

# Small satellite activities at University of Liège



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## Introduction

The only complete public university in the Belgian French-speaking community, the University of Liège prides itself on its pluralistic vision and on its pursuit of excellence in teaching, research, and innovation. With a student body numbering 20,000 and a staff of 4300, 2800 of whom are teachers or researchers, the University of Liège offers enriching and diversified courses of study, is committed to the development of student-centered learning, is intensely involved in international research programmes and is in contact with more than 600 institutions throughout the world (250 in Europe).

The department of Aerospace and Mechanical Engineering (A&M), in particular the Space Structures and Systems Laboratory (S3L), and the department of Electrical Engineering and Computer Science (EECS) are largely implied in the OUFTI-1 project, the first Belgian nanosatellite entirely developed at the University of Liège (Ulg). In the past the A&M department also participated in the ESEO and ESMO European student missions. More recently, the QB50 project brought new possibilities to work on CubeSat missions.

Being a research center of Ulg, the Liège Space Center (CSL) is among the world-leading institutes for space technology research and testing. CSL is working in collaboration with most of the European space industries and laboratories and is also deeply involved in regional projects. The center has been implied in the ESEO and ESMO missions, participates in the OUFTI-1 and QB50 CubeSat projects and will test the Flying Laptop student microsatellite from the Institute of Space Systems of Stuttgart, Germany.

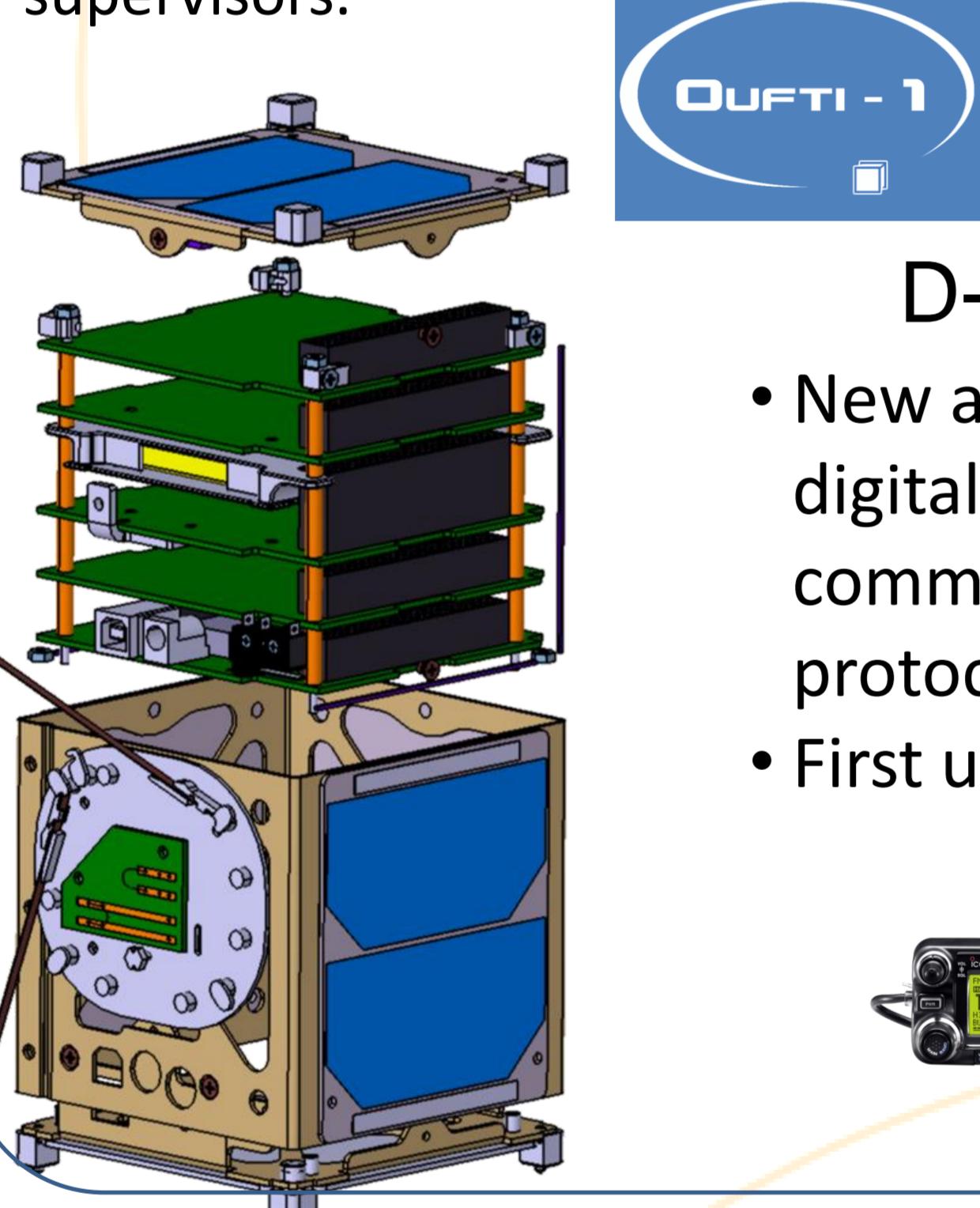
Together, these departments and CSL have made possible the contribution of Ulg on small satellite missions. They have been providing hands-on experience and educational outreach for several years, and are open to bring a strong and qualified expertise to other actors participating in such missions.



## OUFTI-1

OUFTI-1, the first Belgian CubeSat, is an educational project started in 2007 the goal of which is to provide students hands-on experience on satellite projects, and to test a D-STAR communication protocol as well as new solar cells. Besides, the onboard computer electronic cards are commercial off-the-shelf and home-made. A dedicated ground station is also developed at the EECS department. The satellite will be tested at CSL.

Since 2007: more than 40 students from the universities of Liège and Louvain, and from engineering schools, supervised by academic and industrial supervisors.



### Payloads:

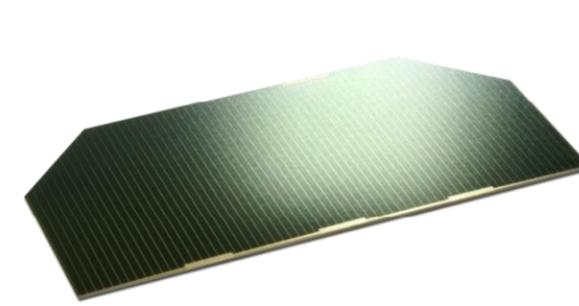
#### D-STAR

- New amateur-radio digital radio-communications protocol
- First use in space!



#### New solar cells

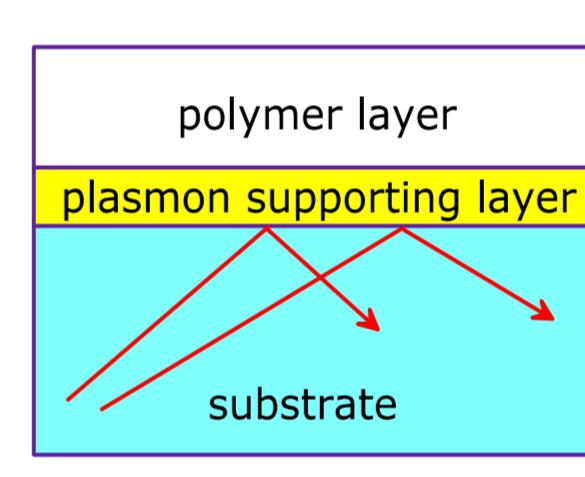
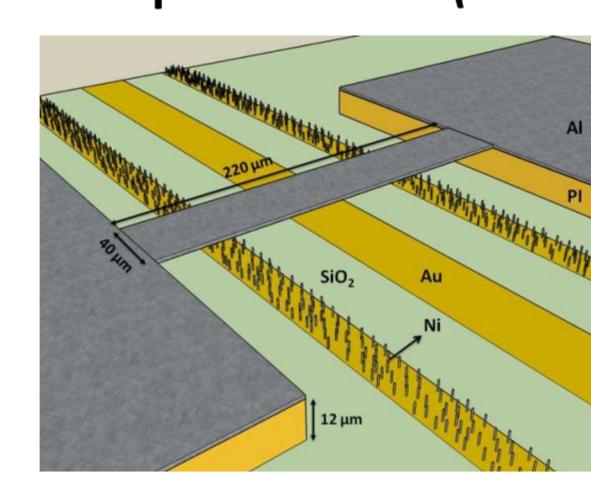
- Triple junction
- High efficiency: 30%
- Developed and provided by AzurSpace



## QB50

In the context of the international QB50 project, the S3L department is investigating the rendez-vous of two CubeSats (a chaser and a target) by differential drag. Furthermore, four payloads are expected:

- Miniaturized ionisation sensor aimed at probing the gas concentration throughout the decay of the CubeSat (*Université catholique de Louvain*),
- Plasmonic sensor consisting of an optical micro-sensor array based on plasmonics for monitoring the etching rate of selected polymer materials exposed to space plasmas (CSL),



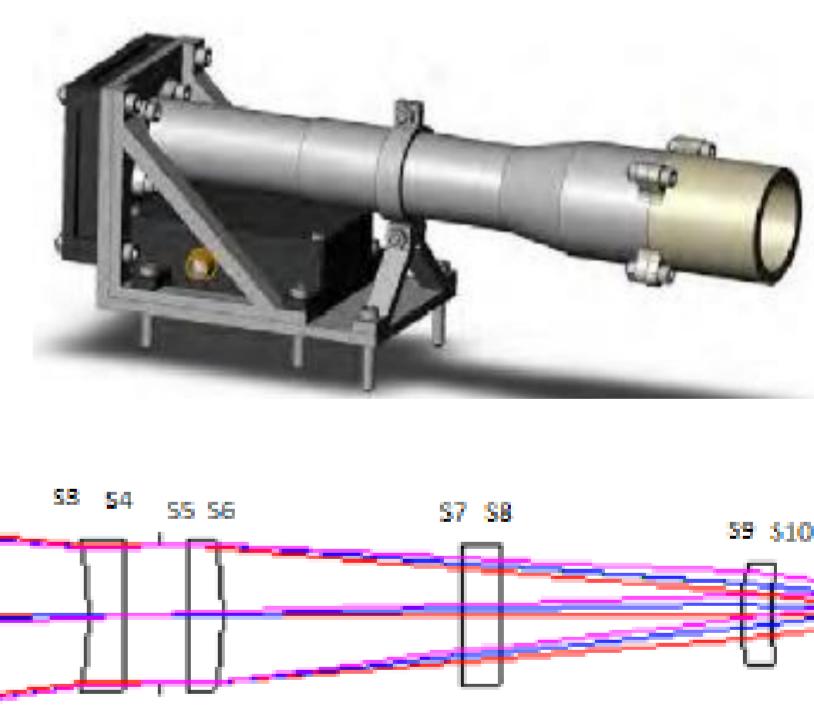
- Development of a miniaturized Attitude Determination and Control System (ADCS) (*Katholieke Universiteit Leuven*)
- Robust algorithm for the propellantless rendez-vous and formation flying (Ulg)



## ESMO

The core payload of the European Student Moon Orbiter, the Narrow Angle Camera (NAC), has been the responsibility of the University of Liège from the beginning of the project until the discontinuation of activities by the European Space Agency in April 2012.

Since the very beginning of the project in 2006, 13 students (from Belgium and abroad) worked on the instrument and were supervised by experts of CSL, until the design eventually reached a sufficient level of detail, while satisfying the requirements of the mission.



## Flying Laptop

CSL is responsible for the mechanical and thermal vacuum tests of the Flying Laptop student microsatellite from the Institute of Space Systems of Stuttgart, Germany. This 60x70x80 cm<sup>3</sup> satellite with a mass of 120 kg will be exposed in CSL facilities to the vibration environment of the launch and the thermal environments expected in space.

In the future CSL and the Institute of Space Systems of Stuttgart may further collaborate to develop an imaging payload onboard another microsatellite platform.

