Thales Alenia Space ETCA:
1963 - 2009
More than 45 years of Experience in Space
Thales Alenia Space ETCA

Three activities

Revenues 2008 : 98 M€
Export : 80%

About 650 people
- Engineering & industrialisation : 46%
- Manufacturing & Quality : 44%
- Sales & G&A : 10%

Launchers

Satellites

19%  65%  16%

Telecom
Facilities: 42,000 m²
Manufacturing & test: 22,000 m²
Clean rooms: 10,000 m².

Hybrid workshop
Ariane workshop
Industrial & Mechanical workshops
Avionics workshop
EPC/TWTA workshop
Environmental tests
Equipment and Services for Space Applications

TAS-ETCA : Lead Center of TAS for Electrical Power
- High Power (PCU up to 21 kW)
- High Voltage (EPC up to 8,5 kV)

Satellites : from micro-satellite to geo-stationary satellite
- Electrical Power treatment and distribution system
- Avionics
- Power supply for Plasmic Propulsion thruster
- EPC for Travelling Wave Tubes
- DC/DC Converters for electronic equipment

Launchers : Ariane 5, Soyuz (Kourou)
- On board Control and security Equipment
- Overall and Specific Check Out Equipment (OCOE/SCOE)
- Electrical Ground Support Equipment
PCU/PCDU Product Range

PCU High Power for Telecom satellites (GEO)

- Equipment mass
  - 10 kg
  - 20 kg
  - 30 kg
  - 40 kg
  - 50 kg
  - 60 kg

- Bus power
  - 5 kW
  - 10 kW
  - 15 kW
  - 20 kW
  - 25 kW

PCDU Low Power for Earth Observation and Science satellites (LEO/MEO)
- SB3000 PCU
- SB4000 PCU
- PCU-NG

PCDU Medium Power for Telecom, Earth Observation and Science satellites (LEO/MEO, Interplanetary)
- SB3000 PCU
- SB4000 PCU
- PCU-NG

PCDU Low Power for Earth Observation and Science satellites (LEO/MEO)
- PCDU MYRIADE
- PCE PROTEUS

PCDU Medium Power for Telecom, Earth Observation and Science satellites (LEO/MEO, Interplanetary)
- PLEIADES DRU
- PDU GIOVE-B
- PCDU Herschel-Planck
- PCDU G*2
- PCE PROTEUS
Range of Avionics products dedicated to:

- Power distribution
- Heaters control modules
- Mechanisms drivers (solar arrays, antennas, ...)
- Propulsion controls and commands
- Lithium Ion Management Unit

Available as

- **Stand alone boards** for Thales Alenia Space interface module (SDIU)
- **Stand alone equipments**
  (1 single function per equipment)
- **Modular Avionic Equipment**
  (more than 1 function per equipment thanks to a modular packaging, already qualified)
EPC version 2.1: ESA qualified in 1998
- RF Power: 15 to 220 Wrf
- Compatible with L, S, C, X, Ku and Ka bands:
- Mass: 1400 g

More than 550 FM's ordered
- for every satellite platforms
- For every market:
  - Commercial, institutional, scientific, dual, ...
  - Europe, USA, Asia, ...

Heritage > 15,000,000 hours in orbit

EPC version 3.0 MP: ESA qualified in 2007
- RF Power: 15 to 165 Wrf
- Compatible with L, S, C, X, Ku and Ka bands:
- Mass: 1150 g

More than 130 FM's ordered
- for every satellite platforms
- For every market:
  - Commercial, institutional, scientific, dual, ...
  - Europe, USA, Asia, ...

Heritage > ~15,000 hours: EQMs on ground
> 2,000 hours in orbit

Dual EPC: under ESA qualification, availability: Q2/2010
Low Power Low Cost DC/DC converters - LPLC DC/DC
- delivering from any type of primary bus all secondary voltages necessary to any users
- Also used in all our own products: PCU, PCDU, PPU, EPC, ...
- Complete portfolio
  - Input voltage: 20V → 50V and 50V → 126V
  - P_out max : 40 W - 1 to 5 outputs
  - Hybrid technology (hermetically sealed packaging)
- Heritage: more than 2000 FM’s already ordered:
  - Products/Payloads: PCU, PCDU, Star Tracker, Earth Sensor, SREM, SADE, OBC, PPU, CMCU, GYRO, MPFL, SSPA, Transponders, DCU, ...
  - Customers all around the world

Power supply dedicated to payloads such as:
- RADAR or Altimeter
- SAR imagery
- Particularity: generation of power pulses
- Heritage:
  - Envisat (RA2-LVPS, ASAR-PSU), Metop (ASCAT-EPC), EUCLID 9.3 – EUCLID 9.7, THALES 1.3, TERRASAR-L, JASON-2 - POSEIDON 3, ...
  - ⇒ ≈ 100 PSU already delivered

Power supply Unit Instrument Interface
- 24-32V input voltage
- 75 W in total for up to 8 DC outputs
- Arming and control of up to 7 heater lines
- Many references
These equipments are based on building-blocks using standard, or customised, subfunctions such as:

- DC/DC converters, LCL (latching current limiters), TM/TC modules, BDR/BCR power hybrids, S3R (Sequentiel Switching Shunt Regulator) hybrids, µ_controllers…

Hybrid microelectronics activity

- relies on hermetic packaging, chip & wire processes (naked dies), various technologies of substrates (Thick film, thin film, DBC,…)
- is oriented on design & production of Hi-Rel devices
- is focused on captive, external and both oriented on Space and specialised applications market

Hardware fabrication in ETCA involves various technologies and methods of productions:

- Hybrid circuits (MCMs, Power modules, Analog, Digital, High Voltage, …)
- Mechanical parts
- Coil & winding parts
- SMD (PWB) assembly
- Cabling and mechanical assembly
Variants of hybrids produced in ETCA

PRODUCTION OF BASIC NETWORKS
- Thick film substrates (on Al₂O₃ - BeO)
  (gold conductor + thick film resistors)
- Pre-metallized substrates: thin film / pattern plated and DBC substrates & Single chip carriers

HYBRIDIZATION AND INTERCONNECTION OF PARTS with "added-on components"
- Capacitors
- Magnetic components
- Naked chips
- Mounting on carrier (Single or multiple)

ENCAPSULATION IN HERMETIC PACKAGE AND SEALING
- HTCC package LLCE hybrid
- Kovar package LLKO hybrid
- Power package HPMO - HPKO hybrid
- Macrohybrid Al package MCPH/SCPH hybrid

LEGEND:
- ESA : qualified ESA-PSS-01-606
- LL : Low power (function)
- P : Power (function)
- HPMO : High power molybdenum package
- MCPH : Multi-cavity power hybrid (Alu)
Hybrid electronics in TAS-ETCA

Passive networks in thick film technology
- **Conductors**: Gold, in mono/multi-layered circuit configuration, Au-Pt for land pads destined to soldering
- **Resistors** (screen-printed or added-on): 0.3Ω ... 10MΩ
- **Thick film shunts** (screen-printed or added-on): 5 mΩ ... 300 mΩ, current capability 30A
- **Substrates**: Alumina (As fired, or polished), Berylla (pre-scribbled as snapstrates)

Hybridization (authorised added-on components and related method of hybridization)
- **Naked chips** (with/without carriers): Au/Si eutectic die bonding, conductive/non-conductive gluing, brazing.
- **Capacitors** (ceramic, tantalium), **magnetic components**, **Current sensors** (from 0.1A to 30A max), Use of purchased substrates: gluing.

Interconnections
- **Gold wire** (thermosonic ball bonding, ultrasonic bonding, opposite electrodes welding and parallel gap welding)
- **Aluminium wire** (ultrasonic bonding, opposite electrodes welding): Ø from 300 µm to 890 µm
- **SnPb soldering** (copper wires in magnetic components)

Packaging
- **LL** (low power): flat pack or plug-in packages: LLCE, LLKO (typical power dissipation: 0.2 W/cm²)
- **HPMO**: High Power Molybdenum packages (typical power dissipation: 6 W/cm²)
- **MCPH/SCPH**: Multi or Single Cavity Power Hybrid packages, gold finish with brazed feed-thrus or conversion coating, with laser welded hermetic connector (typical power dissipation: 3 W/cm²)

Sealing of cavities in dry atmosphere
- **Seam welding** for LL, HPMO packages
- **Laser welding** for MCPH/SCPH packages

Quality level
- **ESA_PSS_01_608 ↔ ECSS-Q-60-05**: (generic specification for procurement of hybrids)
- Manufacturing processes qualified according to **ESA_PSS_01_606**
Power and Control Units for Launchers

TAS-ETCA: Largest supplier of electronic equipment for Ariane 5

- 83 kg of electronics/launcher
- 21 equipments/launcher
- 20% of the AR5 electronics
- 75% of the equipment bay electronics
- 4 to 6 launchers/year

TAS-ETCA: prime contractor for SOYUZ launcher Safety Chain Subsystem

- On board commutation electronics,
- On ground communication system
Key contact

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