OPTOS and OPTOS 2G
Small Platforms for Space Environment and Effects Monitoring Missions

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Scenario I

- Space missions dedicated to space environment and effects monitoring are more and more demanded by scientists and engineers
  - To increase the understanding of:
    - New mission environments (MEO, interplanetary, etc)
    - COTS behavior in space
  - To develop new sensors dedicated to space environment and effects monitoring, etc.
- Micro-nano satellites have been proposed as possible platforms for space environment monitoring.
  - Dedicated missions
  - Constellations

Scenario II

- Subsystems and payload developments specially designed for this kind of platforms are being promoted by ESA.
  - Space radiation sensors have to be reduced (mass, power consumption) keeping performance.
  - This could be a good scenario to for technology development and testing.

OPTOS Project - General Overview

- OPTOS platform is based in CUBESAT standard
  - Only external structure is original from CUBESAT
    - To keep CUBESAT dimensions
    - Structure already qualified.
- Subsystems, payload and inner structure is INTA development
- Engineering management and design as standard space project.
  - ECSS applied during all project phases
  - Model philosophy
    - STM – EQM – FM
- With the objective:
  - Qualify a 3 kg platform as reliable as ‘big one’ satellite.
    - Upgrade CUBESAT standard
    - New technologies in platform
    - Platform with minimum development time and cost.
OPTOS Project – General Overview

- Planning
  - CDR -> June 2008
  - Scheduled Launch date 3Q 2009 with PSLV launcher
- Orbit
  - 670km Heliosynchronous Orbit
- Ground Segment
  - Dedicated OPTOS ground segment at INTA Headquarters
- Estimated cost
  - < 1.5 M€

OPTOS Platform Subsystems – Key parts

- New technologies have been implemented in some of the S/S maintaining the OPTOS philosophy:
  - OBDH
    - Distributed architecture
    - FPGA and CPLD based

<table>
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<tr>
<th>TYPE OF DEVICE</th>
<th>NUMBER OF UNITS</th>
<th>PROVIDER</th>
<th>IDENTIFICATION</th>
<th>CHARACTERISTICS</th>
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<td>VERTEX 9-1000</td>
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OPTOS Platform Subsystems – Key parts

- On Board Communications
  - Wireless Intra-satellite communication Systems
  - Reduced CAN protocol
- Structure and Mechanisms
  - CUBESAT External structure
  - Composite materials internal Structure

OPTOS Payloads

- MAGNETISMS
  - GMR (Giant Magneto Resistance)
    - Magnetic field measurement based on GMR technology
- OPTICS
  - APIS (Athermalized Panchromatic Imaging System)
    - Panchromatic camera designed to study the degradation of optical glasses in space environment conditions and qualify the passive thermal control of the camera
  - FIBOS (Fiber Bragg Gratings for Optical Sensing)
    - Temperature Sensor using miniaturized optical devices and Bragg grating printed in a fiber optic.
- RADIATION
  - ODM (OPTOS Dose Mapping) – INTA/LAAS collaboration
    - TID monitoring, RadFET sensors based.
      - To support OPTOS mission
      - APIS camera – Glasses degradation
      - Improve radiation engineering processes - Comparison models, Geant4 vs real data.
Detected OPTOS platform weak points

- **OBCOM**
  - Wireless systems is not appropriated for such kind of platform due to the high percentage of useable space dedicated to it
- **EPS**
  - The maximum power generated is not enough.
  - Reduce the number of available power buses.
- **S&M**
  - Internal structure helps in the AIV but is volume consuming
- **ADCS**
  - Rough capabilities. Not enough for Earth observation or astrophysics missions
- **TTC**
  - Limited RF power. Half duplex capabilities

OPTOS Second Generation – OPTOS 2G

- In the framework of BRITE project, an improvement of the OPTOS platform is being studied to provide OPTOS platform better capabilities in order to support a wide range of missions:
  - **EPS**
    - Solar panel deployment system [8-15 W]
    - New battery technology: LI-PO.
    - Deployment system to be tested on board XATCOBEO Mission.
  - **S&M**
    - Only one external structure based on Aluminum beams, increasing the volume available for payloads
  - **ADCS**
    - 4 Reaction wheels and 4-5 sun sensors added.
  - **TTC**
    - S band and VHF beacon added. Full Duplex capabilities.
Proposed as IOD platform

- **Cost**
  - Budgeted for IOD platform in the range of ~1M€:
    - Including platform + AIV + Launch + Operation
    - Payloads are not included
  - Spanish Delegation is already evaluating the support of this platform for IOD platform in the frame of SEENoTC

### CONCLUSIONS

- OPTOS and OPTOS 2G are appropriate platforms candidates to support and IOD mission in the frame of SEENoTC.
- **These platforms gives:**
  - Low cost missions – recurrent platforms and designs
  - Fast development
  - Ideal environment to test technology and miniaturized payloads
Thanks very much and ...REMEMBER

**Geant4 Space User Workshop**

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See you there!!