Abstract for Regional Report
at the 7th UNISEC–Global Meeting

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Point of Contact
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POC – Spain

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UVIGO Activities

- Tailoring of Quality Standards →
- Small Satellites
- System Design: End → End

- Technological Demonstrator <-> New Technology

• International Cooperation
  • Application (Amazonia)

System of Systems
- FIRE – RS Fire Detection and Mapping

• Mixed Research Unit: Industry 4.0
  • 6U Remote Sensing Satellites
    Research–Industry 4.0 UVIGO/ CINAE

- Commercial AIV
  • Constellations
    January 2019 - Start-up Alén


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Satellite Missions: Xatcobeo

- First Spanish cubesat (1U)
- Three Payloads:
  - Software defined Radio.
  - Radiation Sensor
  - Panel deployer mechanism.
- Satellite developed tailoring the professional standards of the ESA (ECSS)
- Launch in inaugural Vega flight (13/02/2012)
- 2.5 Years of operation (re-entry)
Satellite Missions: Humsat-D

- Second Spanish cubesat (1U)
- Two Payloads:
  - HUMPL (Messages communications system)
  - Radiation Sensor
- Humsat Constellation demonstrator
- Launch in Dnepr (November 2013)
- 1 Year of operation
Satellite Missions: Serpens

- Third Cubesat of the Team (3U)
- Funded by Agência Espacial Brasileira (AEB)
- Two different sectors. Sector B fully developed by UVIGO
- 2° Humsat Constellation service tested to:
  - Europe, South-America, EEUU, Antarctica
- Launch from the ISS (19/08/2015)
- Re-entry at April 2016
- Automatic Operations, more than 50000 Telecommands executed by Serpens (Sector B)
Dustcube – Asteroid impact Mission

Concept of Operations Phases
1. Cruise
2. Injection
   a. Commissioning
3. Pre-Impact
4. Impact
5. Post-Impact
6. Disposal (TBD)

Discussion (per phase):
- Duration
- S/C main OPS activities
- Level of Autonomy
- Derived Requirements for AIM S/C
SC Configuration (Optical components distribution)

Optical components orientation during nominal OPS:

- **RNH Telescope + NAV Cams** located within +X Face
  - Pointing towards Didymos system

- **I NH Laser Beam**: located within +X Face
  - Pointing towards Didymos system

- **Star-Tracker(s)**: located within -Y and -Y (spare)
  - Pointing towards deep space avoiding the system and Sun.

- **Fine Sun sensors**: (x3)(TBC):
  - SUN-1: Face -X
  - SUN-2: Face -Z
  - SUN-3: Face +X

- **Coarse Sun sensors**: (TBC): installed on solar panels.
Satellite Missions: Fire - RS

Alarm message:
- GPS coordinates
- Time
- Speed and wind direction
- Fire extension

First alarm
- Autonomous fire detection
- Initial characterization

In situ data:
- Detail information
- Images
- Nearby population

Real time alarm download

UAV control center

- Wildfire SW assessment
- UAV flight plan

Universidad de Vigo

LUME-1

Estación Terrena

C<ntro de Control

UAV

Infrared camera

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LUME Architecture

**Satellite LUME-1:**
- Communication with remote devices M2M-IoT
- Communication with UAVs
- Onboard processing unit

**LUME configuration**

- Type: 2U Cubesat
- Orbit: SSO Ap: 520 Km Pe: 485 Km
- Orbital Period: 94.5 Min
- Coms Band: UHF/S-Band/L-Band
- Launch: 27-12-2018. Soyuz
- Payload: M2M - SDR TOTEM + HUMSAT
- Test Area: SUDOE (Galicia + North of Portugal).
SDR Results
SDR Results
History of Local Chapter Activities

**Regional Point of Contact since 2011**

- Attended UNISEC-Global Meeting in 2012, 2017 and 2019
- Organized MIC Seminars, Workshops in 2012 and 2013
- CanSat Training Program/Competition in the course 2019-20202 in cooperation with the European Space Agency
- Practical Space Projects
  - 5 CubeSats already launched.
  - More than 100 students have participated in the educational and research activities since 2007.
UNISEC-Global Activities in 2019

**Number of**
- Member Universities: 1 (4 Engineering Schools: Telecommunications, Industrial, Software and Space)
- Students: 10
- Professors: 4
- Others (Corporative members, etc.): Alén Space (spin-off company of UVIGO)

- **Organizing a Program/Training/Competition**
  - Master Degree on Systems Engineering
  - Operation Training using LUME-1 satellite

- **UNISEC-Global Meeting attendance: 2019 in Japan**

- **On-going Practical Space Projects: 3**
  - Wiptherm (Wireless Power Transmission – H2020 project)
  - Operation of LUME-1 satellite
  - Arcoptix with the European Space Agency.

- **CanSat Competition/Training: 1 in cooperation with the European Space Agency**
Plan for 2020 and beyond

Please describe plan for 2020 and beyond in your local chapter and the region.

• Establish a student lab for nanosatellites
  – Telecommunications
  – Software
  – Aerospace
  – Mechanical

Launch every 2-3 years a complete manufactured in-house by students -> Coming back to the Cubesat origins
Plan for 2020 and beyond

• Consolidate the Cansat program with regional secondary schools.

• Initiate a Laser Communication Program for Nanosatellite missions, including the participation of the OGS located at the Astrophysics Institute of Canarias Islands in Tenerife.
Mission and Objectives of FET actions are expected to initiate radically new lines of technology through unexplored collaborations between advanced multidisciplinary science and cutting-edge engineering.


**MEMBERS OF THE 2.3 M€ Project CONSORTIUM**

- University of Porto (Science Faculty)
- Centitv
- University of Limoges
- Inesc TEC
OBJETIVES

• The WiPTherm project will design, implement and pilot an innovative Wireless Energy Transfer (WET) system, able to wirelessly recharge the energy storage components used in CubeSat technologies.

• The energy harvesting system comprises dozens of microarrays of 2D thermoelectric generators, resulting in a photo-thermoelectric plasmonic (HPTP) system that has the ability to convert photon energy into electrical energy (via thermal gradient).

• The wireless thermal stimulation will be performed through a large-range pulsed highpower laser beam capable of operating remotely.
Low-temperature face

\( T(\text{cold}) \) - temperature of the coldest face

\( T(\text{hot}) \) - temperature achieved by the absorber due to incident laser beam

CubeSat

PET substrate with the HPTPGs

Diffraction Grating (divides the main beam)
Under operation (laser working), the average temperature of this face should not surpass the highest temperature threshold possible for the cubesat.