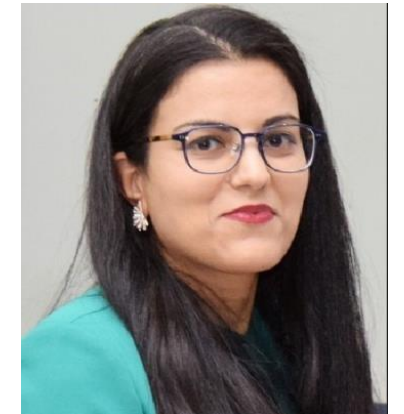


*15 April 2023*

## ESPITA Kibocube Project\_TUN-SAT1



*Dr Aouinet Hana  
Director General ESPITA  
Project Manager TUNSAT1<sub>1</sub>*

# Who are we ?

## OUR DIPLOMAS

- Engineering diploma in Mechanical Engineering
- Engineering diploma in Electromechanical Engineering
- Engineering diploma in Electrical Engineering
- Engineering diploma in Computer Engineering
- Engineering diploma in Telecommunication Engineering
- Professional Master in Software Engineering, Embedded Systems and IoT, Data science,

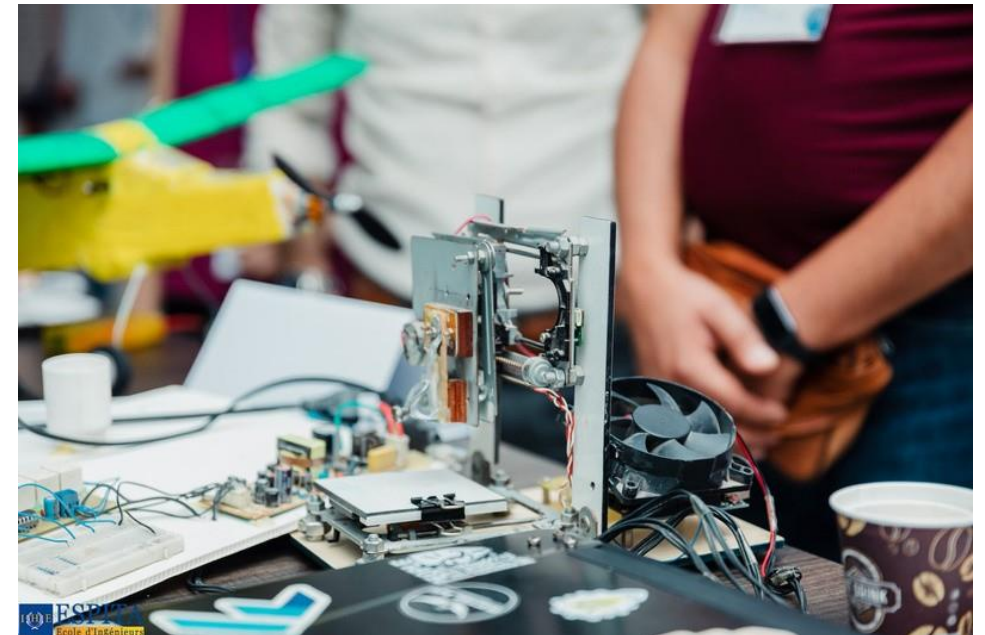


- OUR MISSION
- To prepare engineers in the scientific and technical fields
- of innovation, opened to the business world and international cooperation as well as research and development.
- In Espita future graduates acquire the technical and managerial skills that will allow them to lead changes.

# SPACE SECTORS HAS BEEN THE CENTRAL ASPECT



**courses program,  
trainings, Graduation  
projects ,national and  
international Events,  
follow-up of international  
activities ,especially,  
those dedicated to  
education and research**





# Tunisian Space Activities for students

## Environnement



# General Context

United Nations/Japan Cooperation Programme on CubeSat  
Deployment from the International Space Station (ISS)  
Japanese Experiment Module "KiboCUBE"



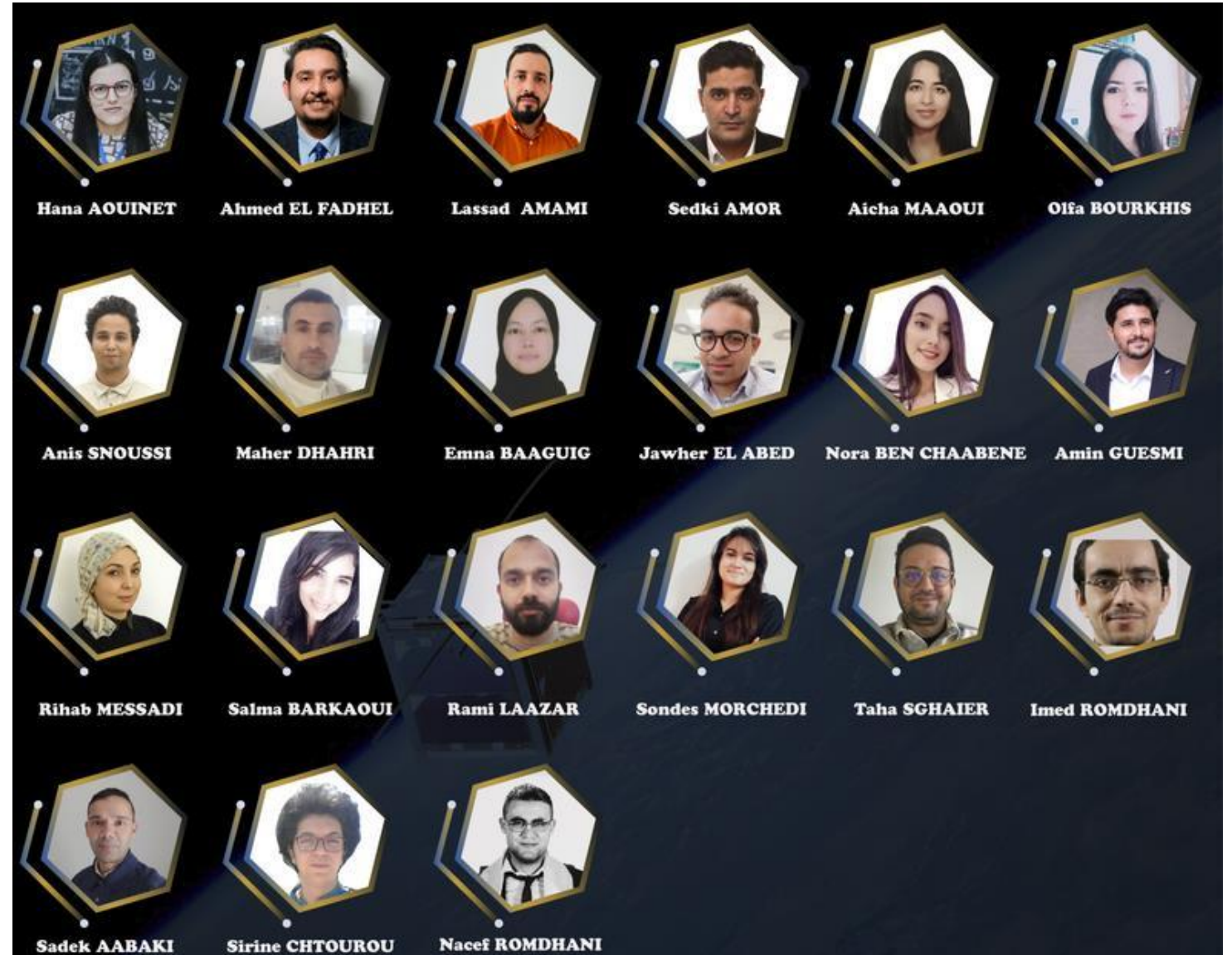
KiboCUBE in partnership with Japan Aerospace Exploration Agency provides the opportunity to develop a cube satellite (CubeSat) and have it deployed from the International Space Station Japanese module "Kibo".

KiboCUBE enables access to space promoting the sustainability of future space activities.



# Our TEAM

Twenty experts worked on the design of the satellite and the preparation of the Tunisian proposal for the program Kibokube



# Our TEAM and Collaboration





# Ceremony

**16 February**

Thank you Japan ! Thank you UNOOSA !



UNITED NATIONS  
Office for Outer Space Affairs

About Us - Our Work - Space4SDGs - Information for... - Events - Space Object Register - Documents

Our Work - Access to Space for All - Awardees



**ACCESS TO SPACE FOR ALL  
AWARDEE PAGE**

**École Supérieure Privée d'Ingénierie et de Technologie Appliquée, ESPITA**

"This is an opportunity for Tunisian students and researchers to contribute to the enhancement of Tunisia's position as an emerging nation in the global space industry. Our goal is to make ESPITA engineering school one of the best African universities for the most brilliant and elite students in the field of space science and engineering, and to provide high world-class level training to qualify the next generation of engineers that will develop the local African space industry." - **Aouinet Hana, Project Coordinator, Director of ESPITA**



Team Photo ©ESPITA



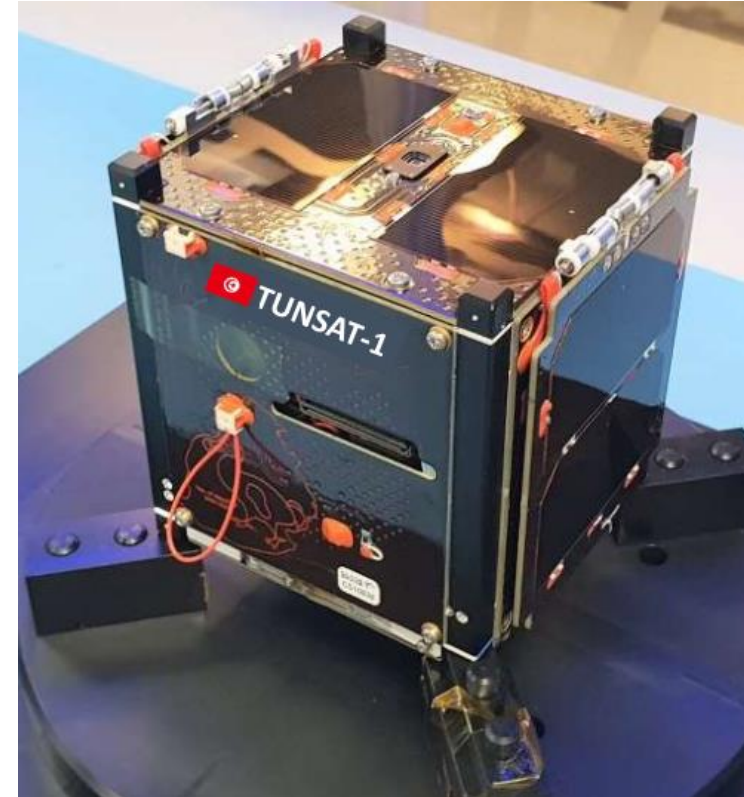


# Objective

- \* Take an image of Tunisia from the sky and successfully send it to the ground station (Tunisia take a selfie)

- \* Use this mission as an example to teach at least young Tunisians the different stages of an aerospace project

- \* 30% of the satellite components will be manufactured locally in Tunisia and operational in orbit



- \* Support the development of the Tunisian legal framework for space activities

# Our satellite specifications

7- Solar panel system sub-assembly

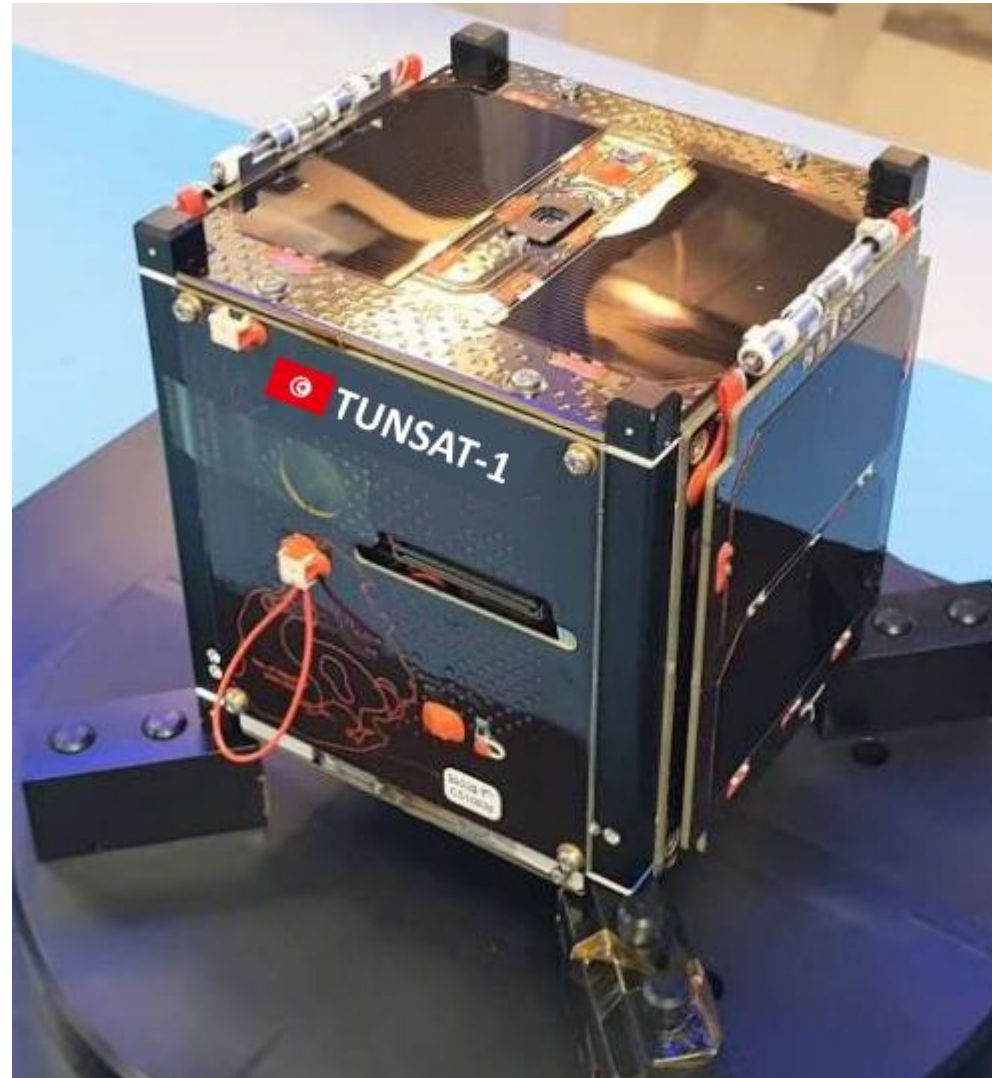
5- Antenna system sub-assembly

9- Payload sub-assembly

3- Attitude determination and control system sub-assembly

6- Communication system subassembly

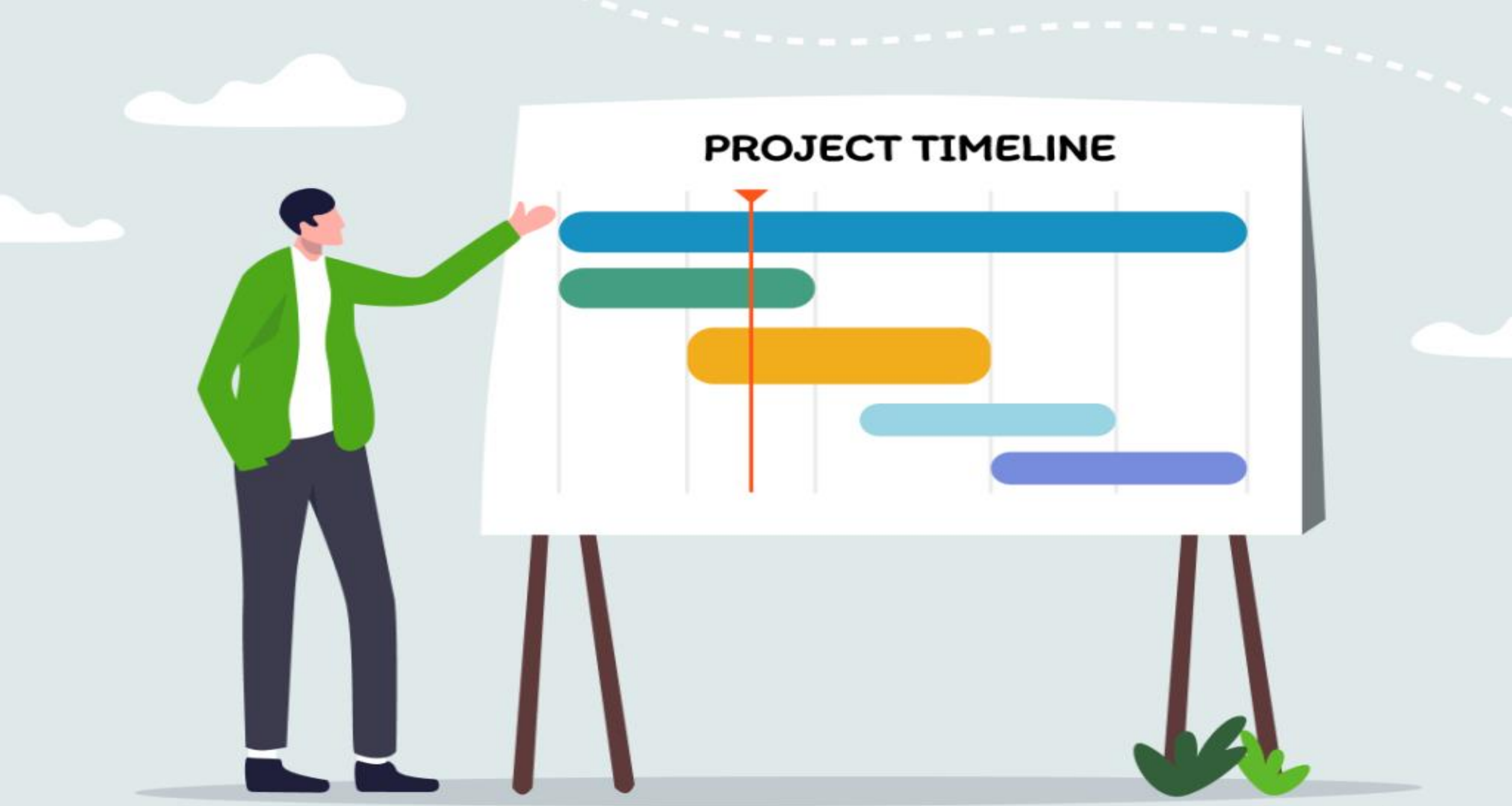
4- Ground stations sub-assembly



8- Command and data handling systems sub-assembly

2- Power System Sub-Assembly

1- CubeSat structure sub-assembly





# Impact of TUN-SAT1 on Tunisia and Africa



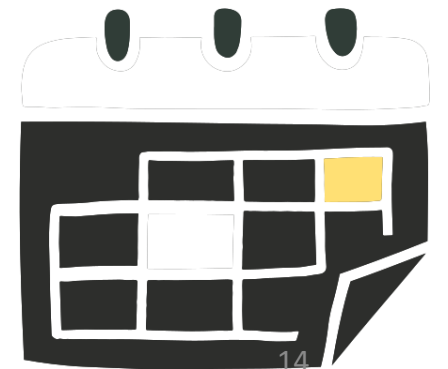


# Aerospace, AI and Digital Centre

ESPITA was able to grow ,to expand by  
inauguration **AEROSPACE, AI AND DIGITAL  
CENTER** on **July 2022**



Our Participation to  
speak about  
TUNSAT1 in the  
International  
aerospace events





speaker  
23 Juin 2022

*Tunisia Digital Summit, IA in the aerospace sector.*

6<sup>th</sup> ÉDITION  
ÉDITION HYBRIDE

23 Juin.2022  
HÔTEL LAICO - TUNIS - TUNISIE

"AÉROSPATIAL & INTELLIGENCE ARTIFICIELLE :  
QUELLES ÉVOLUTIONS POUR DEMAIN ?  
COMMENT L'IA VA RÉVOLUTIONNER  
L'AÉROSPATIAL ?"

11H40  
12H00

DR.AOUINET  
**HANA**  
Directrice générale ESPITA

KEYNOTE 18

#TDS

speaker  
25 April 2022

Newspace Africa Conference under the theme "Making  
Africa the New Hotspot for space business"



Nairobi, Kenya

Theme: Making Africa the New  
Hotspot for Space Business

25 - 27 April 2022

[www.events.spaceinafrica.com](http://www.events.spaceinafrica.com)



Organized by  
 SPACE IN AFRICA

Day 1 25 April 2022	Day 2 26 April 2022
<p>07:00 - 09:00 Registration</p>	<p>07:00 - 09:00 Registration</p>
<p>09:00 - 09:10 Welcome Address - Space in Africa By <b>Temidayo Oniosun</b> Managing Director, Space in Africa</p>	<p>09:15 - 09:45 Keynote &amp; Colloquy By <b>Dr Val Munsami</b> Chancellor, International Space University; Former CEO, South African National Space Agency (SANSA)</p>
<p>09:10 - 09:25 Welcome Address: Kenyan Space Agency &amp; Minister of Defence By <b>Hon Eugene. L. Wamalwa</b> Cabinet Secretary of Defence, Government of Kenya, <b>Colonel Hillary Biwott Kipkosgey</b> DG/CEO Kenya Space Agency</p>	<p>09:45 - 11:00 Heads of Space Agencies Panel By <b>Dr Hana Aouinet</b> Director General of ESPITA Tunisia; Coordinator of TUNSAT-1, <b>Dr Gayane Faye</b> Coordinator of Senegal Space Program/Professor and Director of Applied Remote Sensing Laboratory at Cheikh Anta DIOP University, <b>Dr Doreen Agaba</b> Technical lead of the Department of Aeronautics and Space Science, at the Science Technology and Innovation Secretariat, Uganda., <b>Col Francis Ngabo</b> Chief Executive Officer, Rwanda Space Agency, <b>Fernand Bale</b> Director, Côte d'Ivoire Geographic and Digital Information Center (CIGN)</p>
<p>09:25 - 09:40 Keynote By <b>Dr Tidiane Ouattara</b> African Union Commission Space Science Expert, GMES &amp; Africa Program Coordinator</p>	
<p>09:40 - 10:45 Exhibition Opening &amp; Coffee</p>	

26 August 2022

## THE WORKSHOP ON AFRICA-JAPAN CUBESAT COOPERATION





26 August 2022

# THE WORKSHOP ON AFRICA-JAPAN CUBESAT COOPERATION

## WORKSHOP ON “AFRICA - JAPAN CUBESAT COOPERATION”



### Panel Discussion

– Towards establishing sustainable space activities –  
26th August, 2022, Science City, Tunis, Tunisia



En ligne  
**KANAI Norishige**  
JAXA Astronaut



**Hazuki MORI**  
Expert to the Space  
Applications Section  
of UNOOSA



**Mr. Yasuo ISHII**  
Vice President,  
Japan Aerospace  
Exploration Agency  
(JAXA)



**Dr. Hana AOUNET**  
Director, ESPITA,  
Tunisia



**Dr. Meshack NDIRITU**  
Space Applications  
Training Officer, African  
Union Commission (AUC)



**Mr. Luc St-Pierre**  
Chief of Space  
Applications  
Section, UNOOSA



**Mr. Kamel BESBES**  
Professor on  
Electronics and  
Microelectronics



**Dr. Izumi YOSHIZAKI**  
JEM Utilization Center,  
JAXA



**Mr. Charles MWANGI**  
Ag. Director Space  
Sector & Technology  
Development, Kenya  
Space Agency (KSA)



**Assoc.Prof. Tetsuhito  
FUSE**  
LaSEINE, Kyutech,  
Japan



**Mr. Mohamed FRIKHA**  
Founder of TELNET  
Holding SA

17 September  
2022

Co-organized by:

Hosted by:



Session 3b: Science, Technology and Innovation from  
Satellite Development



Chair:  
**Umamaheswaran Raman**  
ISRO



Rapporteur:  
**Natally Mendez**  
Asociacion Astronautica Colombiana



Presenter:  
**Chantal Cappelletti**  
University of Nottingham



Presenter:  
**Hana Aouinet**  
Private High School of Engineering &  
Applied Technology



Presenter:  
**Tetsuhito Fuse**  
Kyushu Institute of Technology



Presenter:  
**Yaqoob Alqassab**  
National Space Science Agency  
(Bahrain)



Presenter:  
**Cecilia Marsicovetere**  
Universidad del Valle de  
Guatemala



Presenter:  
**Adrian Salces**  
Philippines Space Agency



Presenter:  
**Maximiliano Pisano**  
National Commission on Space  
Activities (Argentina)



# International Aerospace and defense exhibition

14 October 2022





# Our Students Projects







## Conception de CubeSat 3U

**Borgi Mokhtar**  
 Étudiant en niveau d'étude : 4ème électromécanique  
 mokhtar.borgi19@gmail.com



SPACE STAR'22  
 1<sup>st</sup> Conference on **SPACE Science, Technology, Applications & Regulation**  
 27-29 October 2022, Sousse, TUNISIA

## 1 Présentation

L'école Supérieure Privée d'Ingénierie et Technologies Appliquées est un établissement d'enseignement supérieur privé, basée à Sousse et agréé par le ministère de l'enseignement supérieur et de la recherche scientifique (agrément N 2012-01). Espita est l'école lauréate du 6ème Edition du programme Kibocube organisé par l'agence spatiale Japonaise JAXA et le bureau des affaires spatiales des nations unies UNOOSA.

## 2 Synoptique générale des produits ,technologie , réalisation

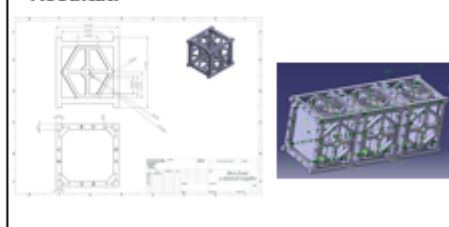
### Objectifs:

Le but de ce projet vise à fournir une norme pour la conception des nanosatellites afin de réduire les coûts et le développement, augmenter l'accessibilité à l'espace et maintenir des lancements fréquents.

### Design:

«La conception est faite par un assemblage de 3 unités»  
 «Chaque Unité est composé d'un cadre monobloc et de 4 câbles en forme d'hexagone afin de fournir une plus grande résistance»  
 «La taille finale du CubeSat est de 100X100X140

### Résultat:



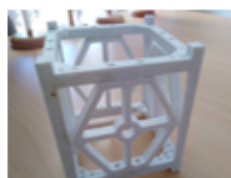
### Exigences Générales:

- Toutes les pièces doivent être attachées au CubeSat pendant le lancement, l'ajout et le fonctionnement.
- Aucun débris spatial supplémentaire ne sera créé.
- Aucune pièce pyrotechnique n'est autorisée.
- Les matériaux de CubeSat doivent être conformes à la norme AFSPCMAN 91-710, volume 3.

### En termes de développement de mes compétences pour le métier d'ingénieur :

- Découvrir le domaine de nanosatellite
- Les connaissances générales sur les types des CubeSat
- Spécification de Conception des différents satellites
- Les CubeSat Disponible dans le Commerce
- Les problèmes de conception et leur solutions

### Prototype







## Maxus sounding rocket ESPITA

**Rayen Hamzaoui**  
 Field and level of study : 2nd year Electromechanical engineering  
 rayenhamzaoui@gmail.com



SPACE STAR'22  
 1<sup>st</sup> Conference on **SPACE Science, Technology, Applications & Regulation**  
 27-29 October 2022, Sousse, TUNISIA

## 1 Introduction

Private School of Engineering and Applied Technologies "ESPITA" is a private higher education institution, based in Sousse and approved by the Ministry of Higher Education and Scientific Research. ESPITA uses the Kibocube International space competition to launch CubeSat in 2022. ESPITA organized "The Workshop on Africa-Japan CubeSat Cooperation "Towards Establishing Sustainable Space Activities" in August 25 and 26 on the margin of TICAD II.

## 2 General overview of products, technology, production

**Definition**  
 The Maxus sounding rocket is a single-stage rocket developed by the European Space Agency and used in the Aalto University program. It is a joint venture between the Finnish Space Corporation and Aalto University.




**Fundamental concepts of fluid dynamics**  
 Fluid dynamics is a subfield of mechanics that studies the flow of fluids and the forces exerted on them. Fluid dynamics has, in turn, several subdisciplines, including aerodynamics.

**Parameters to be evaluated**  
 The Maxus sounding rocket is a single-stage rocket. It is a joint venture between the Finnish Space Corporation and Aalto University. The rocket is designed to be launched from the Finnish Space Corporation's launch site in Sodankylä, Finland.

**Theory of flight according to Bernoulli**  
 Bernoulli's principle can be derived from the principle of conservation of energy. The theory of conservation of energy states that the energy of an isolated system remains constant. In fluid dynamics, Bernoulli's principle states that as the speed of a fluid increases, its pressure decreases.

**Fluid dynamics**  
 The aerodynamic forces on a fluid domain. Both the flow and the fluid's flow properties are used to describe a fluid domain. In order to analyze the flow, the fluid domain is divided into different regions or a high velocity to approximate the velocity, and a gradually lower velocity further away from the body. To ensure the boundary conditions are as close as possible to the actual conditions, a velocity analysis was performed in each direction. Figure 7.4 shows the fluid domain for the Maxus configuration.

**Center of pressure**  
 In order to analyze the center of pressure, it is important to predict the flight stability of a rocket. For positive stability to be achieved, the center of pressure must be further away from the nose than the center of gravity. This means that any aerodynamic forces resulting from an increase in angle of attack results in increased restoring moment to rotate the rocket back to the normal position. In order to achieve a positive static margin, the center of pressure must be located at a restoring moment for any angle of attack from the normal position.





## CubeSat ESPITA

**Youssef Fahem**  
 Field and level of study : 2nd year Electromechanical engineering  
 youssef.fahem.26@gmail.com



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## 2 General overview of products, technology, production

**Key Concepts**

- CubeSat are a class of nanosatellites that use a standard size and form factor.
- They originally developed in 1998 by California Polytechnic State University.
- Material: Aluminum 6061, oxidized.
- Outer Dimensions: 100.0mm x 100.0mm x 132.5mm.
- Approximate Mass: 3.5kg.
- CubeSat Design Specification, REV 1.1.1, CP-001-001.1

**Results**

• Prototype:



• Test: structure size, feasibility of assembly

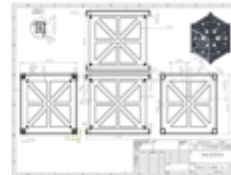
• Modify

**Purpose**

- Design and assemble the frame of the satellite with SolidWorks.
- Validate structure size, check requirements in need 3d-printed display model.
- Application of requirements were: (vacuum tolerance), Thermal (vacuum tolerance), Shock (vibration test in project)

**Application/Discussion**

- My 3-unit CubeSat design is consisting of 6 cubes and 4 cables designed by SolidWorks, and its dimensions in black colors.
- To have an efficient solution for the conception and control industry, I chose to make the design light in weight by using less volume of material, so I used the Aluminum alloy which has low density. For endurance to shock and vibration, I used Al6061 which has extremely high mechanical characteristics. Besides the addition of high quantity of silicon.



## 3 Contributions of the Internship

- Learn the basic in SolidWorks.
- Acquire huge knowledge in research.
- Learn to work in group with new members.

# Scientific Research





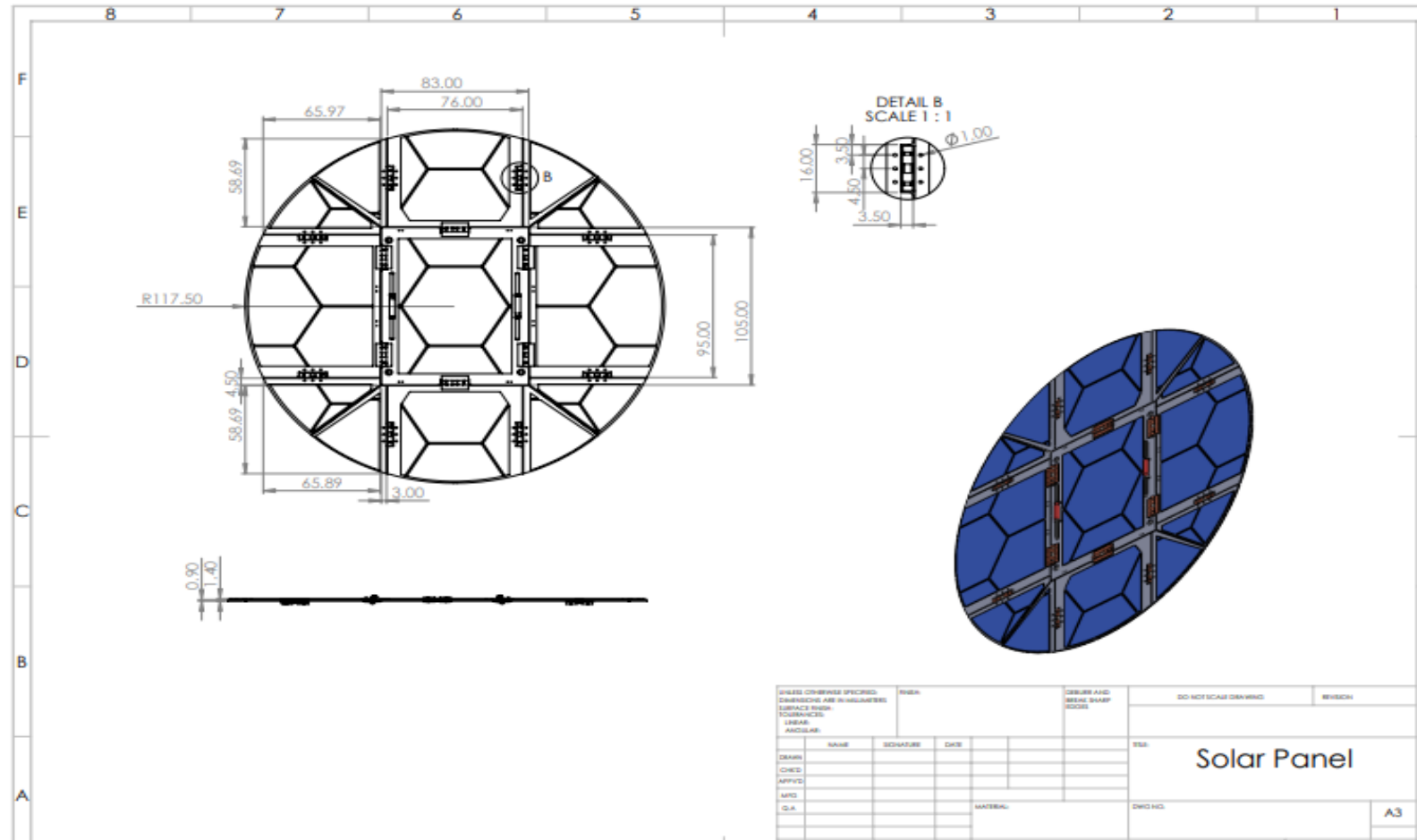
# Modeling and Numerical Engineering Laboratory



## Objective and Missions

Collaboration with technical centers, institutes and universities both Tunisian and foreign for the development of aerospace industry and the application of the results obtained by scientific research.

## **Aptical payloads and An innovative deployable hexagonal shape solar panel system for 1U Cubesat**



**James webb solar panel system**

The process of choosing the best payload (in this case camera (fig3)) for a cubesat follows through a section of decision-making: What operations should the camera be able to perform and what should the camera do to reach the goals of the project. Our solution it offers 3 sub-cards of size 5x7cm each which are arranged as follows (fig2):

- \* EspCam board with the Ra-02 transceiver (Lora 433 Mhz + wifi)
- \* Nano receiver board with nRF95 transceiver (866 Mhz frequency)
- \* Esp32 reception/transmission card with the nRF95 transceiver (866 Mhz frequency + wifi)

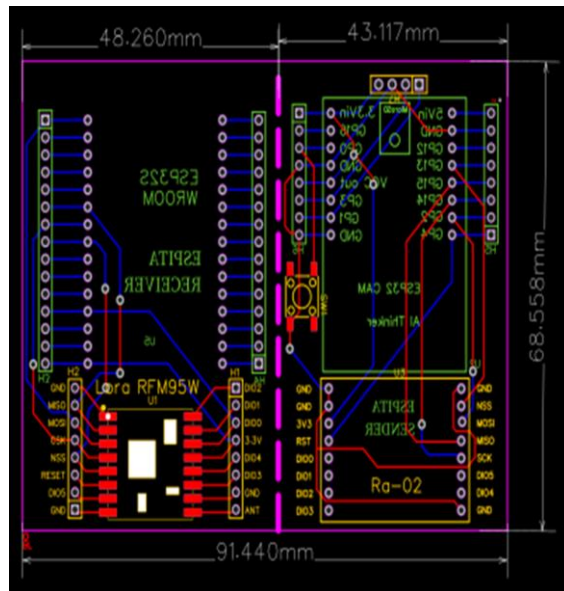


Fig : 3D color PCB

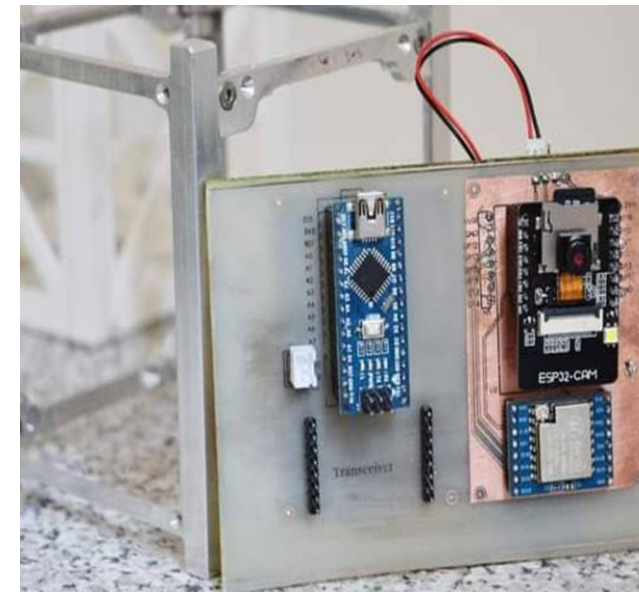
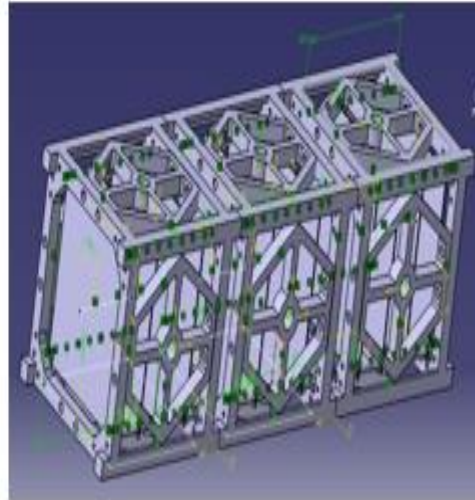


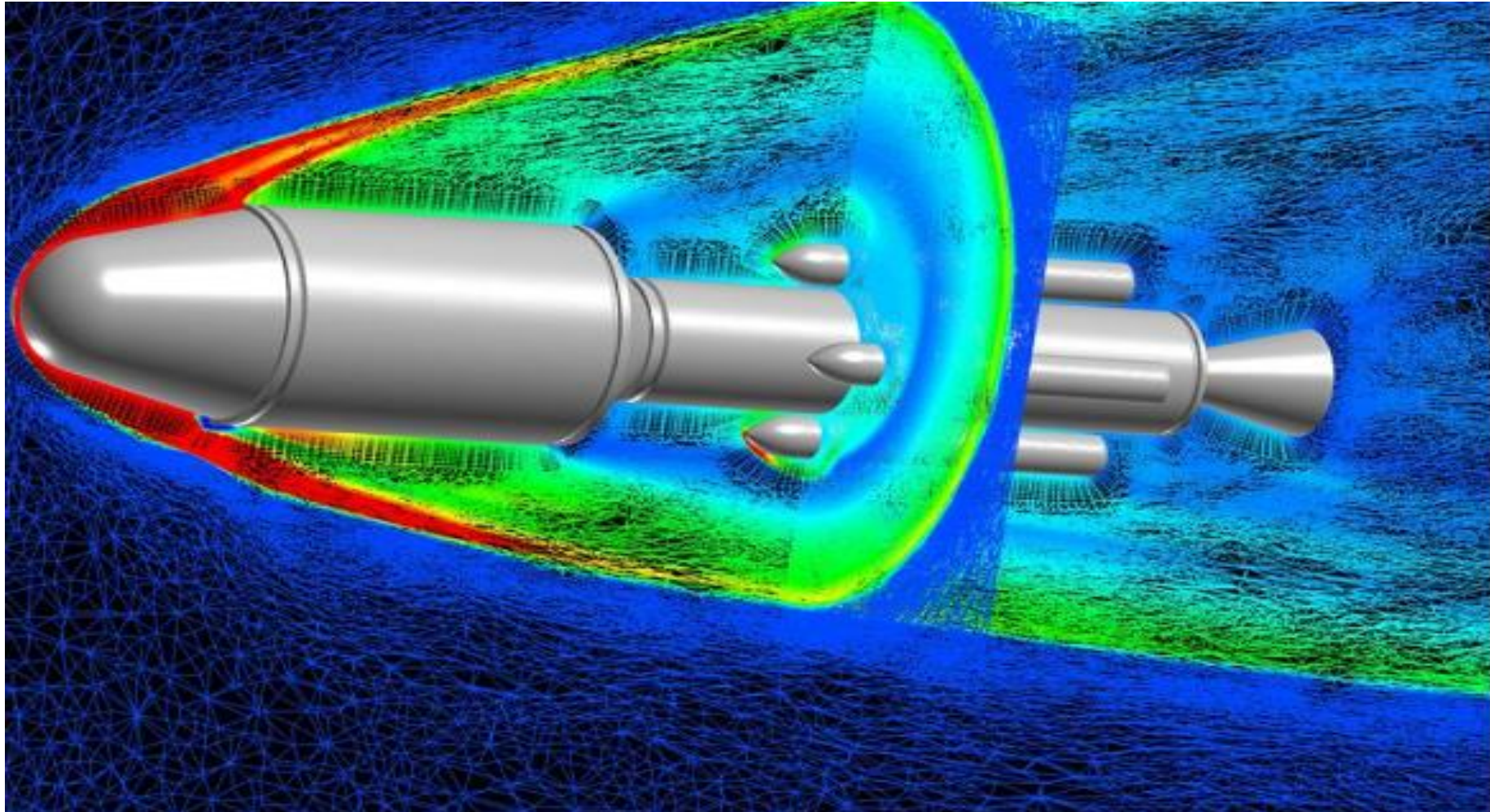
Fig : Camera Module



## A 3U CUBESAT



### **3/Aerodynamic Analysis of a Subsonic Missile design using Computational Fluid Dynamics**





# Our Future project with Jaxa\_Kyutech\_La Seine

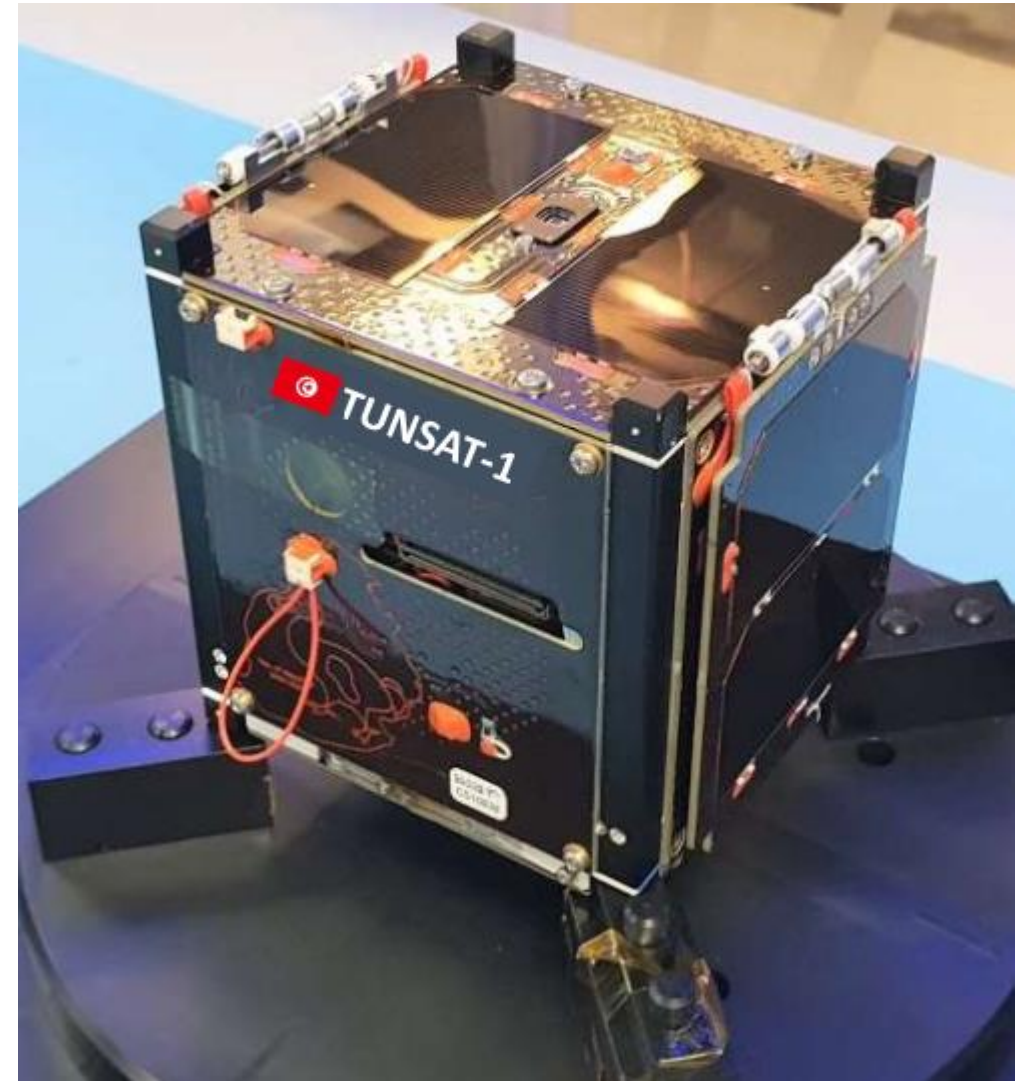
- Winner of PHASE1  
APRS PAYLOAD Competition





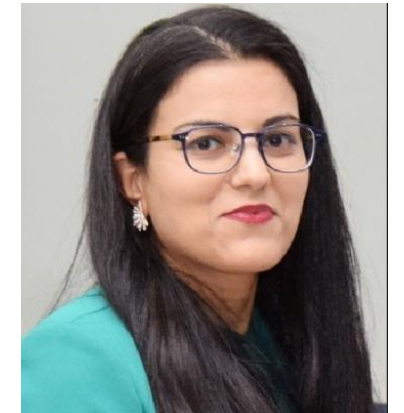
“  
Tell me and I forget, teach me  
and I may remember, involve me  
and **I learn.**”

*Benjamin Franklin*



*15 April 2023*

**Thank you for your attention**



*Dr Aouinet Hana  
Director General ESPITA  
Project Manager TUNSAT*