

HUMAN SYSTEMS INTEGRATION SILICON MINING

Alessandro Fossataro & Johan Jayaprakash

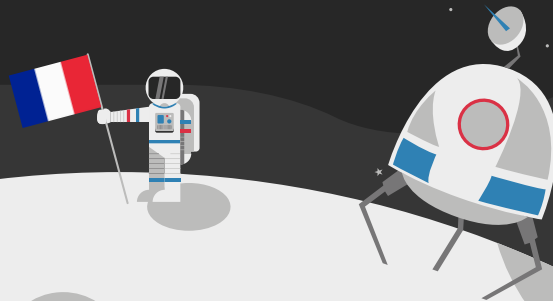


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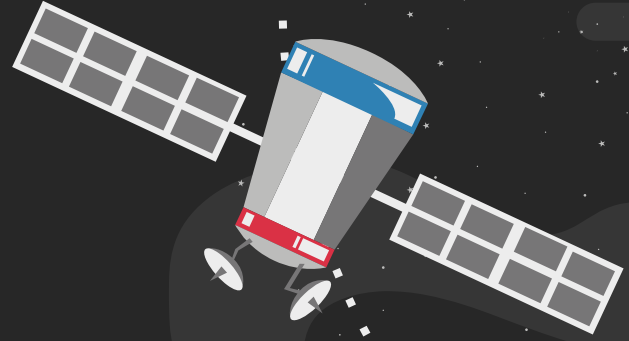
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What is our added value?
User benefits of our
project?

01

INTRODUCTION

- What are the objectives?
- What is the context?



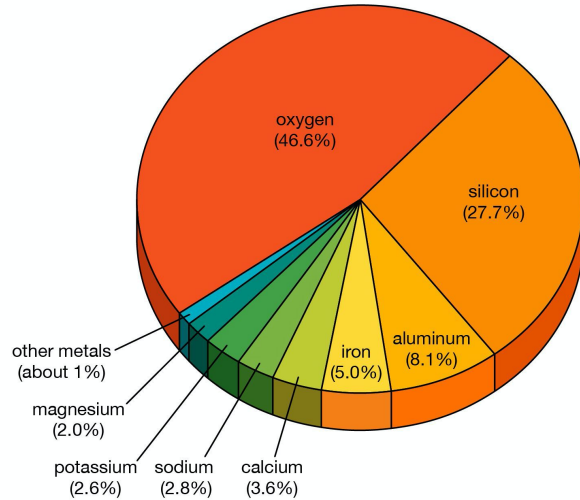


Objective: Silicon material extraction

Our project is to mine the silicon from the Moon to respond to shortages caused by wars, severe weather, pandemics, trade-wars...

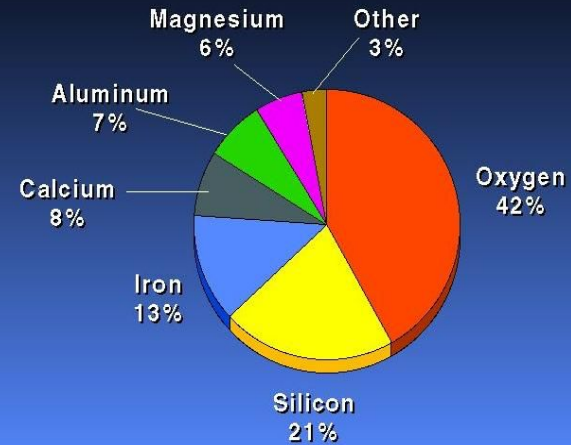
What is the context?

Mineral composition of Earth's crust



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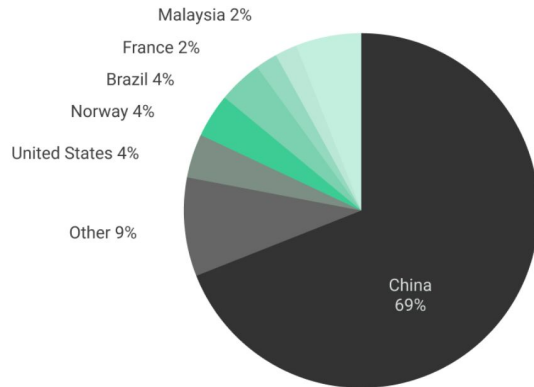
Lunar Soil Composition



Source: https://fti.neep.wisc.edu/fti.neep.wisc.edu/neep602/LEC12/IMAGES/soil_comp.jpg

What is the context?

Silicon Production 2020



MINESPIDER

Source:
<https://www.minespider.com/blog/know-the-source-the-polysilicon-supply-chain>

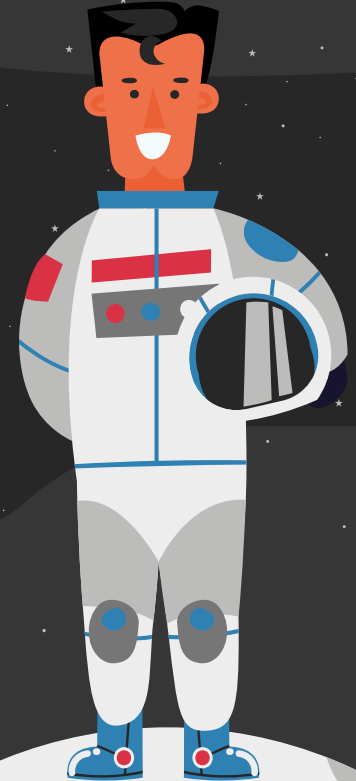
Europe, whose semiconductor companies hold just over 8% of the world market, has no major foundry capable of producing components of less than 22 nm.

The two European leaders are the German Infineon and the Franco-Italian STMicroelectronics.

Source:
<https://business.lesechos.fr/entrepreneurs/web/dossiers/18065397/18065397-zoom-sur-la-crise-des-semi-conducteurs-345761.php>

“That's one small step for a man,
one giant leap for mankind”

-Neil Armstrong



How our company is involved in?



STMicroelectronics is a french-italian chipmaker company, recognised as the world's 3rd largest maker of microcontroller chips, which are used in a wide range of applications, and is one of the top five automobile chip suppliers.

Lunatic Rangers is working with STMicroelectronics to bring their business to a next level by collaborating with NASA, we will be mining silicon material from the Moon.

THE 5W AND 2H APPROACH

WHY → Increase the productivity of France in Silicon, have a monopole in the European market

WHEN → Within the next two decades

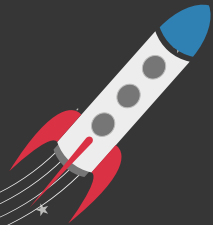
WHERE → We will be mining the silicon directly on the Moon

WHO → Lunatic Rangers have the expertise to propose a new innovative way to extract silicon

WHAT → Extract the silicon from the Moon and send it back to Earth

HOW → Through a partnership with NASA

HOW MUCH → Budgeting in process with our main client: STMicroelectronics



TOP CHART

PEOPLE

Who's doing stuff?

Lunatic Rangers are working on silicon production to make a better management of resources and to help the societies that produce microchips.

**SILICON MINING
(HSI)**

ORGANISATION

TECHNOLOGY

What we do stuff with?

We use a regolith extractor to mine the silicon and a magnetic rail gun to supply the silicon to Earth → need for prototyping and virtual assistance.

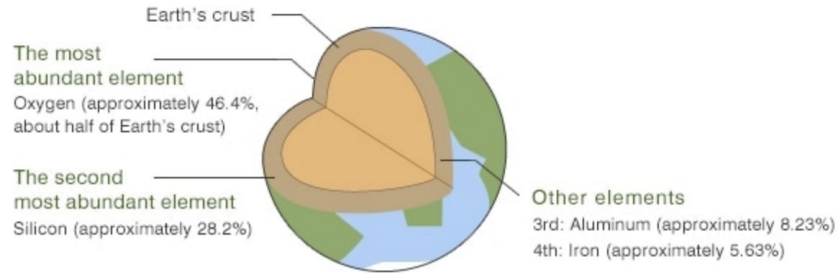
How stuff is done?

*Partnership with NASA.
Define safety standards for the human lunar base.*

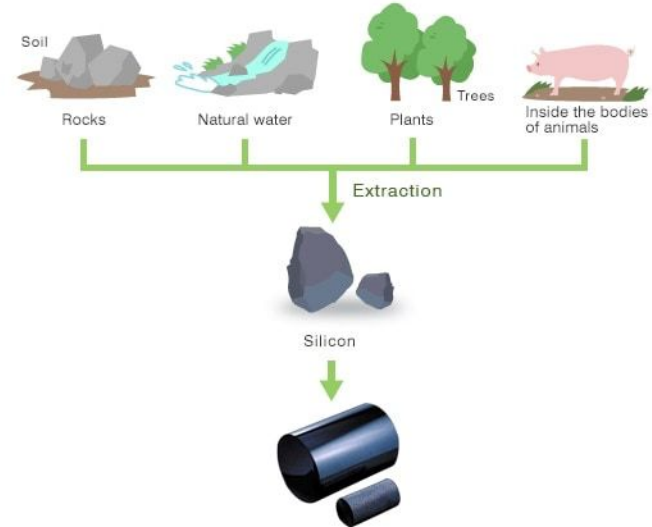
How do we extract silicon on Earth?

Source: <https://www.hitachi-hightech.com/global/en/knowledge/semiconductor/room/about/silicon.html>

Abundance of silicon in Earth's crust

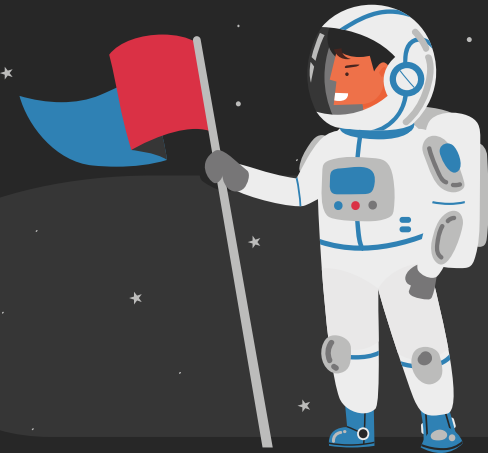


Silicon is found in a lot of things on earth.



Several issues to solve...

- ❑ Achieving a very high silicon purity is very difficult in lunar environment.
- ❑ We plan to have a human base on the Moon: for safety reasons, we should have the right distance between that and the drilling facility.
- ❑ In order to ship the silicon to the Earth we plan to manufacture a magnetic rail gun: at the current stage we only have concept ideas → an important engineering phase need to be done
- ❑ TRL of Moon mining is still in the R&D phase: we should plan to execute several simulations before physically start the project
- ❑ Societal issue: the Moon has important value in many cultures and religions → mining it may cause ethical issues



Sources:

<https://journals-sagepub-com.ezproxy.universite-paris-saclay.fr/doi/10.1177/0309133314567585>

<https://www.space.com/36442-could-moon-miners-use-railguns-to-launch-ore-into-space.html>

<https://www.jpl.nasa.gov/infographics/the-lunar-gold-rush-how-moon-mining-could-work>

Who are our stakeholders?



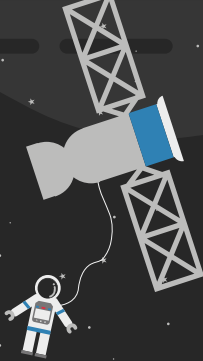
Microchips
producers



Lunatic Rangers



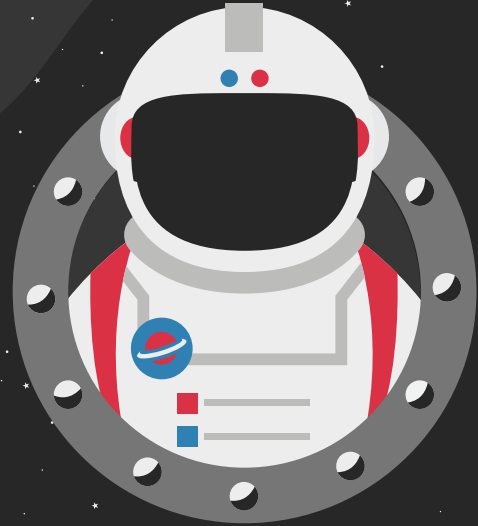
Solar cells
producers



Automotive
industry



NASA



02

BUSINESS PROCESS

How are we going to mine silicon from the Moon?

Task breakdown structure



03

EARTH SUPPLY

How the silicon is going to be shipped on Earth?



Concept of operations (ConOps)

Lunatic Miners

Our company will be in charge of the overall management of our production site on the Moon

Silicon extracted

We will find the stockage of our silicon resources. Humans will plan the work and robots will execute

Collection

Collection of the extracted silicon

Supply

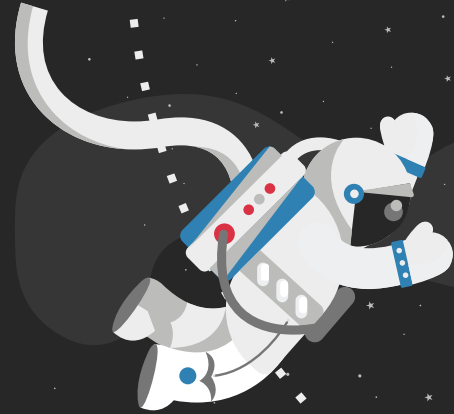
Made through a magnetic rail gun so that we avoid multiple trips between Earth and Moon



04

CONCLUSION

What is our added value?
User benefits of our project?



Conclusion

What is our added values?

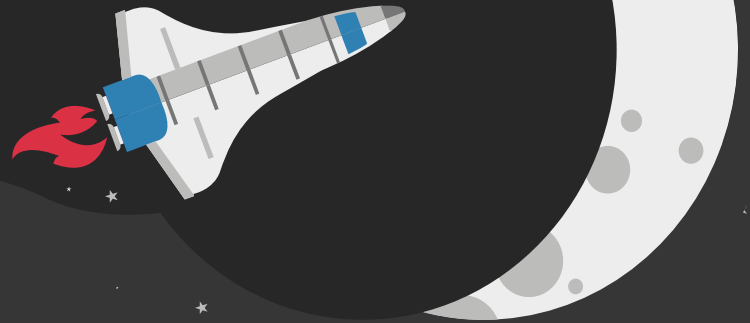
We identified some key elements that could bring a real added value:

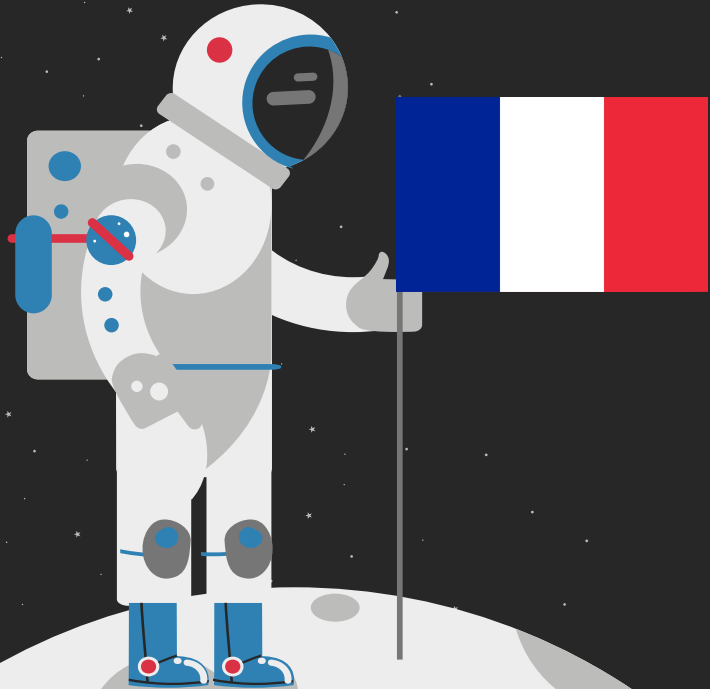
- *A zero emission production of silicon*
- *Limit the number of employees working on the field*
- *Be more sustainable and responsible towards our Earth's resources*

And the most important thing: **being innovative**

What else?

In order to build a sustainable project and a durable human presence we will be installing solar panels on the Moon to facilitate the production of electricity for the installations.





Thank you!

Do you have any questions?

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