

# Statement of Work



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# 1. Introduction

## 1.1. Document Purpose

The purpose of this document is to describe the activities that have to be performed by the competing teams within ROSPIN Academy Level 3 (Aug - Sep 2022), in order to submit the required deliverables of this space mission design competition.

## 1.2. Context Overview

Given the recent increase in the interest and governmental spending on space missions in the Cis-Lunar space, it has become essential to develop communications and localization services for activities in the Moon's orbit and on its surface. Such a system would defer the cost of establishing such a network for each independent mission to the Moon, by providing a commercially operated and accessible system that can answer the needs of multiple customers and users. ESA has already started incentivising developments on this topic through its ESA Moonlight programme. So far, they have issued contracts to two European industry groups that are led by SSTL and Telespazio, respectively, and these groups are working on Phase A/B1 studies to validate concepts for a Moon-centric communications and navigation constellation, from both a technical and a business standpoint. NASA is also working on advancing this topic through the outcomes of the LunaNet project, which has not yet reached a commercial phase. In the context of such fast paced developments on and around the Moon, and with more than 30 planned missions to the Moon between 2020 and 2030, it becomes very clear that a relatively inexpensive and fast to produce technology demonstrator is needed for such Lunar constellations.

## 1.3. References

A collection of some relevant references is available on the Google Drive for ROSPIN Academy Level 3 [in this folder](#).

## 1.4. Executive Statement of Work

Your team is a company that wants to apply to a new call from ESA for a Phase A/B1 study that is focused on a quick to develop CubeSat constellation around the Moon. Your study will run in parallel to the feasibility studies that are being conducted by SSTL and Telespazio and it will also rely on the outcomes of the CAPSTONE mission by NASA and Advanced Space.

Your study will aim to demonstrate both the technical feasibility and the business case for a Lunar constellation of CubeSats, each with a size of up to and including 12U, that can provide commercial communication and navigation services for Moon missions.

No assumptions or constraints are provided about the potential customers and users of your constellation, and hence no specific user needs or requirements are provided either. You will have to identify and decide such aspects through your business model and formulate an appropriate strategy. You will also have to demonstrate that your proposed constellation system is both technically-feasible and is aligned with your defined business model.

## 2. Work to be Performed

### 2.1. Task 1 - Mission Concept and Architecture

**Table 2-1: High Level Breakdown of Task 1**

Task	Description
T.1.1	Present your mission statement, objectives, requirements and timeline, defined in compliance with your business model.
T.1.2	Explain the rationale and procedure behind the trade-off that led to the selection of your baseline mission concept and architecture.
T.1.3	Justify your proposed technical solution for delivering the entire CubeSat constellation to your target orbit(s) in Cis-Lunar space, focusing <u>at least</u> on considerations such as launcher(s) selection, orbital transfers, etc.
T.1.4	Present any other considerations you deem relevant for pitching your mission concept and architecture.

### 2.2. Task 2 - Feasibility of the Proposed Constellation Design

**Table 2-2: High Level Breakdown of Task 2**

Task	Description
T.2.1	Present your constellation design, focusing <u>at least</u> on the selected number of CubeSats, their phasing, the number of orbital planes, etc.
T.2.2	Explain the rationale for which your constellation design is feasible and optimally suited to meet your mission requirements.
T.2.3	Explain the correlations between your constellation design and your CONOPS for providing communication and navigation services, both to other spacecraft in Lunar orbits and to vehicles on the Lunar surfaces.
T.2.4	Present any other considerations you deem relevant for pitching your constellation design.

## 2.3. Task 3 - High Level CubeSat Design

**Table 2-3: High Level Breakdown of Task 3**

Task	Description
T.2.1	Present your high level CubeSat design, showing <u>at least</u> the system configuration and budgets (e.g. mass, power, etc.) at system level, etc.
T.2.2	Explain the key decisions taken for the subsystems you consider as being critical to deliver your mission requirements, e.g. <u>at least</u> the communication, navigation, propulsion, payload, etc. subsystems.
T.2.3	Explain the correlations between your CubeSat design and the characteristics of the environment in Cis-Lunar space.
T.2.4	Present any other considerations you deem relevant for pitching your high level CubeSat design.

## 2.4. Task 4 - Business Model for the Proposed Commercial Constellation

**Table 2-4: High Level Breakdown of Task 4**

Task	Description
T.2.1	Present your complete Business Model Canvas (BMC) for your proposed commercial constellation for Lunar communications and navigation.
T.2.2	Explain the rationale behind the key assumptions you made in your BMC.
T.2.3	Discuss any implications you foresee due to the transition towards the New Space era and explain how these were taken into account in your BMC.
T.2.4	Present any other considerations you deem relevant for pitching your business model.

# 3. Assumptions and Constraints

## 3.1. Assumptions

**Table 3-1: Mission Assumptions**

Assumption	Description
A.1	You have to launch your entire constellation using commercial launcher(s).
A.2	When defining your mission concept and architecture, you can use as heritage any already existing data and reasonably inferred conclusions and technology demonstrations from the CAPSTONE mission.
A.3	Your company is free to fulfill a set of secondary objectives that may include technology demonstrators or scientific experiments. If added, you have to prove the relevance of these secondary objectives, as well as to prove that they will not affect the primary objectives.

## 3.2. Constraints

**Table 3-1: Mission Constraints**

Assumption	Description
<b>C.1</b>	You are limited to a maximum CubeSat size of 12U.
<b>C.2</b>	If you include the Lunar Gateway as part of your communications relay, you must prove its compatibility with your mission and consider the business implications of depending on such an external system.
<b>C.3</b>	Your proposed mission concept should fit within ESA's medium class mission profile with a budget cap around 500 million EUROS.

## 4. Deliverables

**Table 4-1: Deliverables**

Deadline	Deliverable
<b>Fri, 02 Sep @ 14:00</b>	Report covering all the work that has to be performed, max. 40 pages.
<b>Fri, 02 Sep @ 14:00</b>	A3 poster summarizing the key visuals and mission facts, 1 page.
<b>Fri, 02 Sep @ 17:00</b>	Presentation hand-out (i.e. slides), which will be delivered in 20 minutes, followed by a 20 minutes Q&A session.

The templates that must be used to prepare the reports and the PowerPoint presentation hand-outs are available on the Google Drive for ROSPIN Academy Level 3 [in this folder](#).

All the written deliverables have to be prepared in English. The presentation can be delivered in English or Romanian.