The 6th
Mission Idea Contest

UNIVERSIDAD TECNOLÓGICA NACIONAL
FACULTAD REGIONAL CÓRDOBA

Bacteriological Mutation by Cosmic Radiation

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Introduction

Since the arrival of the first human to the moon, 50 years ago, we are beginning to live a new era in space exploration, one that puts Mars as the next major objective. Achieving this goal will require the joint effort of people around the world, both to develop new and improved technologies and to better understand the environment to which astronauts will be exposed.

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Mission Objectives

1. Determine if bacteria exposed to the ISS environment suffers some behavioral change.
2. Determine the bacteriological growth change by comparing sequential images of two bacterial lawn, one in the ISS and another on ground.
3. Determine the effectiveness of antibiotics in the space environment.
4. Record the intensity, time and cumulative dose of cosmic radiation and the temperature to which the bacteria will be exposed during all the experiment operation time.
5. Expose samples of lyophilized bacteria to the space environment for further analysis on land.

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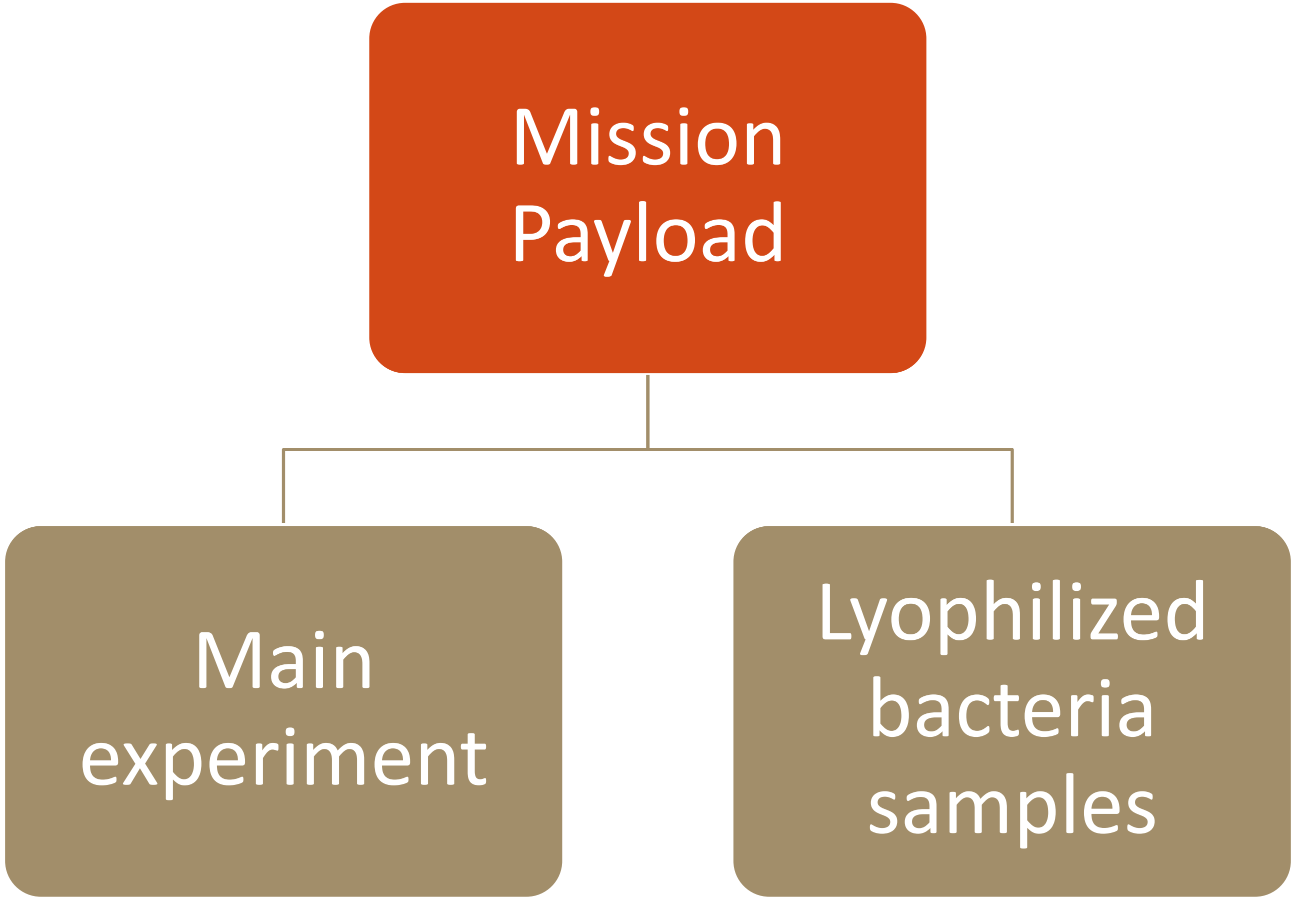
Platform Selection

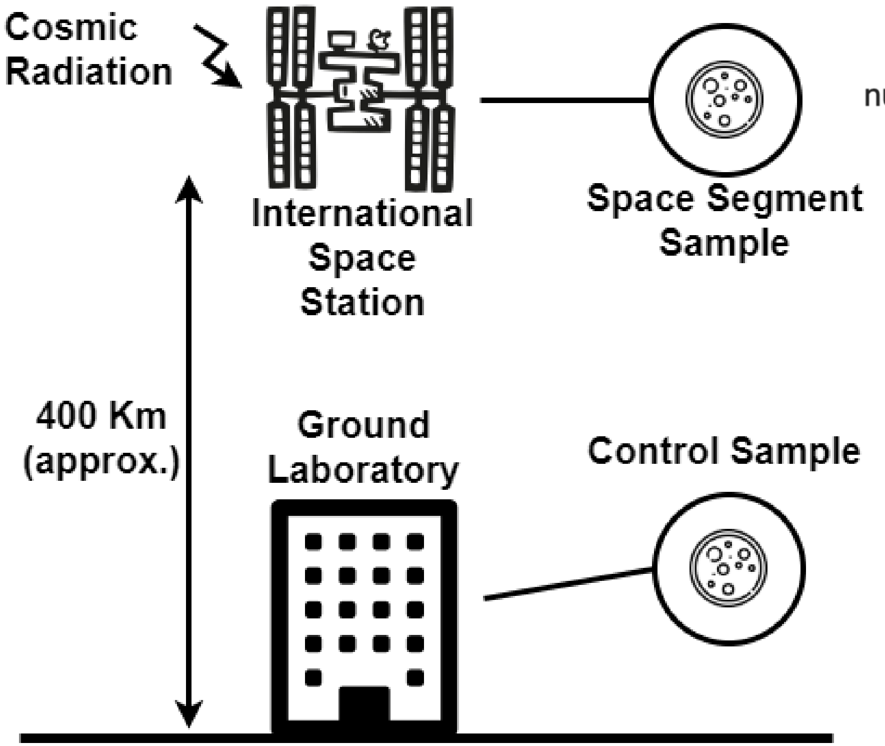
The ICE Cube service was selected to carry out this experiment since it is located in the Columbus module, which offers the following advantages:

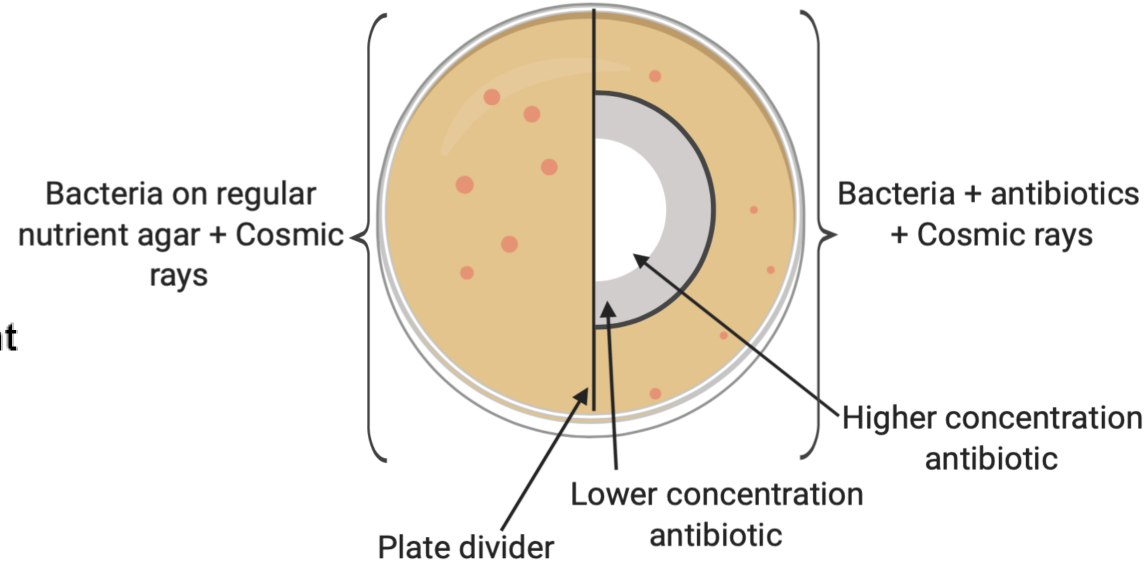
- It is pressurized, avoiding the thermal control of the experiment. It also eliminates the possibility of outgassing happening.
- It is an environment almost identical to the one inhabited by the ISS astronauts on a daily basis.

Experiment Concept

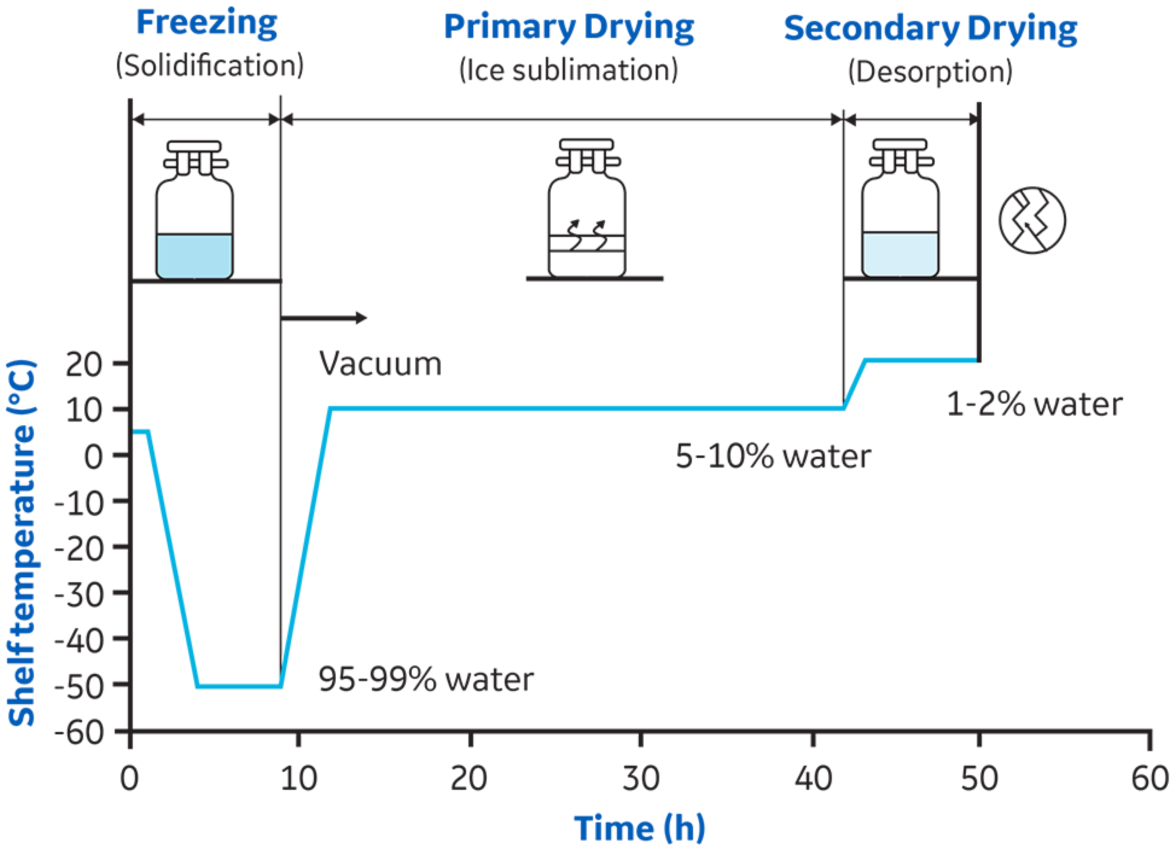


Experiment Concept – Main Experiment





Experiment Concept – Lyophilized samples



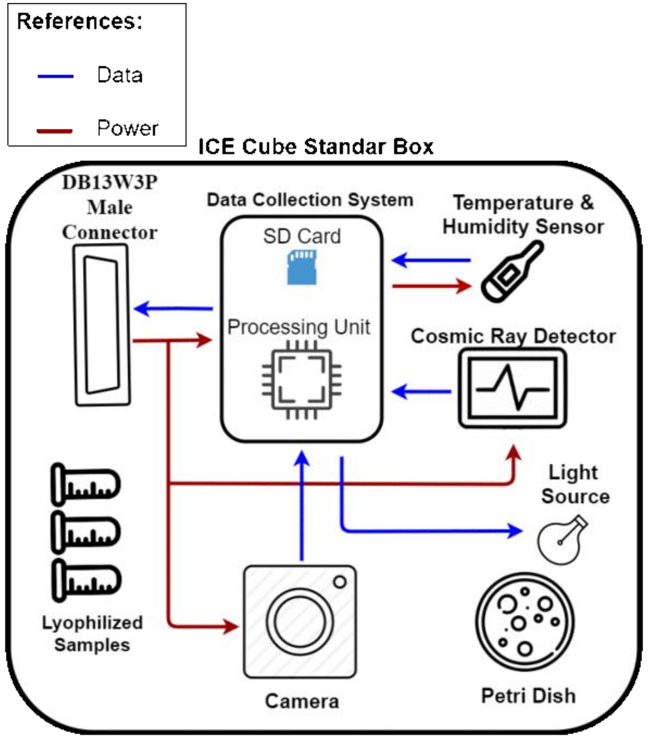
Bacteria Selection

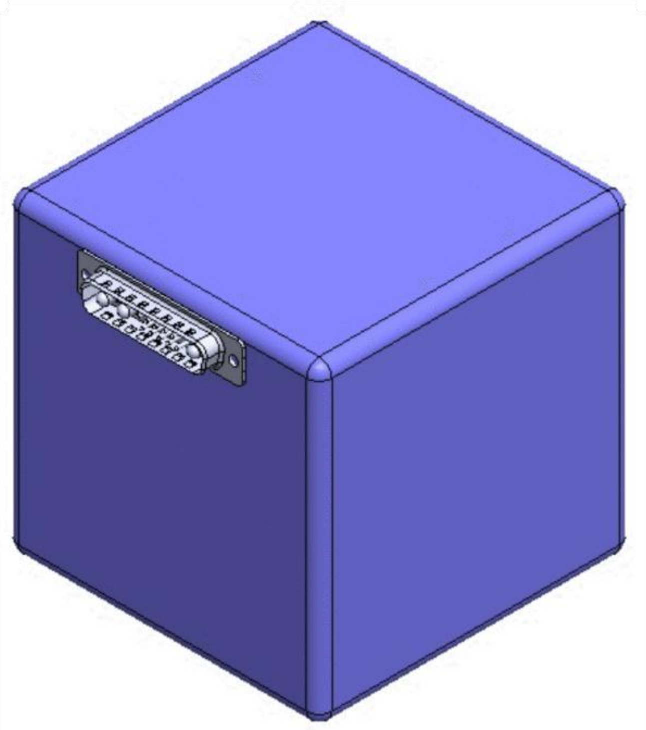
- Pathogenic properties
- Temperature ranges
- Typical growth curves
- Survival capacity
- Possible antibiotics

Lactobacillus acidophilus

Staphylococcus aureus

Space Segment Description





Concept of Operations

Pre-launch Operations

In Flight Operations

Re-entry operations

Sample	Flight without antibiotics	Flight with antibiotics	Ground without antibiotics	Ground with antibiotics
Observations	40 colonies	16 colonies	30 colonies	4 colonies

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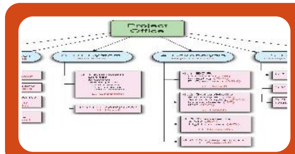
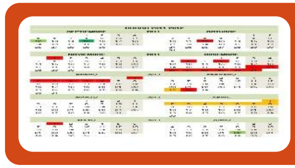
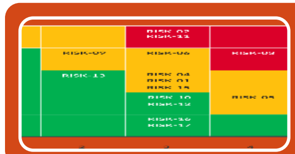
Implementation Plan


Project Organization


Schedule


Infraestructure


Cost estimation and Budget plan


Risk analysis

Project Organization

- Project Leader
- Experiment Responsible
- Mechanical Responsible
- Electrical/Electronic Responsible
- Software Responsible
- Technology Linking Unit

Schedule

Task	Months													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Experiment design and revision	■	■												
Purchase components		■	■	■										
Software development and testing		■	■	■	■									
Prototype development and functional testing			■	■	■	■								
Final product integration and testing						■	■	■						
Space segment delivery and launch (*)								■	■					
Experiment operations										■				
Environment data collection										■	■	■		
Space segment return (*)													■	
Science data analysis and results										■	■	■	■	■
Documentation	■	■	■	■	■	■	■	■	■	■	■	■	■	■

* This times are responsibility of the ICE Cube service.

Infrastructure

Office

- Project management
- Softwre development
- Ground Operations

Workshop

- Integration
- Testing

Laboratory

- Samples preaparation
- On ground experimentation

Cost analysis

Item	Quantity	Cost ($USD)
Petri dish + bacteria sample + antibiotic	2	500
ICE cube standard structure	1	1000
Data collection system + light source + temperature & humidity sensor	1	1500
Camera	1	1000
Cosmic ray detector	1	4000
Transportation and Pre-launch campaign	1	3000
End-to-end ICE Cube service package (for a 1U / 1kg payload)	1	55000
Total	-	66000

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Risk Analysis

	Negligible	Minor	Moderate	Significant	Severe
Very likely					
Likely		C		B	
Possible					
Unlikely					
Very unlikely					A

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Conclusions

- ✓ Simple and robust design.
- ✓ Relative low cost.
- ✓ High scientific value.
- ✓ Feasible project.
- ✓ It is a way to introduce high students to the space activity.

Acknowledgments

Laura Banken and Dr. Pablo de Leon -University of North Dakota.

Dr. José Echinique and the CIBICI Laboratory team – Universidad Nacional de Córdoba

Dr. Mario Lanfri and the UFS Master Students – Comision Nacional de Actividades Espaciales

The ICE Cube service staff.

All the Marcelino Champagnat Institute Staff.

All the UNISEC-Global Staff

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Thank you!