eurocomp
The newsletter of the Space Components Steering Board

Introduction

The aim of *Eurocomp*, the newsletter of the Space Components Steering Board (SCSB), is to keep you informed of the various activities being coordinated by the SCSB and its subgroups, the Components Technology Board (CTB) and Implementation Team (IT). In this second issue, you will find detailed information concerning the CTB 5-year strategic plan for space component technology development. At the IT level, information is given concerning the new European Space Components Coordination (ESCC) structure; the European Qualified Manufacturing Line (QML) approach, and the ESCIES information exchange system for participating partners.

There are also two articles presenting the results and a synthesis, respectively, of the ESCCON 2000 Components Conference and of the Eurospace Workshop on Electronic Component Reliability, both held in March at the European Space Agency's Research and Technology Centre (ESTEC) in Noordwijk, The Netherlands.

The Opening Address of ESCCON 2000 was given by SCSB Chairman Alex Soons.

ESCCON 2000 in session.

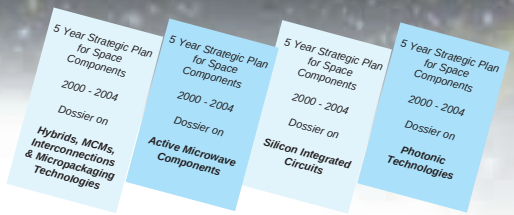
Looking to the future, in the next 6 months, among all the work packages underway, the efforts will be concentrated on the following aspects:

– setting up the new structure and transfer of the coordinated component activities into this new structure;
– the Technical Update of the ESA/SCC System. All the ESA/SCC Generic Specifications have been reviewed in order to reduce component costs by removing unnecessary requirements and by bringing the test flows in line with the standard practices. With reference to the semiconductor Generic Specifications, in addition to the technical update, plastic encapsulated devices (PEDs) were introduced into these documents. The European QML and Performance approaches will be introduced in a second step. The new issues of the Generic Specifications will be published after approval during the second half of 2000;
– pilot exercises with two silicon manufacturers demonstrating the European QML approach;
– the European Preferred Parts List. The first issue was released last October and is available at

http://www.estec.esa.nl/qcswww/eppl

An updated list is under preparation for release by the middle of 2000;
– preparation of the next edition, issue B, of the document ECSS-Q-60 related to component selection and quality assurance requirements for space programmes.

A 5-Year Strategic Plan for Space Components



The first issue of *Eurocomp* introduced the work of the Component Technology Board (CTB) and its preparation of a 5-Year Strategic Plan for Space Components. This issue highlights the need for this approach, the preparation of the plan, the key issues and the scope of the Dossiers. Later issues will focus on each of the Dossiers in turn and explain in greater detail the content and the actions of the plan.

The Need

The need for this initiative became evident with the dramatic changes occurring in the military and consumer electronics industries. High-reliability components, often of military origin, have been the components of choice for space applications, but this source has drastically decreased as military budgets have been cut and many high-reliability component manufacturers have withdrawn altogether from professional applications and turned towards the booming consumer markets. This trend has continued for a number of years and is predicted to extend into the foreseeable future.

These changes have occurred against a background where advanced components at competitive prices have often been the cornerstone for realising competitive space systems in an increasingly cost-conscious and competitive market.

A fundamental revision was called for in the approach taken for the assessment, development and procurement of components and their underlying technologies for the space market.

Acting in Concert

The membership of the Component Technology Board represents the main interest groups in the European space community: industry, the agencies and the component manufacturers. In keeping with its terms of reference, the CTB set out to formulate a 5-Year Strategy at a truly European level, with co-funding from all the interested parties.

The use of the funding available for space component activities was therefore optimised by acting in concert so that duplication or fragmentation of activities was avoided.

The Strategic Areas

The field of electronic components is very broad, within which all the components are important and necessary for the realisation of space systems. The goal of the 5-Year Strategy is, however, to focus on those areas that are of the greatest strategic importance, in particular those technologies that will assure a competitive edge in future space programmes.

Four areas were identified as being of the highest strategic importance:
– silicon integrated circuits;
– active microwave and millimetre-wave component technologies;
– high-density packaging, in particular hybrids and multi-chip modules;
– photonic devices and technologies.

Formulating and Funding the Programme

The task was then to formulate a plan addressing the main issues to be covered in each area. ESA took the action of behalf of the CTB to lead the preparation of the Dossiers. ‘Dossier Captains’ were nominated to lead Working Groups in each of the four areas, and Eurospace nominated experts from among its member companies to serve on these Working Groups. Information was gathered as widely as possible, and then a series of working meetings led to the formulation and refinement of the recommendations and of the activities that should be undertaken. The close involvement of industry members ensured that the commercial space interests were fully represented. The overall plan was presented to and approved by both the Components Technology Board and the Space Components Steering Board.

Each of the participating parties is now identifying those activities that they will (co-)fund. Within ESA, the Dossiers serve as the baseline for the ESA’s contribution to the 5-Year Strategy under the Agency’s Technology Research Programme, as approved by the Industrial Policy Committee in April this year.

An Overview of the Dossiers

Silicon Integrated Circuits

Of all the component sectors, the area of silicon integrated circuits has been the most affected by the dramatic reduction in the number of manufacturers addressing the high-reliability market. The space and military markets represent less than 1% of the total market and this level continues to reduce as the consumer markets boom. The manufacturers

therefore focus mainly, or exclusively, on consumer applications.

The situation has reached a critical stage and the Dossier therefore addresses, as its priority issue, the challenge of securing the necessary high-reliability and radiation-tolerant components for the European space industry. This will require the combined resources of all interest groups and the commitment to a longer-term strategy.

The full set of recommendations in the Dossier was generated after a careful analysis of the current industrial status, trends, constraints and problem areas, both in general industrial terms and in specific terms for the space industry and the component needs of future space programmes.

This has produced the following set of general recommendations to provide continued access to state-of-the-art microprocessors, ASIC technologies, logic and linear devices required for spacecraft platforms and payloads:

– ensure radiation-hard technology from European sources through radiation-hardening and qualification activities;
– use other existing European foundry/component capabilities for space through characterisation and evaluation activities;
– provide advanced commercially-based components from worldwide sources;
– take specific actions to facilitate the supply of components, e.g. early identification of system needs, technology availability and obsolescence, and definition of quick-turnaround evaluation.

Active Microwave Components
The development of active microwave technology is a fast-moving area with dramatic changes expected in the coming years, such as the introduction of wide band-gap devices offering dramatically improved performance in terms of frequency, power and hardness (radiation, operating temperature, etc). The availability of European sources for these and other key technologies will be of strategic importance.

Whereas the hybrid and silicon integrated circuit technologies represent a generic need for space systems, the active microwave components govern the performance of a range of specific spaceborne applications in the areas of telecommunications, Earth observation and science, including:

– multimedia applications at Ku/Ka-band;
– mobile communication satellite systems;
– radar systems, including X- and L-band synthetic aperture radar, cloud radar and radar altimeters;
– a range of scientific payloads, including radiometers for measuring background microwave radiation noise of the Universe from frequencies of 30 GHz up to the THz range.

To prepare the technologies for these applications, the Dossier contains the following recommendations:

– low-noise & millimetre-wave technologies;
– high-power technology, including high-power silicon transistors, HEMT & HBT technologies for power MMIC, wide band-gap devices;
– mixed analogue/digital, high-speed digital technologies;
key support activities for emerging technologies and comparative investigations;
– marketing, promotion and partnership, information exchange.

Hybrids, MCMs, Interconnections and Micropackaging Technologies
High-density packaging and interconnection technologies are of major importance for optimising the performance, integration density, reliability and costs of space electronic hardware. This technology area, similarly to that of the Silicon IC Dossier, tends to be generic in that the technologies are needed for the full ranges of satellite missions, onboard systems and payloads.

The major evolution in this area is being driven by:

– the need to package increasingly complex integrated circuits;
– the need for better cost/performance ratios, shorter time-to-market and greater miniaturisation;
– the increased complexity of electronics in satellites: digitisation, higher frequencies, etc.

The key issues to be addressed are:

– the availability of materials and processes for European users;
– access to high-density packaging suppliers offering competitive process and delivery times;
– keeping abreast of the evolving technology in order to anticipate the advantages offered for system and equipment design, manufacturing and testing;
– accessing and adapting the technologies developed for other industrial sectors.

The European Space Components Information Exchange System

The European Space Components Information Exchange System (ESCIES) has recently completed its beta test phase at ESTEC and is now in service at:

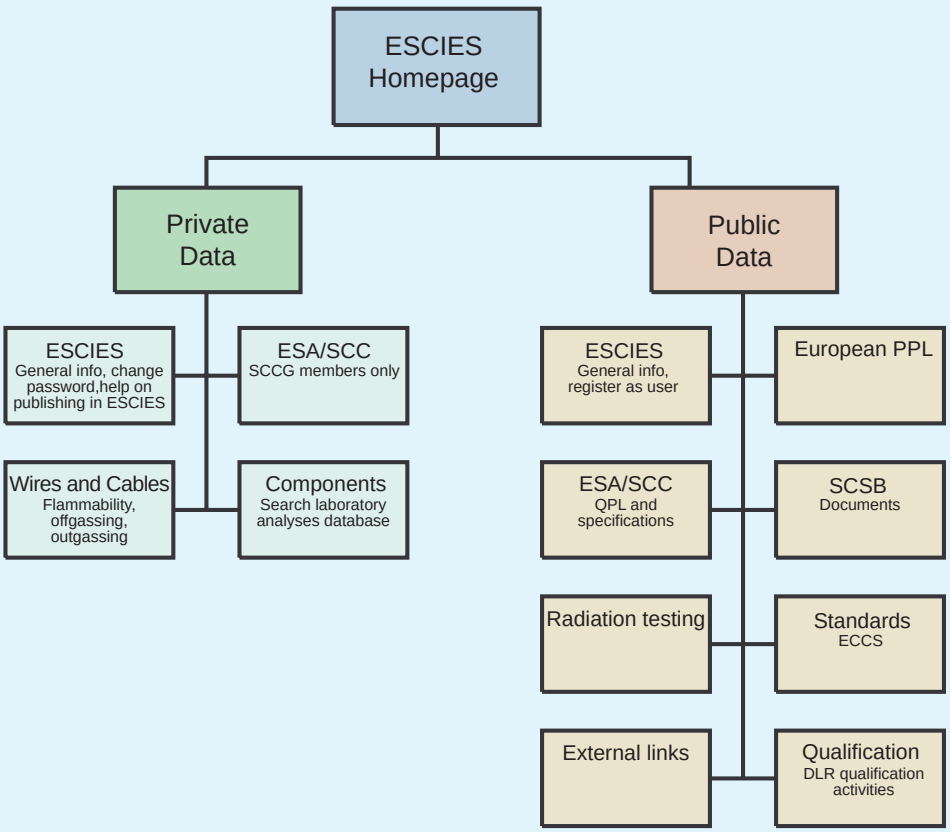
http://www.escies.org

Since our brief description of ESCIES in Eurocomp #1, a great deal of effort has gone into finishing the prototype. The production server has been configured with particular attention to security measures at the operating system and web server levels. The ESCIES prototype has been mirrored from the internal development machine on to the production machine. The search engines have been completed and tested. In parallel, the data sets from the ESA sources have been continuously refined and updated. The beta test was performed by a user group comprised primarily of the ESA Components Division. This testing ensured that ESCIES was working in virtually every respect on release to the user community.

The real challenge has now begun. This is to turn ESCIES into a true information exchange system. In October 1999 an invitation to contribute data was issued by the SCSB Chairman to members of the SCSB, CTB, IT and EPPL TA, and ESA/SCC Chief Inspectors. This included a request to each organisation to appoint an ESCIES Coordinator. To date, only a limited number of companies and organisations have responded. The collective task for the SCSB community is to increase this number dramatically and turn the participation into one of data contribution. If this challenge is met, then ESCIES will meet the goals set by the SCAHC recommendation for a CIES.

Anybody seeking further information should contact Tony Gouder at ESTEC (agouder @estec.esa.nl).

The ESCIES Web Site is being developed under ESTEC contract by TERMA Elektronik AS.



The ESA/SCC QML Concept

This new concept covers all aspects of the ESA/SCC qualification of technology flows used to produce EEE parts for space applications. In this qualification approach, a manufacturer's defined technology flow is evaluated, certified and qualified, after which it can be added to the ESA/SCC Qualified Manufacturers' Listing (QML). Any component made within the boundaries of the qualified flow, and meeting the requirements of the procurement specifications, can then be included on the QML as qualified.

Although having similarities to the existing ESA/SCC Capability Approval approach, the new concept emphasises not only the manufacturing processes to be employed but also a complete quality management programme designed to ensure component quality.
Differences from Capability Approval are made more apparent by considering some key items of the QML concept:

– cooperative relationship between manufacturer and Qualifying Authority (QA);
– possibility of merging commercial and military- or high-reliability-quality systems;
– transfer of responsibility to the manufacturer's Technical Review Board (TRB) once QML certification/qualification has been granted;
– enhanced flexibility for manufacturers, because the concept describes a non-mandatory test baseline which can be modified by manufacturers on condition that component quality and reliability is not degraded.

In addition, and in common with the US QML system, the new concept allows Qualified Parts List (QPL) manufacturers to select 'transitional' QML qualification. This involves less effort to obtain full QML approval but must be completed within a reasonable period of time (2 years is proposed). Manufacturers who do not want to apply for QML can also maintain their QPL products until the component type or the technology becomes obsolete.

The major differences between ESA/SCC QML and MIL QML are:
– the ESA/SCC system is a uniform system;
– the ESA/SCC QML concept is applicable to all EEE parts, including passive parts;
– the ESA/SCC QML concept maintains a dedicated and clearly visible evaluation step;
– QML and transitional QML parts shall be listed separately from QPL parts

Interested readers can find more details at

http://www.estec.esa.nl/qcswww/SCSB/QML.pdf

EEE Reliability Workshop

ESTEC, Noordwijk, The Netherlands
20 March 2000

The EEE reliability prediction workshop was organised by Eurospace at ESA/ESTEC in March, the day before the ESCCON 2000 conference (see the accompanying report). About 120 people attended, including US & Japanese representatives. The main outcomes of the Workshop are summarised as below. It emerged that reliability requirements (and consequent needs) can be divided into two categories:

Projects with quantitative reliability specification
– These will need a reliability tool that includes both model and data. RAC PRISM and CNET RDF tools are the only possible alternatives proposed so far to MIL-HDBK-217.
– The CNES-Multipartenariat constituted a French working group which concluded that RDF should be used for commercial parts (217 remaining for HIREL). Such an approach is certainly necessary for the extension to European level to investigate PRISM & RDF tools in parallel.
– A complementary approach of correcting reliability handbooks (ISDF 13-98 project) was also presented. It may be a short-term alternative to non-updated handbooks.
– Maintenance of the databases will remain a problem. Past efforts have been unsuccessful (e.g. DIRAC). Maintenance of RDF will be necessary beyond 2008. Maintenance of the PRISM database was suggested by RAC. Both RAC and RDF suggested a Data Share Consortium at the French or European level for RDF, and at the US or international level for PRISM.

Projects with no quantitative reliability specification
– These projects do not need reliability prediction tools, using risk-mitigation instead and consequent engineering tools such as FMEA and test/manufacturer data. Specific approaches of risk limitation can be used.

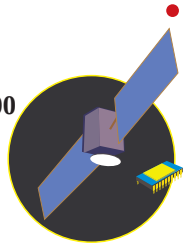
– Taking into account that 'reliability specified programs' perform the same analysis on a case-by-case basis (specific parts/use), it is important to standardise this methodology. It is necessary to consider the adoption of existing standards (e.g. SSB EIA documents) or if new European standards have to be developed, especially for failure-rate estimating.
– When addressing specific EEE parts points (design/qualification/use/mount), a Physics of Failure approach has to be developed to provide a comprehensive understanding of the phenomena.
– Even for reliability trade-offs (architecture design), reliability prediction tools will have to be used.

As a general comment, it was pointed out that parts failures represent fewer than 30% of the total field failures. It was considered necessary to have a tool integrating those extrinsic aspects (manufacturing, design, ...); PRISM allows this kind of analysis. Such an aspect has to be considered as a second-level (longer-term) action. For all of these approaches to have international recognition, the European documents should at least correspond to ECSS standards. Non-space international committees (IEC) have rejected RDF as a possible standard and there is no evidence of the adoption of PRISM as an official standard in the US (NASA has so far made no comments on formal recognition).

The EUROSPACE working group is now preparing recommendations based on the above points and those from the previous European meeting, in June 1999.

ESCCON 2000

ESTEC, Noordwijk, The Netherlands, 21-23 March 2000



The first Space Components Conference, organised under the auspices of the Space Components Steering Board (SCSB), was held in March. ESCCON follows three previous ESA Space Components Conferences. The international flavour was strongly maintained in 2000 with contributions from Europe, the United States and Japan. 270 participants came from 18 countries spanning North and South America, Europe and the Far East.

The 3-day programme was opened by the Chairman of SCSB, Alex Soons. Recalling the activities of the SCAHC and the many recommendations and changes that have occurred in European Space Components Coordination since the last conference in 1997, Mr Soons was pleased to open the conference as the fulfilment of a direct recommendation of the SCAHC. Further, he was able to announce initial plans for ESCCON 2002 and 2004, which will be hosted by the UK and France, respectively.

The conference featured six technical oral sessions and a supporting poster session. 67 papers were presented covering Radiation, Packaging, Assurance/ Procurement, From IP to Product, Microwave, Emerging IC Technologies and Products and, finally, Electro-optics. In the oral sessions there were invited papers, keynote and extended papers. In the Microwave session, for instance, invited speakers from the space community and beyond presented the state-of-the-art in the diverse and competing technology fields – silicon germanium, silicon carbide, indium phosphide, gallium arsenide and gallium nitride. A paper from the user's perspective maintained a balance – and this was also seen in other sessions.

The Assurance/Procurement session saw many views and methods presented to deal with the diminishing availability of high-reliability and radiation-tolerant parts. These were complemented by other papers giving results and progress of Space component activities under the aegis of the SCSB.

The breaks, lunches and a successful social programme saw a considerable exchange of views between participants. In closing the conference, Mr Soons was justifiably able to state that it had been an intense, technically stimulating and very successful 3 days. With offers to organise the next two conferences, the SCSB looks forward to a strong and productive future ESCCON programme.

The Proceedings of ESCCON 2000 will be published by the ESA Publications Division in June. The papers will also be made available via ESCIES. See http://esapub.esrin.esa.it and http://www.escies.org

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