

SOCCER

Civilian IPs re-use in Systems-on-Chip for Aerospace & Defence

Building up a European Exchange Structure for IP blocks adapted and qualified for application in Aerospace industry

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Outline

- ★ Short introduction to the SOCCER project
- ★ Rationale for use and re-use of IPs in aerospace applications
- ★ A methodology for IP selection, adaptation and qualification
- ★ Catalogue of IPs for Aerospace and Defence industry:
 - ★ Functional description
 - ★ Data model
 - ★ Contents
 - ★ An example of IP out from the catalogue
 - ★ Future catalogue extension

Introducing SOCCER Project

Partners are European industries working in Aerospace and Defence, excellence academia and design houses with **common interest for Intellectual Property (IP) use in Systems-on-Chips (SoC):**

- ★ To define and assess methods to **select, validate and qualify commercial IPs**
- ★ To set up a **library of specific IPs commonly used for aerospace and defence applications**
- ★ To ease the **design of complex SoC based on IPs**

4 participating countries, 7 partners

Duration: April 2003 - November 2005



SOCCER is supported by **WEU Western European Union** through the **WEAO Western European Armaments Organisation - Research Cell** within the framework of **SOCRATE System of cooperation for research and technology in Europe**



SOCs vs. Aerospace & Defence: a rationale for SOCCER

Aerospace and Defence industry will never again have access to electronic components designed and manufactured specifically to meet their needs, as in the past years.

They **must learn how to use civilian electronic components.**

- ★ Entire aerospace industry now consumes less than one per cent of the electronic components produced
- ★ Defence industry has no broad-based access to a vertical supply chain for electronic components
- ★ Life cycles of integrated circuit are shrinking, to the point where the term component life cycle is meaningless
- ★ Obsolescence management heavily impacts costs



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Aerospace and Defence specific needs

Two main categories of requirements:

- ★ on the **physical implementation** of the final SoC in which the IP is instantiated - i.e. the target technology (either Cell Based IC or FPGA)
- ★ requirements on the **IPs**

Systems must withstand harsh storage and operational environment. Main IP related requirements are:

- ★ **IP quality** - linked to the contents, methodology and rules used to develop it
- ★ **IP reliability** - related with the number of failures, measured on a manufactured component, i.e. a chip including the IP
- ★ **IP safety** - a system level characteristics, implying requirements on the reliability level of its components, and on the system architecture
- ★ **IP certification** - related with the compliance to standards (e.g. ISO, RTCA-DO, etc.);
- ★ **IP lifetime** - i.e. availability of maintenance and support for the IP, including technology porting



A methodology for IPs management

– IP selection

- Main issue: select the right IP versus system needs
- ↳ Validate the IP compliance at an early stage: not after purchase!

– IP adaptation

- Pragmatic: IPs will never fit exactly our needs
- ↳ Need for methods and tools to manage the risks linked to adaptation

– IP qualification

- How to assess the quality of an IP (= 1 / effort to use it)
- ↳ **Qualification process and metrics**

IPs exchange model

Make / Team / Buy

decision :

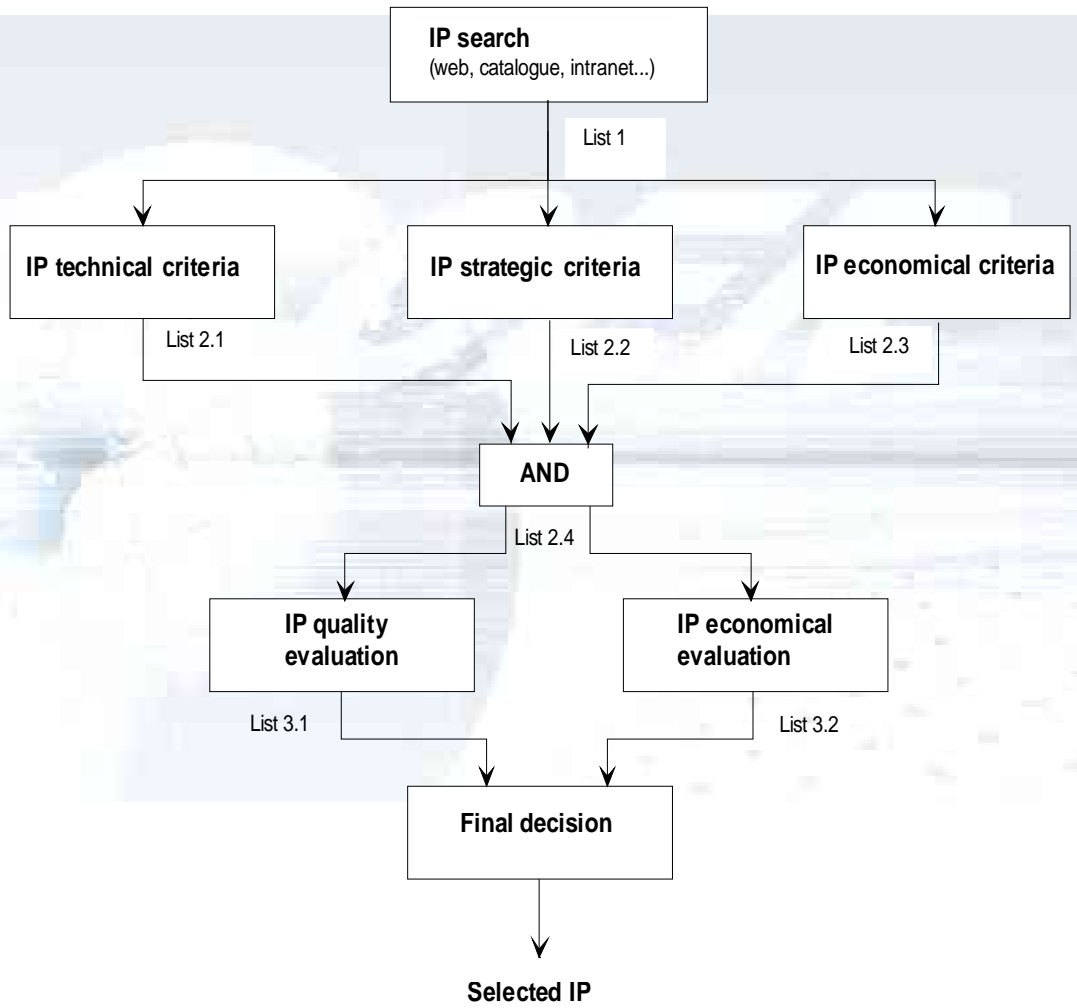
- ★ Specify typical and minimum contents for IP
- ★ Define IP selection criteria
- ★ Build an IP selection process

1

2

3

4

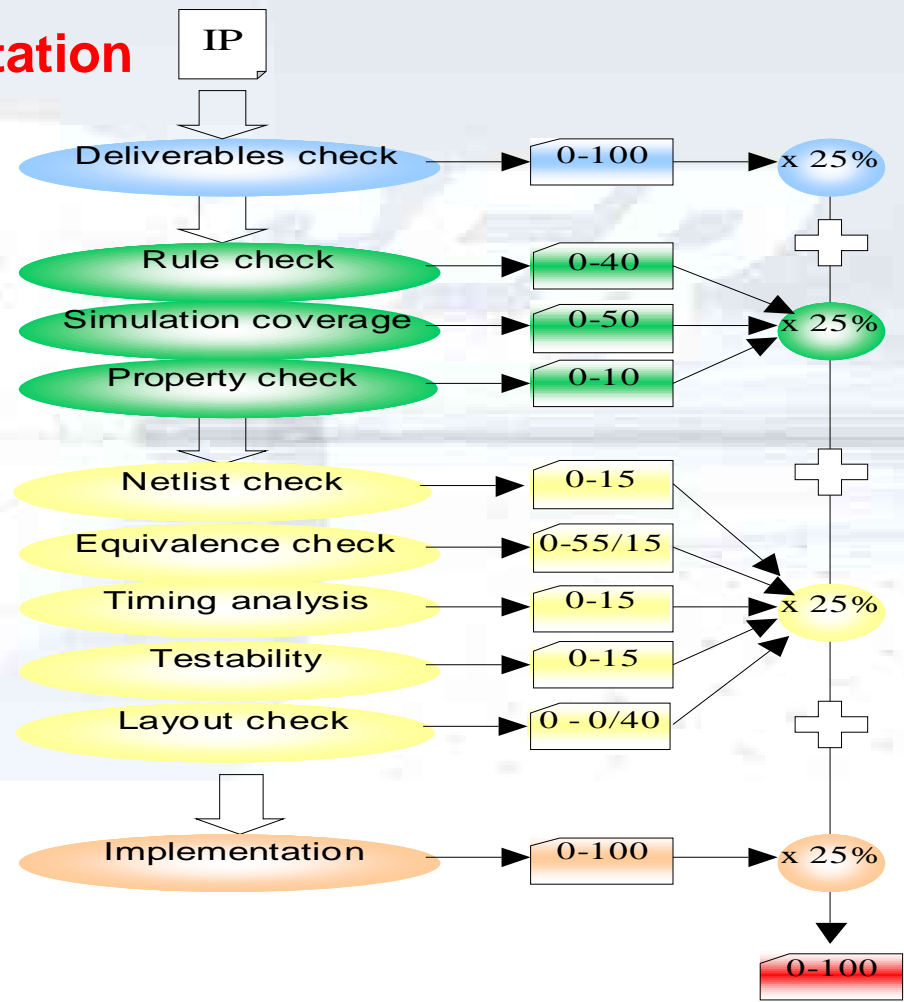


Adaptation and qualification of commercial IPs

Design rules for IP design and/or adaptation

Qualification metrics: 4 categories

- Deliverables checking
 - ↳ verifying that documents are available
- Code checking
 - ↳ focusing on RTL, test bench, simulation quality
- Design checking
 - ↳ dealing with netlist
- Physical checking
 - ↳ concerning implementation



IP Catalogue: motivation and scope

★ Objectives:

- To create **a structure for Aerospace & Defence IP exchange**
- To include some IPs in this structure in order to **validate it** and to be able to **initiate a dynamic IPs exchange mechanism**

★ Description:

- Catalogue structure definition
- Catalogue, IPs delivery for exchange



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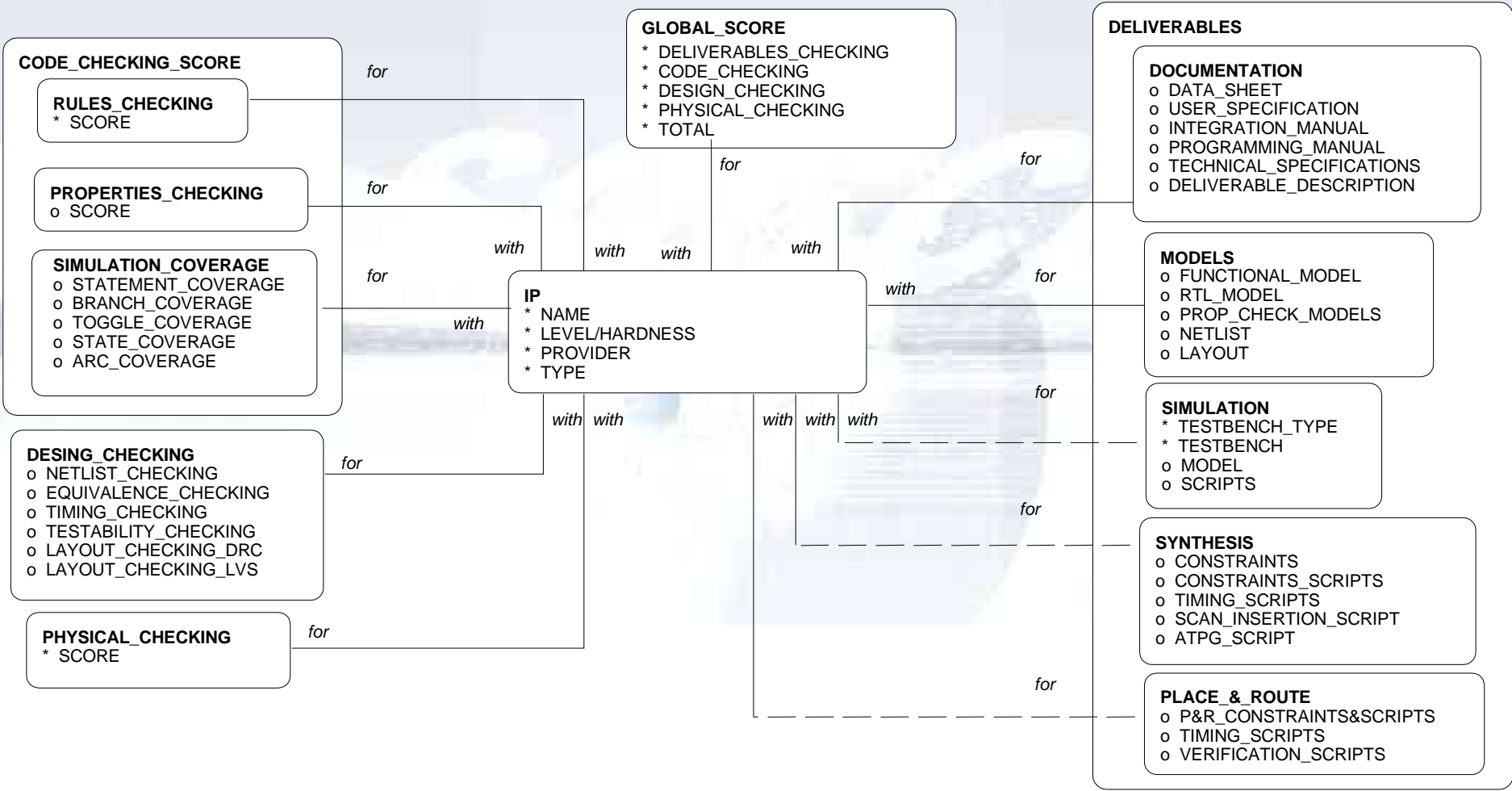
Catalogue Implementation

- ★ A **three-tier architecture**:
 - Web Server: Sun Java System Application Server Platform
 - Application Server: Sun Java System Application Server Platform
 - Database Server: Oracle
- ★ SOCCER Catalogue available through a web browser providing web applications with facilities for:
 - **IP searching**
 - **IP profile consulting**
 - **Downloading of unclassified IPs archived in the Catalogue**
- ★ User authentication with username and password. Two types of users:
 - Soccer **Users**, just allowed to consult & view remotely;
 - Soccer **Members**, permitted to consult & view remotely but also to download the IPs
- ★ Database will be **populated with a set of IPs** for demonstration purpose, used in actual silicon demonstrator (FPGA boards)

Data model notation

- ★ Entities are displayed as boxes on the diagram, and display details such as attributes
- ★ The types of the attributes that are displayed on an entity are indicated by the symbol displayed to the left of the attribute name
 - ① |, unique Identifier (UID), a combination of attributes and/or relationships that serves to identify uniquely an occurrence of an entity.
 - ① *, mandatory Attribute
 - ① ⁰, optional Attribute
- ★ Relationships display graphical indications of the optionally and cardinality of the relationship ends
 - ① ----- Optional
 - ① _____ Mandatory
 - ① _____ Single
 - ① ↙— Multiple

Data model



Graphical User Interface components

- ★ **Search and download panel** with:
 - text components to enter the search criteria
 - a table to show the most meaningful IP data
 - buttons to execute the search and download operations
- ★ **IP viewer panel**
 - A panel with two sides for visualising the IP data.
 - The left-hand side shows the IP items as a tree
 - The right-hand side shows the value of the item that has been selected in the left-hand side

Catalogue contents at date May-05

- ★ **Quixilica Floating-Point Unit** for PPC405 Core. IEEE-754 compliant single-precision floating-point unit for Xilinx Virtex-II Pro embedded PowerPC microprocessors
- ★ **Multf 32-bit single precision Floating Point pipelined Multiplier**
- ★ **Binary pattern correlator megafunction** - compares the digital pattern with masking capabilities and parallel correlation summing network for maximum speed
- ★ **EIA RS-170 Timing Generator** video encoder fully compliant with the EIA RS-170 standard, providing the raw outputs with the correct timing for use with generic video DACs, the video control signal composite sync and blank



Cooperation Agreement



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Catalogue contents at date May-05

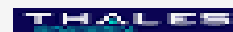
- ★ **JPEG2000 Encoder** BA112JPEG2000E JPEG 2000 algorithm, used for military avionics imaging application
- ★ **JPEG Fast Encoder** high performance megafunction for image and video compression applications, compliant with ISO/IEC 10918-1 JPEG standard, ideal for any cross platform application
- ★ **I2C /AMBA APB core** I2C serial bus Master Core with AMBA APB parallel interface
- ★ **Leon 2: synthesisable processor free core** based on the Sparc V8 architecture, designed under contract from the European space Agency
- ★ **Nios® 3.0 pipelined general-purpose RISC** microprocessor



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Catalogue snapshots: examples

The screenshot shows the SOCCER IP Catalogue web application. At the top, the word "SOCCER" is displayed in a large, stylized font. Below it, there is a navigation menu with buttons for PROJECT, PARTNERSHIP, IP TECHNOLOGY, IP Catalogue (highlighted in red), RESOURCES, and EVENTS. A search bar is located at the top right, with fields for "Name", "Contract", "URL", "Keywords", and a "Go" button. The main content area is titled "IP Catalogue" and contains a search form with fields for "Provider", "IP Level / Address", "Time", and "Keywords". Below the form are "Submit" and "Reset" buttons. A message below the form reads: "Enter search criteria and click on 'Submit' to search". Below this, there is a section titled "The help up will guide you how to use the Catalogue application" with a list of links: "Find a topic", "User manual", and "Search criteria". At the bottom, there is a section titled "Enter the input facility in creating a new IP" with a link "Logout the Catalogue". The footer of the application features logos for ESA, CNM, CRISA, Collins Aerospace, MBDA, SAAB, and THALES.

Catalogue snapshots: examples

The screenshot shows the SOCCER website interface. At the top, the word "SOCCER" is displayed in a large, stylized font. Below it, there is a navigation menu with buttons for "HOME", "CONTACT", "ABOUT US", and "SEARCH". A search bar is also present. On the left side, there is a vertical menu with buttons for "PROJECT", "PARTNERSHIP", "IP TECHNOLOGY", "IP CORES", "IP CORES", "IP CORES", "IP CORES", and "EVENTS". The main content area is titled "IP Catalogue" and contains a search form with fields for "Project" and "IP Core". Below the search form, there is a section titled "IP Data Form" with a "New IP Core" button. The "IP Data Form" section includes a table with columns for "Documentation" and "File path please refer to the IP doc". The table has rows for "Technical specification", "User Specification", "Implementation", "Use case description", "Interfacing details", "Use & reuse", and "Models". The "Implementation" row is highlighted in blue. Below the table, there is a "Models" section with a "Company Name/Address" field.

Catalogue snapshots: examples

Failure checking

Technological Score

Type	Score	Weight	Value
Reliability checking	verifiable results: 60%	45.0	<input type="text"/>
Equipment checking	Equipment results: 60%	25.0	<input type="text"/>
Failure analysis	Failure analysis results: 60%	30.0	<input type="text"/>
Failure identification	Failure identification results: 60%	30.0	<input type="text"/>
Life cycle checking	Life cycle results: 60%	0.0	<input type="text"/>
	Life cycle results: 60%	0.0	<input type="text"/>

Physical Design Score

Type	Score	Value
Physical Design	Physical Design results: 60%	<input type="text"/>

Description

Export Print



Catalogue snapshots: examples

The screenshot shows the SOCCER IP Core Catalogue website. The header features the SOCCER logo and a search bar. The left sidebar contains navigation tabs for PROJECTS, PARTS LIST, IP TECHNOLOGY, APPLICATIONS, and SERVICES. The main content area displays search results for 'Catalogue' with a search bar and a list of IP cores. Each result includes the core name, a Global Score, and a Download link.

Search Results	Global Score	
CCP44444	100.00	Download
IP Provider: Thales Communications		
IP Description: IP Core for the CCP44444 project		
CCP44444	100.00	Download
IP Provider: Thales Communications		
IP Description: IP Core for the CCP44444 project		
CCP44444	100.00	Download
IP Provider: Thales Communications		
IP Description: IP Core for the CCP44444 project		
CCP44444	100.00	Download
IP Provider: Thales Communications		
IP Description: IP Core for the CCP44444 project		
CCP44444	100.00	Download
IP Provider: Thales Communications		
IP Description: IP Core for the CCP44444 project		
CCP44444	100.00	Download
IP Provider: Thales Communications		
IP Description: IP Core for the CCP44444 project		

Catalogue snapshots: examples

The screenshot shows the SOCCER IP core catalogue interface. The header features the 'SOCCER' logo and navigation buttons: 'Home', 'IP blocks', 'About us', 'Search', and 'Help'. Below the header, there are navigation tabs: 'PROJECT', 'IP TECHNOLOGY', 'RESOURCES', and 'HELP'. The 'IP TECHNOLOGY' tab is active, showing a tree view of IP blocks. The 'Design Checking' block is selected, and its properties are displayed in a table.

Type	Score	Weight	Value
Deliverables checking	0 to 100%	25.0	25.0
Code checking	0 to 100%	25.0	41.0
Design checking	0 to 100%	25.0	25.0
High level checking	0 to 100%	25.0	100.0
IP block			14.00



Catalogue snapshots: examples

The screenshot shows a website interface with a header containing the word "SOCER" in a stylized font. Below the header is a navigation menu with links for "Home", "contacts", "site map", and "search". A sidebar on the left lists categories: "PROJECT", "PARTNERSHIP", "IP TECHNOLOGY", "INFRASTRUCTURE", and "EVENTS". The main content area displays a list of IP cores with columns for "IP Provider", "Description", "IP Provider", "Description", "IP Provider", and "Description". A "Download" button is visible next to the first two entries. A "Descarga de archivos" dialog box is open in the foreground, showing a globe icon and a file named "temple_5_712.zip" with a size of "500 KB". The dialog box has options for "Quitar este archivo ahora?" and "Guardar este archivo ahora?".

Descarga de archivos:

Nombre del archivo: temple_5_712.zip (500 KB)

¿Quitar este archivo ahora?

Eliminar este archivo ahora.

Guardar este archivo ahora.

Pedir permiso para guardar este archivo.

IP Provider: Denso-Elex

IP Description: IP-H: Windup/700V/5kV/1.5A/4500W/4.0A/5000W

temple 11 | 1 | 1 [Download](#)

IP Provider: NCC

IP Description: Fusing Point/400V/5A

IP-H: fast P 11 | 1 | 1 [Download](#)

IP Provider: CALM, 307-1154

IP Description: ipco-Duo berco/0.5A/0.7A/1.5kV/0.50A/0.50A/500W/1.5A

The catalogue use

- ★ **Users** will have a highly **valuable information** as starting point for the IP blocks they intend to use in their SOC designs, avoiding problems already encountered by other users of the same IP blocks.
- ★ **Users** will be able to **update IP information** when necessary, or create new versions when adding new features to the IP. Users shall commit to provide use feedback to the database
- ★ **IP vendors** will have the possibility to hang their IPs in the database for **evaluation and / or use in the aerospace and defence sector**
- ★ The database will have associated a **working procedure**, which will describe the way the information is introduced, maintained, searched and delivered by users. All database users will have to follow the procedure to guarantee data coherency and maintenance



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SOC CER Offers to ESA

- Introduce reduced number of IPs in SOC CER catalogue to demonstrate methodology (for free)
- Future Interest
 - Include new IPs
 - SOC CER catalogue as IP repository
 - Independent IP validation structure
 - New partners



Centre for Nuclear Modelling



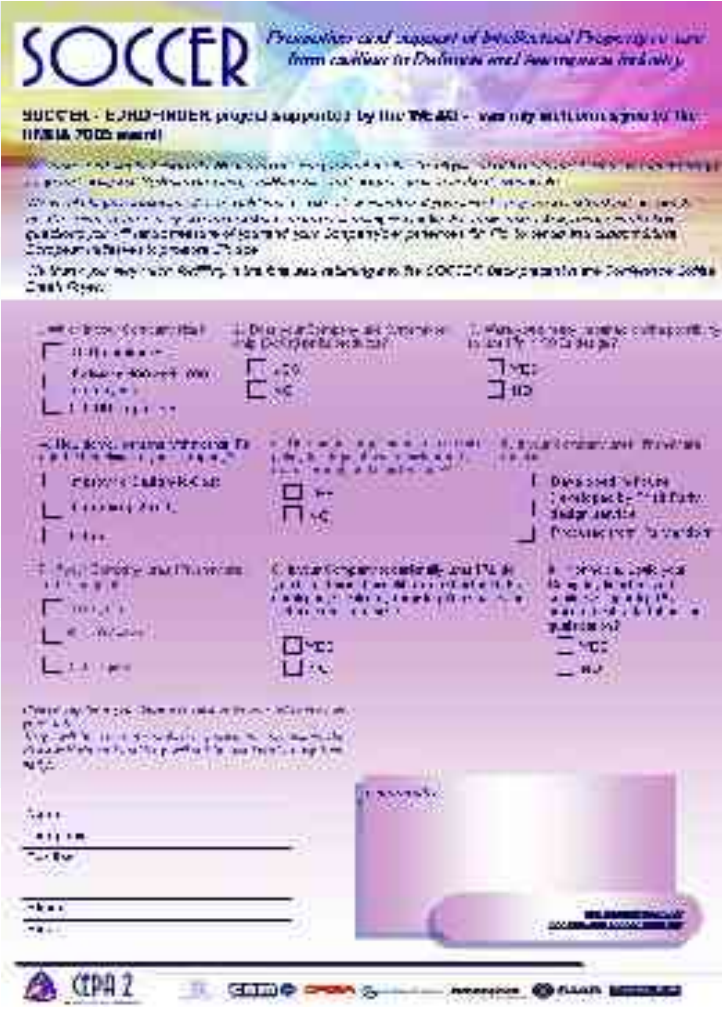
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We need your feedback

Please fill in the circulated form and return it to the SOCCER table!

Please visit us and see our industrial demonstrators including SOCCER IPs at work!



Contacts

More about SOCCER?

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Consorzio Aeronautico



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