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LUNAR -I Rover project proposal.

# SKY WEB

Sky Web is a commercial space start-up company which was started in hope of sending humans to LEO and outer space again to make mankind a multi-planetary space civilization. These are the main objectives of Sky Web for next 6 years (2024-2030).

* Create a LEO(Low Earth Orbit) station that will act as a starting point for deep space and moon missions.
* Send humans to moon and create a moon base.
* Send humans to mars and beyond.

SKYWEB is still at the startup stage. But with a correct vision and solid ideas, we have full confidence that we can achieve the goal of putting Europe as the pioneer of the future of space exploration. Following document is about how SKY WEB hopes to help ESA’s Terrae Novae 2030+ strategy.

INTRODUCTION

Space exploration is one of the main conquest mankind will never stop to love. Exploring space, exploring other planets, leaving the solar system and beyond are our current main purposes of space missions. One of the quotes from famous movie ‘Interstellar’ is that quote,” mankind was born on earth, but never meant to die here.”

Space exploration can be simply defined as the exploration of celestial structures in outer space by means of continuously evolving and growing space technology. Humans first observed space from the earth and it’s known as the science of Astronomy. But with the rapid development of rocketry in the 20th century has helped mankind to leave the earth surface and reach LEO(Low Earth Orbit) and beyond. t

Currently, space exploration has reached a new breaking point. Many organizations from different countries and continents are continuously trying to achieve the status of frontier of space exploration. With involvement of private sector, it has increasingly advanced during last 15 years.

Like other nations, European space agency is actively working on improving and empowering their presence as a leading role of the space industry and space exploration. ESA already have developed a detailed idea about the future of space exploration.

System and Mission Requirements

The moon is the nearest space object near to earth and it is the only natural satellite earth has. Distance from earth to moon is 384,400km. But mankind reached the moon during 60’ and 70’s.

LUNAR-I rover is a concept design for ESA’s upcoming lunar mission program under the ‘Terrae Novae Strategy’. The primary goal of the Lunar-I rover is to study and explore the moon’s south pole and preserved water in the PSR(permanent shadowed region).

Rover has these 4 main objectives.

* Reach the Moon’s south pole/PSR area.
* Study the area.
* Extract samples of ice/water.
* Return to moonship.

Mission Requirements

Before we started this project, we carefully studied Apollo and recent missions to moon such as ISRO’s ‘Chandrayan’ project.

Main objective, for the mission is to explore the south pole area and collect samples of water.

The purpose of the mission is to study the areas which contain water/ice and bring back samples for further research. This will be a great opportunity to future missions specially we can determine how humans can use the water resources for future missions such as drinking supplies and as a fuel source.

LUNAR-I rover has these mission requirements.

1. Functional –

The main objective of the mission is to land the LUNAR-I rover near moon’s south pole and explore the selected PSRs and collect samples of the water.

To meet these objectives, the designed system must have a good connection between sub-systems and a good communication system with the mission control.

Main challenges for the functions of the rover system are vacuum space, darkness/no sun light, sustainable energy resource(difficult to use solar energy due to no sun light) radiation, lunar dust.

1. Operational –

Rovers main task is to explore the selected are in the PSR. Rover’s main operational duties are to take photos using its camera system, map the area using Lunar Penetrating Radar(LPR) system.

Rover is included with robotic arm that can be controlled from mission control room. This robotic arm will take samples and collect them inside the storage of the rover.

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1. Constraints –

LUNAR-I rover will be built for one specific task only. The main and only task of the rover is to explore and collect samples of the water which is preserved in moon’s south pole.

System Requirements

There are multiple factors that can be a cause for completing a successful mission. System meeting its specific requirements will play a significant role throughout the mission. Rover’s technical capabilities and design should help to achieve its mission purpose.

LUNAR-I rover will need these system requirements.

1. Performances (expecting) and design –

LUNAR-I rover will include a navigation system to find the way throughout its journey on moon. The robotic arm which can be controlled by the mission control center will collect samples of water from the surface.

Rover will have a 6-wheel suspension system for its movements throughout the mission.

Our aim is to build the rover as light as possible as this is a one mission rover system.

Rover will also include the lunar penetrating radar system to map the area which it will explore.

Rover will also include an advanced camera system to get a 360-angle viewpoint from the rover.

Rover will also include an advanced direct communication system as distance between moon and the ground using high-gain microwave antenna for sending data directly to earth/ground control center.

DESIGN AND JUSTIFICATION

LUNAR – I rover will be designed as a lighter and one mission-rover. The whole design concept of the rover will be based on its purpose. The purpose is to explore the PSR in moon’s south pole and collect sample of moon water/ice.

Rover will be designed as a lighter rover than any other rover built previously as it has only one main purpose compared to other rovers. Reduced mass will have a positive effect in many areas. It will help to save fuel for lift-off and relaunch. It will also help to move rover easily on the surface of the moon.

Robotic arm will be designed to check/study the selected spots closely and collect samples. It will have a small drilling device, camera/s, lights, scanner for closeup studies as well as sample collecting unit.

Rover will include with advanced computing system for calculating, navigation, moving, moving the robotic arm, and communicating purposes.

Rover will have a deep lights system covering many angles as it will conduct the mission mostly in Permanent shadowed regions.

LUNAR – I rover is using direct communication with ground control as distance between moon and earth is relatively small. It will have a high-gain microwave antenna system to send and receive data.

Rover will also be included with an advanced camera system to cover the 360-angle of the point of view from rover.

Mission Design and Development plan

First we must define the purpose of the mission. The purpose of the mission is to send the moonship and LUNAR-I rover to moon’s south pole, collect the samples and study the area with scientific equipment and bring back the samples to earth.

After the mission handover,

1-3 weeks – recruiting the team.

2-3 months – advanced designing of the proposed systems

5-6 months – building process begins.

Within first 10 months – finish the first prototype.

10 month – start building robotic arm.

10 -12 months – start first stage of testing.

12 -15 months – testing, identifying, and correcting the issues.

13 – 18 months – building the scientific equipment that will be placed in the rover.

18 – 20 months – second stage of testing

20 – 24 months – correcting the issues.

24 months – final stage of testing.

25- 28 months (2 year and 4months from the kick-off) – completing the project.

Concept of operation

Concept of the LUNAR – I rover is very easy to understand.

LUNAR – I rover is a lighter un-manned moon research vehicle.

The rover will be designed to do mainly specific task only.

Rover will have a navigation system to follow for the targeted area.

Rover will have a 6-wheel suspension system and a robotic arm connected to rover’s left side.

Ground control can manually control robot movements on suspension system and robotic arm.

Robotic arm will be used for the closeup search about the surface area and collect samples of the water/ice.

Rover will have an advanced camera system to cover 360-angle viewpoint from it. This will guide to understand more facts and landscape.

After the moonship landed on the surface near targeted area of exploration, rover will be deployed.

Then the rover will stop to selected amount of period to re-charge the batteries.

Then it will start the journey to the PSR.

After entering the PSR, rover will automatically detect the brightness of the area using sensors and light will turn-on. (to save energy.)

LPR mapping system will also be start at the same time.

After the rover deployed to moon surface from the moon ship, it will send a signal to ground control centre.

Rover is designed to do the research of maximum of 3-6 months on the surface.

After collecting the samples and enough exploration, rover will come back to moonship and will dock inside.

Estimated Cost analyze.

Estimated cost analysis for the Lunar – I rover.

Employee salary – 900,000 – 2,000,000 euro(max range)

Equipment development – 5 million euro(max)

Testing – 2 million euro(max)

Other parts and development – 3 million euro (max)

Computer and software dev – 800,000 euro – 1.5 million euro(max range)

Mission maintenance – 1.5 million euro(max)

Total mission cost (without launch cost) – 15 million euro.

