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University of Vigo - INTA
Project Presentation
University of Vigo: Leader Spanish university in R+D devoted resources 260 research groups, 50 European projects, 25 patents.

INTA: Public research organization specialized in aerospace research and technology development. Experience in aerospace with many national and international projects.

Both institutions have agreed to collaborate in the development of XATCOBEO.
XATCOBEO: design & development of a satellite as educational demonstrator based in OPTOS experience

XATCOBEO SYSTEM:
SPACE SEGMENT (Cubesat 1U) + GROUND SEGMENT + USER SEGMENT

University of Vigo’s responsibilities:
Educational matters
Design and development of new technologies

INTA’s responsibilities:
Support in engineering and management
AIV facilities and expertise

Educational satellite system with professional reliability
Standards:
  - CubeSAT Design Specification (Rev 10)
  - ESA ECSS standards:
    - Space Project Management (ECSS-M-00)
    - Space Project Engineering (ECSS-E-00)

Model Philosophy: PFM

Mission objectives:
  - To contribute to the CubeSAT community with:
    - Qualification of a new deployment mechanism
    - Qualification of a 2 payloads
  - To integrate students in a CubeSAT development with high-end requirements

  Emphasis in working methodology
  (HOW is more important than WHAT)
XATCOBEO: Objectives

- Design and development of:
  - CubeSAT satellite 1U (10x10x10cm) Weight < 1kg
  - Ground segment (at the University of Vigo)
- To involve students in a space project
- To learn work methods based on ESA standards
- New technologies incorporated (SRAD, RDS, PDM)
- Launching with VEGA at the end of 2009
Project Organization

• ORGANIZATION PROBLEMS
  - Mixed teams INTA/UVIGO
  - More than 40 people creating software, hardware and documents at the same time.
Project Organization

• SOLUTION

Hierarchical organization

Electronic Management
1. Tasks are split into WorkPackages (WP).
2. Each WP is assigned to a different team.
3. Each team is formed by:
   - 1 supervisor
   - 1 student responsible
   - N members and cooperators
Project Organization

• ELECTRONIC MANAGEMENT

AGENDA

DOCUMENTS

LIBRARY
SPACE SEGMENT
**XATCOBEO: Subsystems (I)**

- **Power:**
  - Lithium battery
  - Solar panels: 2 cells on each side

- **Software:**
  - C code
  - Modes: Start-Normal-Communications-Safe

- **Computer:**
  - Microprocessor embedded in programmable logic device (FPGA)
XATCOBEO: Subsystems (II)

- **Communications:**
  - 4 antennas (TBC), omnidirectional radiation diagram
  - Uplink for telecommands, downlink for telemetry, in ham radio frequencies

- **Thermic:**
  - Passive thermic control
  - Paints and insulating materials
  - Conductive materials depending on cases

- **Structure and mechanisms:**
  - Structure: CubeSAT 1U
  - Mechanism of deployment of antennas
XATCOBEO: Experiments

- **Payloads:**
  - Software RADio board for communications (SRAD):
    - Software radio that can be configured on board
  - Radiation Dose Sensor (RDS):
    - Sensor to measure radiation

- **Panel Deployer Mechanism (PDM):**
  - Try out on board a mechanism of deployment
• Sensor to measure the total accumulated radiation dose.

• It is based on commercial RADFET technology
SRAD

A/C

D/C

System Bus

RF Frontend

Predefined radio schemes and modules
(Standard modules & Backup modules)

Free Space

Soft Processor

Buffers

Software modules

IP Stack

Control Routines

SBUS

Reconf. Routines

HW Modules (Encoding and modulation)
GROUND SEGMENT
XATCOBEO: Ground Segment

Located at the University of Vigo:

Students will be the operators of the satellite

Three main parts:

- System Control Center (SCC)
- Operation Center (OC)
- Distribution Center (DC)

Additional software required to operate payload SRAD.
Ground segment – SRAD

- User interface
- SRAD Instruction Set
- Control Routines
- SRAD IP STACK
- Software Host
- RF Frontend
Conclusions

Educational development → professional results:

Two different geographical teams: Management

New technology qualification
- Improvement in power availability (SPAD)
- Developing a new TTC kit for CubeSatellites (SRAD)
- RDS: Radiation Dose Sensor.

Main Xatcobeo payload → TO TEACH STUDENTS A WORKING METHODOLOGY
Some Pictures