

Promoting Space Science and Technology in the University of Cádiz with Project-Based Learning

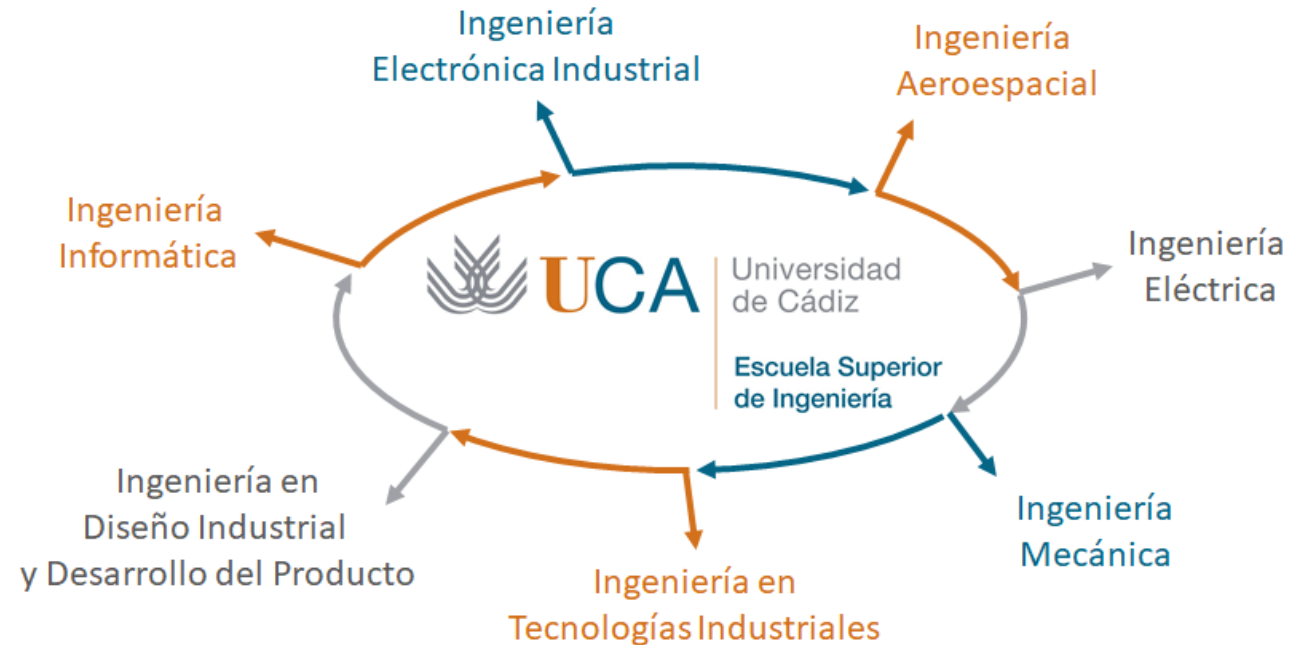
Antonia Morales-Garoffolo, Ignacio Mateos, Irene del Sol, and Isabel Egea
Universidad de Cádiz, Escuela Superior de Ingeniería

Abstract: Traditional education in engineering has been based on a “chalk and talk” model for years. The digital era and the fact that students should develop skills adapted to the current working market, however, reflect the need of alternative or complementary pedagogical methods. One of these methods is Project-Based Learning (PBL). This methodology makes the students play a primary role in their education and can be summarized as follows: they work on a realistic project with a specific objective so that they need to research, collaborate, develop critical thinking, creativity, and communication. In 2018, we started carrying out Space Science and Technology PBL at the Engineering School of the University of Cádiz. Up to now we have had successful results by applying this method: An educational nanosatellite is being developed within the context of PBL at the University with the support of the ESA Education Office. Consequently, both the students and some of our colleagues (with little or no experience in the area) are improving their knowledge in Space and Science technology, an attractive yet underrepresented field in the educational programs of the University.

Context of the research

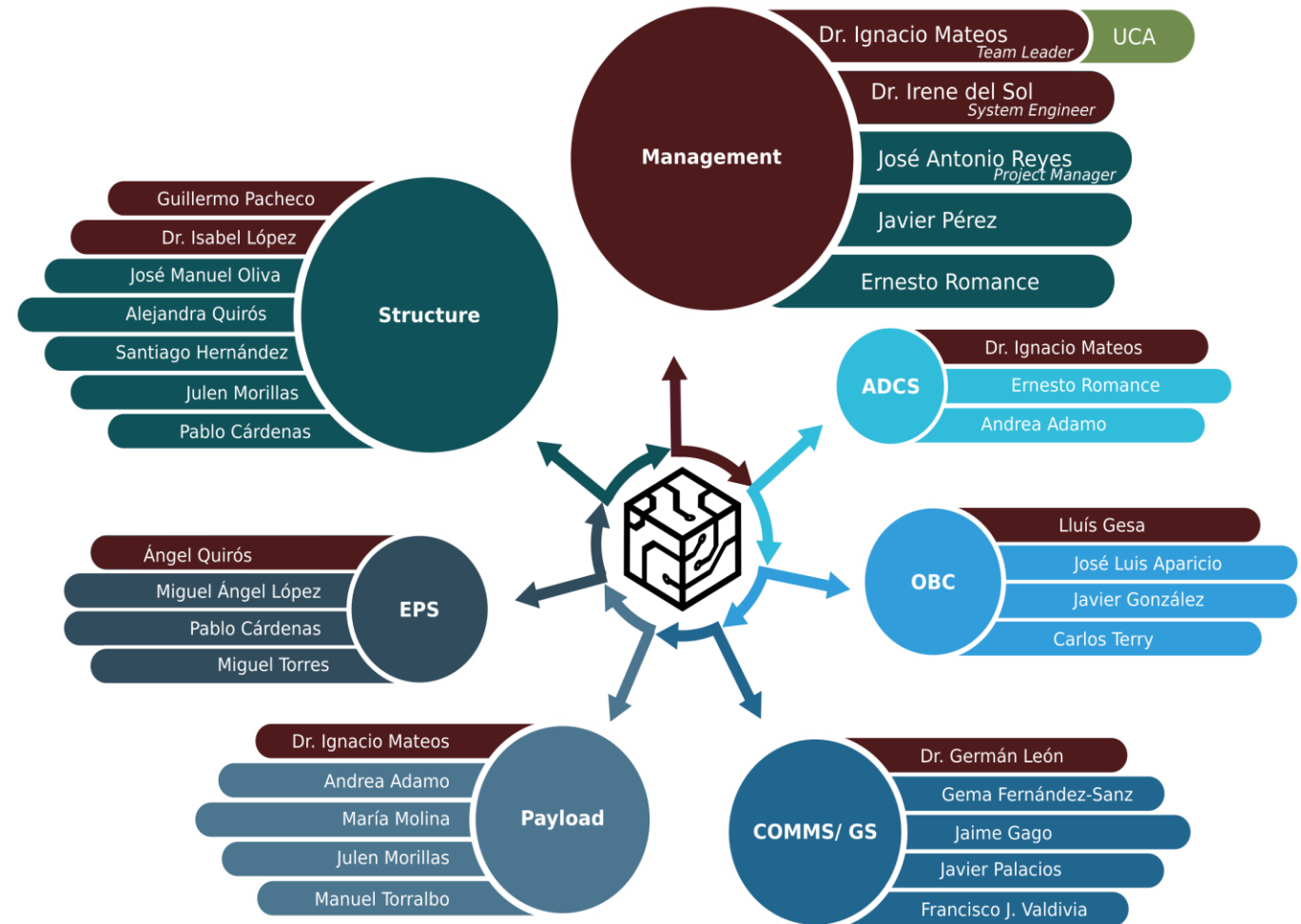
- Many Engineering Degrees.
- Some professors with previous experience in space research.
- No/little space science and technology in syllabus.
- Many students interested in space.
- What can be done to include this area in the students' education + improve learning skills?

⇒ **Space Science and Technology PBL**

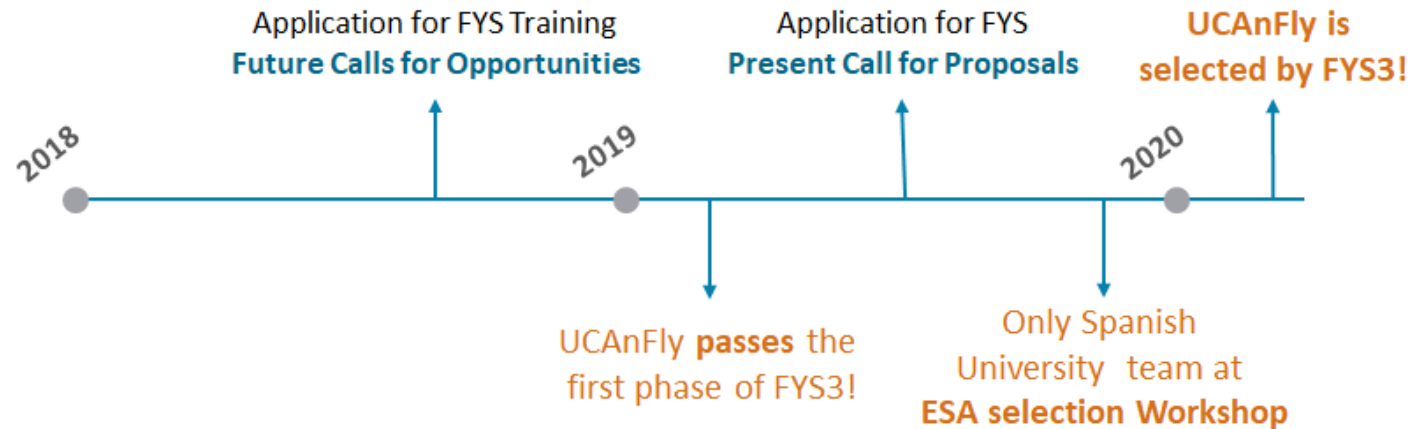


Description of the Work and Methodologies

- In **2018**, the **UCAnFly** project is proposed to any university students interested.
- **What is UCAnFly?** A nanosatellite to test emerging technologies, which could be used in space-based gravitational wave detectors, fundamental and/or solar or planetary physics experiments.
- **The team:** Students from various engineering degrees, MScs, and Doctoral programs + experts + collaborators. Subgroups work on different subsystems.
- **Objective:** Apply to ESA'S *Fly your satellite!* Program, which aims to complement academic education and transfer knowledge in the field of science and technology for space applications.

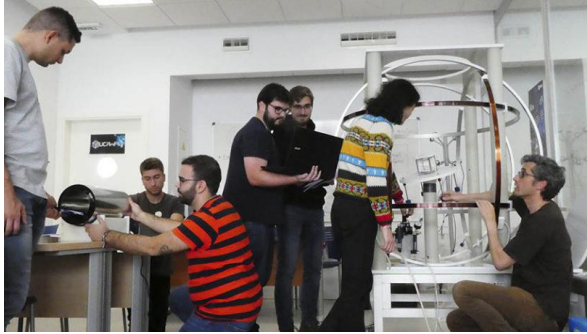


Results (I)



- UCA nFly is selected by the “Fly your Satellite!” program in 2020.
- The project is carried out with the **support of the Education Office of the European Space Agency.**
- Till the end of 2020, work on the design and development activities (phase C): i) status meetings, ii) webinars, iii) splinter meetings, iv) critical design review.
- **Student satisfaction** (survey performed before the selection workshop): **79%** find UCA nFly to be **very important for their education**, while **21%** find it *important*. None of the students have scored UCA nFly *somewhat important* or *unimportant* in their education.

Results (II)



Lab activities



Weekly group meetings/ESA status meetings



Explaining UCAnFLY to the Spanish Science Minister



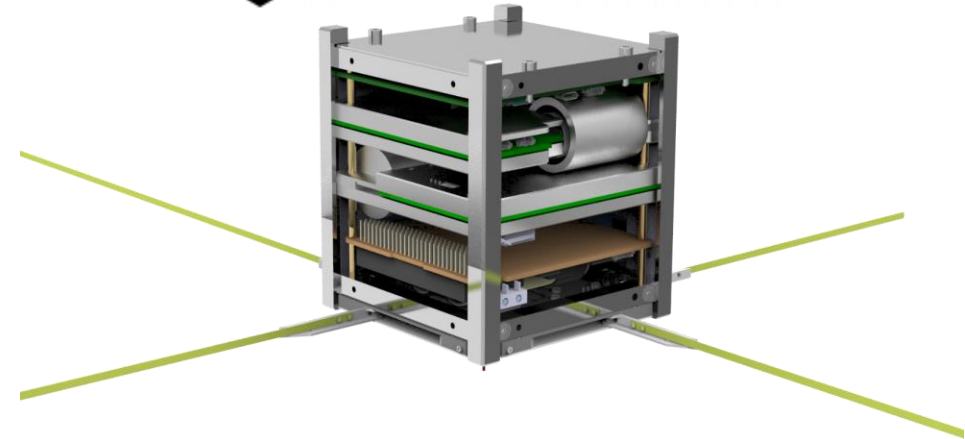
Outreach activities



Selection Workshop at ESTEC (ESA)

Impacts and Prospects for the future

- **Further UCAnFly milestones** (all with the help and assistance of ESA):
 - Subsystem level testing, procurement & manufacturing (Phase D1).
 - Assembly and integration.
 - System functional testing
 - Environmental testing (Phase D2).
 - Launch campaign (Phase E1).
 - In-flight operations (Phase E2).
- **Impact on the University of Cádiz:**
 - Creation of a specialization in Space and Science Technology (within a MSc offered at the university) starting in 2022.
 - We aim at gaining more experience in Space Science and Technology PBL at the University of Cádiz and disseminating our educational results.



We wish to thank from the bottom of our hearts a very involved and special collaborator: **Lluís Gesa** (Institut d'Estudis Espacials de Catalunya). He has left an extremely valuable footprint on UCAnFly. **Mai t'oblidarem, bon amic!**