual tests at ASIC component level are specified in projects along requirements set in ESCC Generic 9000 for microcircuits.
4. Other necessary tests, typically Radiation tests, are also specified in the ESCC system of specifications.

ECSS-Q-ST-60C: Relevance

The ECSS-Q-ST-60C Rev.1 is written from the Space Project Users point of view setting the requirements that will make the components fit for purpose in a space project. It is part of the List of ESA Approved Standards (LEAS)*.

The standard defines requirements for EEE Parts w.r.t.:

- **Selection**
- **Control**
- **Procurement**
- **Usage**

The ECSS-Q-ST-60C Rev.1 does not include detailed description of requirements related to EEE parts qualification

The Requirements for EEE Parts Qualifications are included in the ESCC system of Specifications.

* This standard has been widely adopted by the European Space Industry for application beyond ESA projects

Component Selection per ESCC–Q–ST–60C

Components shall be selected on the basis of proven qualification, characterization, and previous space experience and data, relevant with regard to the requirements for the programme, from manufacturers or sources (preferably European) employing effective Product Assurance Programmes in manufacturing and test.

Preference shall be given to components which necessitate the least evaluation or qualification effort.

Starting with the design phase of the project the supplier shall ensure maximum use of preferred and qualified components to achieve an effective component reduction and standardization.

Preferred sources

Parts shall be chosen from the EPPL (European Preferred Part List) part I

Parts subject to export restrictions or regulations shall not be preferred.

The ESCC Specification System

The ESCC System is a self-standing system of component specifications which provides:

- The **technical specifications** of EEE parts for **parts procurement**
- Methodologies for component **evaluation and qualification**
- Test methods
- Quality Assurance requirements
- Operational provision for the overall system and participating organizations

All ESCC Specifications are in the public domain of the ESCIES web site. The web address is https://escies.org

All ESCC specifications are under configuration control by ESA, that also coordinates the publication of the specifications and provides a professional editing environment based on SW/HW.

The ESCC Qualification System

The **ESCC Qualification** is a status given to standard electronic components which are manufactured under controlled conditions and which have been shown to meet all the requirements of the relevant ESCC specifications.

All ESCC Qualification certificates are listed in QPL and QML available in ESCIES.ORG

Different but equivalent and similarly structured approaches are possible:

1. **Component Qualification** for standards parts (ESCC 20100)
2. **Capability Approval** for customized or application specific components (ESCC 24300)
3. **Technology Flow Qualification** for stable and reliable manufacturing technology flows (ESCC 25400)

Irrespective of the selected qualification approach, and unlike the US MIL

System, the ESCC system of qualification is based on a distinctive 2 step qualification approach:

The ESCC Qualification System Approaches

- The **ESCC Qualification Approval (#20100)** is the ESCC quality assessment technique designed to certify that individual components, ranges of components or structurally similar components are of appropriate performance and reliability for use in space applications. The approach is applicable to components of standard design which are **in continuous** or **repetitive lot by lot production.**

- The existing **ESCC Capability Approval (#24300)** is the ESCC quality assessment technique designed to certify that a manufacturing capability within a specified technology domain is of appropriate performance for use in space applications. The system is applicable to components manufactured in relatively **small quantities** for use in **unique applications** where manufacturers technology, materials and processes are used to fabricate components **customized to specific user requirements**.

- The existing **Technology Flow Qualification (#25400)** is the ESCC quality assessment technique developed to ensuring the reliability and performance of space components whilst maximizing the benefits of the manufacturers best practices. The Technology Flow Qualification system is designed for component manufacturing technology flows that combine effective quality management techniques with stable and reliable technologies that **are supported by quality improvement and Technical Review Board** (TRB) principles. Technology Flow Qualification is suitable **for both standard continuous lot by lot** production components **and non standard components** that **have design features customized to specific user requirements.**

The ESCC Process Capability Approach (PCA): A new ESCC concept in preparation

- The **new ESCC PCA** is based on the existing Capability Approval certification approach, however not necessarily aiming at the ESCC qualification of the final products.
- The new ESCC PCA certification will define the ESCC quality assessment criteria to certify that elements of **"patchwork" supply chains – e.g. the present situation for many Mixed Signal ASICs for space -** individual manufacturing processes and technologies, possibly furnished by different parties, are of appropriate performance and reliability for use in space applications, objectively determined by the ESCC Executive.

Advantage

- The certification of distinctive self-standing production steps individually available as services will establish a basic **common PA denominator** (Quality Management, domain definition, evaluation test data, technical requirements, audits, transparency, responsibility) that **minimises resources and simplifies the configuration of flexible supply chains for the benefit of all participants from provider(s) to user.**

The ESCC PCA Certification Concept

- **ESCC PCA certification** is aiming for the quality assessment of single EEE parts manufacturing processes, functions and operations to establish confidence in their suitability as part of the **supply chain** of EEE components for space use.

- The ESCC PCA approach will be based on a set of requirements whose verification is achieved by **evaluation**, **testing, inspection, audit** and will rely on Quality Assurance principles and provisions equivalent, as applicable, to those governing the ESCC Qualifications.

- ESCC PCA activities will be conducted in accordance with a plan prepared by the CTB and approved by the SCSB (as done for the Annual Qualification Plan) and will be supervised by the ESCC Executive. Successfully completed PCA are certified by ESA acting as the ESCC Certification Authority.

- Industrial processes and services for which a PCA certificate of assessment is issued will be listed under ESCIES.org – initially this will cover **foundry, assembly and test services**. The pilot introduction is planned to commence in 2013.

Additional information…

ESCC

https://escies.org

ESCCON 2013

Dates: March 12—14, 2013

Contacts

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The ESCC standardization system in support to Analogue and Mixed Signal ASIC

BACK-UP SLIDES

European Space Component Coordination - Purpose

The ***European Space Component Coordination (ESCC)*** as defined through its Charter and Founding Act has been deliberately set up to serve a dual purpose.

EEE Component Harmonisation and Standardisation.

- "Harmonisation of proposals for component policies, standards, specifications and component technology R&D programmes".
- "Executing evaluation, qualification and certification programmes for components and component manufacturers on the basis of common European component specifications."
- Through the representation and involvement of all principal stakeholders ……
    - ESA and National Space Agencies,
    - the user community,
    - Major European Space Component Manufacturers and
    - the European Commission as an observer

    …… it is able to implement a system with the appropriate level of governance that spans across the space technology and product life cycle from development to obsolescence which meets the declared objectives.

The ESCC Standardisation System: The Highlights

✓ESCC **Specifications**

(**836 ESCC Specifications** and 40 Documents and Procedures)

✓ESCC **Qualification (QPL) activity** (initial qualification and maintenance of qualification)

(**116 active Qualification Certificates**, 320 total certificates since 1972)

✓ESCC **QML**

(**4 Domains**)

✓The European Preferred Parts List (**EPPL**)

Manufacturers Under ESCC Qualification

- **The following European manufacturers hold ESCC qualifications :-**

Atmel France
AVX (Ceramic Capacitors) United Kingdom
AVX (Tantalum Division) United Kingdom AVX/TPC France
Axon'Cable France Betatherm Ireland C&K Components France
Chelton Les Ulis France COBHAM MAL United Kingdom COMEPA France
Compagnie Deutsch France Draka Fileca France
Eurofarad France W. L. Gore & Co Germany
Hypertac SA France Hypertac Limited United Kingdom
Infineon Technologies A.G. Germany IRCA - RICA Italy
Isabellenhütte Germany Leach International Europe France Leoni Germany
Microspire France Nexans France RAKON France Radiall France
SCHURTER AG Switzerland
Souriau Connection Technology France STMicroelectronics France
STPI France Tyco Electronics United Kingdom
Vishay Electronic Draloric Selb Germany
Vishay S.A. Division Sfernice France

The ESCC System Structure

- **The ESCC System is composed of 2 primary functions**

  Harmonisation Task (in charge of definition of component policies, standards, specifications and component technology R&D programs)

  Executive Task- (in charge of component specification, evaluation, audit, qualification and certification)

- **The Harmonisation Task includes the following bodies:**

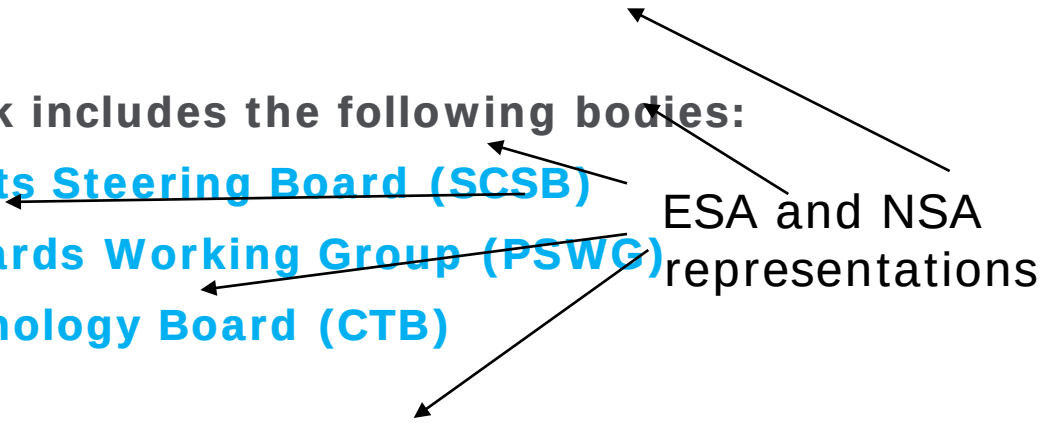
  Space Components Steering Board (SCSB)

  Policy and Standards Working Group (PSWG)

  Component Technology Board (CTB)

  ESCC Secretariat

  Ad Hoc Working Groups



- **The Executive Task:**

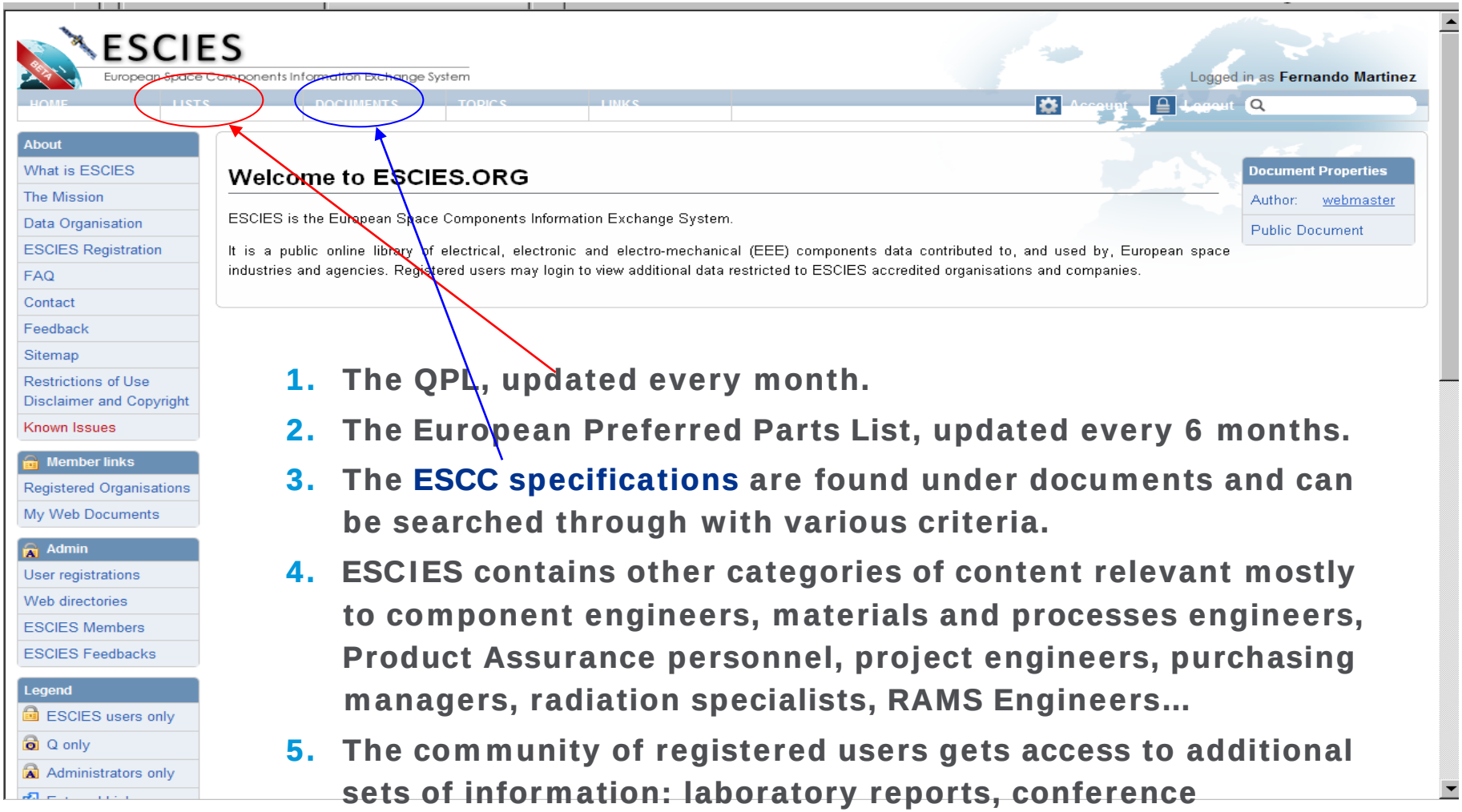
  ESA and National Space Agencies

The ESCC Components Standardisation and Specification System: The Benefits

The most obvious benefits of the Components Standardisation offered by the ESCC system are:

- ✓ **Part type reduction** – through the EPPL
- ✓ **Reduced costs** – through QPL and MoQ (Qualification and maintenance of qual), the EPPL and the system of specifications for procurement.
- ✓ **Efficient and effective test methods** – through the system of specifications for evaluation, qualification and procurement of parts.
- ✓ **Quality management systems-** for efficient controls, survey and audits that give confidence in the consistent delivery of high reliability components.
- ✓ **Harmonization** of parts requirements and needs providing a framework for technology and parts developments.

ESCC Specs, QPL, QML, EPPL on ESCIES.org



1. The QPL, updated every month.
2. The European Preferred Parts List, updated every 6 months.
3. The **ESCC specifications** are found under documents and can be searched through with various criteria.
4. ESCIES contains other categories of content relevant mostly to component engineers, materials and processes engineers, Product Assurance personnel, project engineers, purchasing managers, radiation specialists, RAMS Engineers…
5. The community of registered users gets access to additional sets of information: laboratory reports, conference proceedings, …

ESCC Specifications Challenges

- ESCC Process Capability Approval Certification

Introduction of the PCA in new ESCC specs based on ESCC 24300 for ATH, Foundries, etc..

- ESCC PCA Certification of Hybrids

In progress. Draft review completed and submitted for discussion and review at PSWG/SCSB.

- ESCC PCA Certification Oscillators

In Progress based on ECI activity and related test results

- ESCC PCA Certification of Assembly, Package and Test Houses

In progress. Draft spec prepared.

The ESCC PCA certification Supporting specifications are in preparation by the ESCC Executive.