



CENTRE NATIONAL D'ÉTUDES SPATIALES



# CNES Vision : Key Components

Philippe GOUDY Deputy Director of CNES Toulouse Center



# Summary

- **Space EEE components situation**
- **CNES Vision**
- **Focus on advanced digital components**
- **Main messages**

## ■ European Strengths :

- ♦ Major WW competitive satellite manufacturers  
==> Strong needs of advanced and standards components
- ♦ A “viable” European Space component market :  
Approx. 300 M€/ year
- ♦ Major component manufacturers in Europe like ATMEL, OMMIC, UMS, STm, ... interested by the space market  
==> Access to state of the art commercial technologies
- ♦ Strong “components” expertise (Agencies, End users, Manufacturers, Assembly, Test, Design, ...) allowing to specify, develop and qualify attractive space components

## ■ European Weaknesses :

### ♦ European R & D budgets are limited compared to US ones (one order of mag.) and not stable

- Approx. 7 to 10 M€/year (including approx 2,5 M€/year for CNES)
- **Not secured for the near future** (ESA ECI > 2011 ?, FP7 ?, ...)

### ♦ Large gap between European and non European space products.

- Silicon CMOS technologies: approx. 2 to 3 years, 1 or 2 generations,
- Processors and DSP's: approx. factor 10 on calculation power,
- FPGA's: approx. factor 10 on equivalent gates count,
- GaN RF and Power switches : approx. 2 to 3 years,
- ...

⇒ **The portfolio of existing European components cannot cover adequately the full spectrum of needs**

⇒ **Risk of dependence of Europe on several domains :**

- Microprocessors, Digital Signal Processors, Memories, ASIC's (< 0.18 microns), linear IC, FPGA, A/D & D/A converters, Power MOSFET's, RF Power transistors and MMIC's, Key passives components (relays, fuses, ...)
- ...

## ■ Major changes/evolutions

- ♦ New global heavy trend with the “Fabless/Fabligh approach” for digital CMOS processes ==> CMOS process < 65nm available in the future ??
- ♦ Recent evolution of the space components supply chain (e.g. MHS, ATMEL, e2v, ...)
- ♦ Access costs to advanced technologies are growing rapidly with a reduced “availability windows” (Space life cycle : 15 years, compared to commercial one : approx. 8 years)
- ♦ Strong need of advanced digital components for future flexible payloads for Telecommunications satellites
- ♦ Enabling New technologies not yet available in Europe (e.g. : RF GaN, Power switches GaN)
- ♦ CMOS Imaging could potentially replace CCD Imaging

- **Necessity to maintain a viable European supply chain :**
  - ♦ **Competitiveness of the European space industry**
  - ♦ **Strategic independence**
  - ♦ **Components for Space is a significant market by itself**
  
- **Active support to the development of space components (Hi-rel)**
  
- **and, on the use of COTS components**
  - ♦ **Complementary approach (Myriade, Pleiades, ...)**
  - ♦ **with appropriate methodology already developed and under ECSS “standardization”**
  
- **Develop and maintain a CNES strong expertise on all the skills needed**
  - ♦ **Radiation environment, Hardening, Reliability, Quality, Expertise, Project support, Laboratories, ...**

- **Harmonize our activities through strong cooperation with:**
  - ◆ **ESA, other European Agencies, Primes and manufacturers** in the frame of European Space Component Coordination (ESCC)
  - ◆ **French primes and equipment makers** within the French Components Multi-partnership for CNES programs **(in particular for COTS components use)**
  - ◆ **JAXA** through the general CNES JAXA collaboration **(FPGA's co-development, Joint in flight radiation experiments, ...)**
  
- **As far as we can, foster common work between Agencies, prime & component manufacturers to achieve a shared approach on :**
  - ◆ Product specifications,
  - ◆ Design,
  - ◆ industrial processes (Front end, Assembly, Test, Product life time, obsolescence management, ...)
  - ◆ ...

- **Develop/Evaluate the selected key space components and contribute to the European effort on :**
  - ◆ **Advanced Digital components (ATMEL, e2v, STm, Lfoundry,...)** Sub micron CMOS technologies, ASIC's, FPGA, microcontrollers, processors, memories, Converters, ...
  - ◆ **Standards components (STm, ...)** Power MOSFET's, fast logic IC 's, Transistors, diodes...
  - ◆ **RF components (MMIC's, ...) UMS and OMMIC**
  - ◆ **Passive components (RED, Vishay, ...)**
  - ◆ **Photonics (e2v, ...)**
  - ◆ ...
  
- **With an development model backed on the commercial market :**
  - ◆ **Utilization of existing high volume technologies/ products /IP's**  
(Avoid very expensive developments from scratch of specific technologies, tools, ...)
  - ◆ **Adaptation of those existing technologies for the space use**  
(mainly : Reliability, hardening, Assembly, Test, ...)
  - ◆ **Business model based on the commercial one**  
(activities are sustained by the sales, R & D sustained by Institutional budgets, ...)



# Focus on Advanced digital components

## ■ Technical context

- ♦ To maintain the space 180nm CMOS (process available since 2006 with EoL approx. 2013)
- ♦ To develop and qualify the next space CMOS 65nm not yet available and New Generation products (Activities started by ESA and CNES but budget to completion is not yet committed)
  - Reminder : Short/medium term Top priorities Identified and validated by ESCC/CTB :
    - 65nm CMOS technology for ASIC's up to 20Mgates (FO ESA CNES activity)
    - FPGA NG 1 to 2 Mgates and EEPROM memory (FO CNES activities 280 et 450kgates)
    - High Speed Serial Links
    - Hi Speed SRAM Memories (FO CNES activity development),
    - Hi speed Converters CAN et DAC,
    - IP's for SoC applications,
    - .....AND : microprocessors NG, microcontrollers NG, DSP NG,

# Focus on Advanced digital components

## ■ Programmatic context

- ◆ Synergies with others niche sectors are limited (different requirements)
  - ◆ Cost to access new technologies are increasing rapidly (eg mask cost, fab cost, ..)
  - ◆ Most of the manufacturers of advanced digital components are in France,
  - ◆ Instability of the space components supply chain
  - ◆ Institutional Europeans Budgets : not sufficient and not stable
    - ECI FO ?
    - FP7 not well adapted for the development of space components  
(at least 3 countries/many co partners ==> limited efficiency for manufacturers and complex management)
    - TRP ESA: Difficult due to low TRL target (1 to 3) and geo return problem for France
    - GSTP very limited
- ==> Short term : Institutional resources are too low to complete the development of the next generation digital components in Europe**

1. The performances and the competitiveness of European space systems are directly dependent of the availability and the performances of advanced digital components

**Absolute need to fill the performance gap between European and non European components**

2. Major component manufacturers, addressing space market, are in Europe but the space niche market is very fragile

**It is urgent to guarantee to the European community an independent access to the new generation advanced digital components**

3. Very particular binding conjunction for the next 5 years :
  - ♦ Strong needs for new generation ASIC's AND FPGA's
  - ♦ CCD's AND new generation CMOS Imaging sensors
  - ♦ Maintain access to the current 0.18µm AND finish asap the development of the 65nm

**Urgency for the European space community to adopt, an ambitious « Digital components plan » (end 2011) answering to those particular challenges**

4. Under the pressure of the rapid evolution of the commercial business model (e.g. Fabless, Fablight, non vertical organisation, SoC, SiP, ...) our space business model (mainly based on the commercial one) will evolves:

**But, absolute necessity to keep under control the following phases :**

- **Design and Intellectual property,**
- **Assembly/Test/Life cycle and obsolescence management**

**and the access to advanced foundries**

5. Actors of the space components community (agencies, Primes/equipment makers, Components manufacturers) have to reinforce and consolidate their commitments in a joint effort

**CNES is continuing the dialog with all actors to find solutions and to reinforce its analysis. A dedicated Working Group has been set up at CNES for that with the target to propose recommendations by end Q2/2011**

# Main messages

**CNES is confident Europe can take up the challenge**

- ♦ **Major WW satellite/equipment makers need state of the art and competitive components**
- ♦ **Viable space market**
- ♦ **Involved manufacturers**
- ♦ **Technology nodes available**
- ♦ **Back end capacities available**
- ♦ **ESCC organisation**
- ♦ **European Strong expertise**
- ♦ **...**

Thank You