Satellite Proposal: COSMOS-Duo MCD

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Abstract

This is our abstract. Disclaimer: This paper was adapted from the Fly Your Satellite! proposal documentation by ESA (https://www.esa.int/Education/CubeSats_-Fly_Your_satellite/Fly_Your_satellite_P)

Keywords: High-energy astrophysics, CubeSat constellations, multi-messenger astronomy, student-led research, CubeSat missions, gamma-ray bursts, gravitational wave counterparts, space technology education.

Abbreviations and Acronyms

Status Overview

1 Mission Description

Formulate and give a description of the main objectives of the project, including the educational objectives and the mission objectives (technological experiment, scientific research, etc.). Summarise state-of-the-art of the subject and give existing literature. Provide a brief justification to implement this mission on a Satellite as opposed to other ground, air- or space-based platforms.

1.1 Mission Objectives

Description of the anticipated scientific or technical data products of a successful mission, what scientific/technological questions will be answered, what knowledge gaps will be filled, and/or what services will be provided.

1.1.1 Mission Data Products

List the specific and concrete end-data users anticipated by the mission (e.g., if the mission deals with precision farming, saying 'farmers' is not enough). Explain if/how end-users are embedded in the project or if there is any collaboration scheme with organisations that will make (potential) use of the mission data products.

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§Collaboration for the Analysis of Photonic and Ionic Bursts and RAdiation

Activity	Started (Y/N)	Date (mm/yy)	Concluded (Y/N)	Date (mm/yy)
Concept definition & Feasibility study	Y	01/21	Y	03/21
Preliminary design phase				
Detailed design				
Structural analysis	Y	04/22	N	
AOCS analysis				
Other analysis				
Subsystem manufacturing and testing				
In-house developed units: prototypes manufactured and tested				
In-house developed units: engineering/flight models manufactured and tested				
COTS units: procured				
COTS units: functionally tested				
Subsystem environmental testing				
FlatSat Integration & Testing				
Satellite stack testing				
Satellite fully integrated				
System level tests performed				
Flight ready				
Launch opportunity secured				
Ground station installed				
Ground station operational				
Other (please specify)				

Table 1: Project Development and Verification Status

1.1.2 End-data Users

If there is any potential for business or downstream applications, these shall be highlighted in this section. Report any steps taken in that direction (contacts, potential partnerships or collaborations).

1.1.3 Business or Downstream Applications

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1.2 Concept of Operations

Give a description of how the mission will work in practice to meet mission objectives and the system characteristics from an operational perspective. This could include, for example, information about operational modes, on-board autonomy, mission planning, scheduling (e.g. payload activation and data recollection scheduled or activated by telecommand, etc.), attitude control and mission analysis, and the strategy for on-board data generation, storage and downlink.

1.3 Mission Phases and Mission Timeline

Identify and briefly describe the mission timeline, including all mission phases and durations and objectives. This refers to the orbital phases and excludes the project lifecycle phases on-ground.

1.4 Mission Analysis

Indicate the acceptable range of orbits to which the Satellite mission is compatible in terms of mission objectives, ground coverage, system performance, etc. and include the general mission constraints.

Information should include altitude range, inclination, orbital lifetime requirements, other constraints such as SSO, eccentricity, RAAN/LTAN, launch window, etc.

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Information should include altitude range, inclination, orbital lifetime requirements, other constraints such as SSO, eccentricity, RAAN/LTAN, launch window, etc.

1.5 De-Orbiting

Describe what is the orbital lifetime and how it is compatible to the ESA zero debris approach. This means that the natural orbital decay duration shall be below 5 years (final numerical value is being consolidated at the time of opening of this Call).

2 Design Definition

2.1 System Description

- *exploded view of the system labelling all the key components/parts.*

- *Satellite in stowed configuration showing the envelope dimensions and location of RBF pin (only for CubeSats), umbilical connector, separation spring (only for CubeSats) and deployment switches.*

- *Satellite in deployed configuration showing envelope dimensions and labels of the deployables*

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- *Satellite in deployed configuration showing envelope dimensions and labels of the deployables*

2.2 System Budgets

Report the system budgets: for example, mass, power, pointing, thermal, link, data, delta-v, etc. indicating the margins that are applied.

2.3 Payload & Subsystems Design Definition

For every subsystem, provide a description of the physical and functional architecture, key features, operational modes (if applicable) and interfaces. Figures and schematics to be included as needed. Additional analysis and tests reports may be included in appendices.

2.3.1 Payload

2.3.2 Attitude and Orbit Control (AOCS)

2.3.3 Electrical Power (EPS)

For EPS additionally include:

- *Description and graphical representation of the circuit of independent inhibits (e.g., kill switch, RBF pin, etc.), which ensure that the spacecraft is off during ground processing and launch.*

- *Information of the battery chemistry, power management circuitry and battery protections (e.g., current interrupting device, overpressure venting valves, circuit for over discharge limitation, under voltage protection, etc.).*

- *Battery qualification, safety certifications and/or flight heritage in space applications.*

2.3.4 On-Board Data Handling (OBDH)

2.3.5 On-Board Software Architecture

2.3.6 Telemetry, Tracking and Communications (TT&C)

2.3.7 Structures

2.3.8 Mechanisms

2.3.9 Thermal Control

2.3.10 Propulsion (when applicable)

2.3.11 Grounding Scheme (EMC/EMI)

2.4 Ground Segment

Give a description of the ground segment physical architecture, key features and locations; include figures and schematics where needed.

3 Assembly, Integration and Verification

3.1 Model Philosophy

Give a description of the selected model philosophy and describe which models are used (Development Model, Engineering Model, Qualification Model, Flight Model, Protoflight Model, any other model of the satellite or of some of its subassemblies) and why.

3.2 AIV Activities

In case assembly, integration and test activities have been performed on subsystem level and on integrated system level, more details should be provided for each test activity including when the test has been performed, its objective, test levels and duration, and the results. List of procedures and obtained results can be added in the dedicated appendices.

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3.3 Development Status Overview

Subsystem / Element	Manufacturer (In-house / COTS)	Model	At the Uni Lab? (Y/N)	Status
Payload 1	In-house	EM	Y	Manufactured an formance test con test completed; V ing
		FM	Y	Same design as manufactured
TT&C	In-house	EM	Y	HAB test cam performed
		FM	N	Gerber files bein manufactured
Structure	¡Company name¿	FM	N	CAD design fin analysis complet Qualified against and thermal vacu cling
Ground Segment				

Table 2: Subsystems and Element Development Status

3.4 Equipment Qualification Status List (for CubeSats only)

Provide the qualification status detail of the satellite equipment/subsystems. For PocketQube projects, the qualification status at equipment (subsystem) level is not applicable, and the spacecraft shall be qualified at once, once assembled.

Subsystem / Element	Manufacturer (In-house / COTS)	Model	At the Uni Lab? (Y/N)	Status
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Structure	¡Company name¿	FM	N	CAD design fin analysis complet Qualified against and thermal vacu cling
Ground Segment				

Table 3: Subsystems and Element Development Status

Item	Product Name & Manufacturer	Model	Thermal Vacuum & Cycling	Randon
TT&C board	CompanyX	FM	-20/+60 degC, 6 cycles	GEVS (1

Table 4: Equipment / Subsystem Qualification Status

3.5 Facilities and Ground Support Equipment

Give a description of the test software and test tools to be utilized, and the electrical and mechanical Ground Support Equipment (EGSE + MGSE) foreseen to be used for handling on ground and tests.

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3.6 Preparation for System Environmental Tests

Give a description of how the satellite will be prepared for testing in environmental conditions (shaker and thermal vacuum chamber) using the table below.

3.7 Legal and Regulatory Status

The following reference may be useful for teams not familiar with the topic: https://swfound.org/media/1886
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Feature	Y/N	Describe what, how and to what level
Recharging during testing		
Switching on/off during testing from GSE (also inside the thermal vacuum chamber)		
Send and receive telecommands to/from the satellite (also inside the thermal vacuum chamber)		
Test sensors installed	Y	The satellite will have X thermocouples installed, which will be cut after the TVAC testing
Software updates possible on-ground / in-orbit after testing		
Accessibility to the internal part of the satellite for executing repairs or changing components		
Screws and nuts secured inside/outside the satellite		
Other(s) – please specify		

Table 5: Satellite Testability and Operational Features

4 Project Organisation

4.1 Team Information

Provide the details of the supervisors of the project. A minimum of 2 supervisors shall cover the three functions. The key roles of team leader and system engineer must be undertaken by citizens of an eligible state.

Team Leader

- *Name*

- *Job title or level of studies*

- *University/Tertiary Education Institution*

- *Department*

Tertiary Education Institution - Endorsing Staff

- *Name*

- *Job title*

- *University/Tertiary Education Institution*

- *Department*

System Engineer

Activity (if applicable)	Status
ITU frequency registration	
IARU coordination	
Licensing	
Mission Authorisation	
Insurance	
UNOOSA registration	
Export control regulations	
Space Debris Mitigation analysis	
Other(s) -please specify	

Table 6: Legal and Regulatory Status

- *Name*

- *Job title or level of studies*

- *University/Tertiary Education Institution*

- *Department*

List of Students
Provide an overview of the key student team members currently involved in the programme. No names are required for this application, only their profile in the project.

(1) **Function** in the project (e.g., outreach, power, subsystem, soldering, machining)	(5) **of years** in higher education so far (e.g., BSc + MSc)
(2) **Involved** in the project **until** (MM YYYY) - expected date	(6) **Field of study** (e.g., aerospace engineering), **& Specialisation** (e.g., Space Systems, Materials and Structure, etc.)
(3) Preparing graduation **Thesis** within the project (Yes/No)	(7) **Nationality(s)** country code
(4) Current **Level** of study (e.g., BSc/MSc/PhD)	(8) **University/Tertiary Education Institution** of enrolment

List of early-career team members
Provide an overview of the key early-career team members currently involved in the programme. No. names are required for this application, only their profile in the project.

Function	Involved until	Thesis (if any)	Level	# of years	Field of study & specialisation	Nation
AOCS Design	Q2 2025	Yes	MSc	5	Aerospace Engineering; Space Systems	IT
System Engineer	Q4 2026	Yes	PhD	7		
PCB soldering						

Table 7: Team Composition and Expertise

Function	Involved until	Thesis (if any)	Level	# of years	Field of study & specialisation	Nation
AOCS Design	Q2 2025	Yes	MSc	5	Aerospace Engineering; Space Systems	IT
System Engineer	Q4 2026	Yes	PhD	7		
PCB soldering						

Table 8: Team Roles and Qualifications

4.2 Organigram

In case the development of the project is shared with another party explain how the collaborations with other organisations or institutions will be practically arranged.

Explain how the handover between different project members is organised.

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4.3 Project Schedule

Present the schedule of your project (e.g. in a Gantt chart), showing when the project started and including all major activities with planned milestones and tasks expected duration. The planning should include those activities for each planned model (e.g. engineering model, flight model), both at subsystem and system level.

4.4 Cost Budget

Provide the cost breakdown of the whole project; indicate who the funding organisations (sponsors) are, what items have secured funding and for which parts you still need to identify funding organisations. Indicate the margins between costs and funds.

4.5 External Parties

Provide details of the cash or in-kind sponsorship support (hardware, software, services) and

Third Party	Role	Support	In return

Table 9: External Parties Involved in the Project

clarify if the third party expects anything in return (e.g. in-orbit data, student trainee).

Note: The list shall exclude normal COTS procurement by the university or tertiary education institution.

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Note: The list shall exclude normal COTS procurement by the university or tertiary education institution.

5 Major Risks

Give a list of the major risks to the project both in technical and managerial terms, and an assessment of the follow-up actions/mitigations plans. Risks may be linked to e.g., reliability, radiation, single point failures, lack of funding, project schedule, procurement delays, manpower, student turnovers, lack of experience in certain areas.

6 Academic Return

6.1 Institution Experience and Background

Give a brief description of the university or tertiary education institution's experience in building educational satellites, if any, or in running other sorts of educational space-related hands-on projects.

6.2 Educational and Academic Return of the Project

Give a description of how the satellite is used for educational purposes in the university or tertiary education institution and how the project will be included in the syllabus of students (e.g. part of master or PhD thesis, a research programme, or any form of project supported by the applicant's university, etc.). Is there any formal recognition of the student work on the project (e.g. ECTS)? Quantify whenever possible, the outputs of the project. If more students are expected to work on the project than included in the proposal please indicate the total number and over what period.

6.3 Proposal Motivation

Give a description of the main motivations for applying to the Fly Your Satellite! programme and what kind of support the team is seeking for in the programme.

Appendices

Appendix A: Technical Requirements Specification

Technical Specification may be attached in any format (also in case it includes more information beyond the Requirement text, such as verification strategy, parent/child relations, etc.).

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Requirement ID	Requirement Text

<div align="center">Table 10: Technical Requirements Specification</div>

Appendix B: Technical Requirements — Compliance Matrix

Attach the filled in 'Fly Your Satellite! Design Specification — Compliance Matrix' (CUbeSats or PocketQubes) in this appendix.

We don't have access to that file, so we leave this section blank.

Appendix C: Pictures

Pictures of satellite subsystems/components, antennas and ground station. Include in the caption which model (e.g., FM, EM, prototype) is shown in the picture.
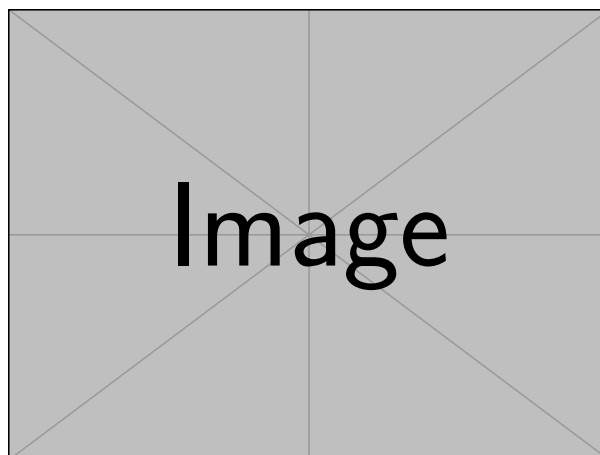

<div align="center">Figure 1: Example caption describing the image shown.</div>

Other Appendices

- *Analysis reports (if available)*

- *Test reports (if available)*

- *Assembly and integration reports (if available)*

- *Space Debris Mitigation Analysis (if available)*