

AIM FOR THE MOON

Chloé Carrière, July 5th 2019

"We choose to go to go to the Moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard." These words of American President Kennedy still resonate in the memories of those present on Earth in the 1960s. Fifty years later, these key moments of the space conquest are once again highlighted with a desire to return to this star "only" 384,400 km from our home.



Figure 1: The First Earth Rise, William Anders, Apollo 8, 12/24/1968

"I was twelve years old in July 1969, and in my child's head this event opens the door to dreams." tells us Claudie Haigneré, the first French woman in space. Thomas Pesquet, who was not yet born in 1969, points out: *"We represent the first generation of people who are training to go into space and who have not experienced Man's steps on the Moon."* The world of space exploration did not stop on the day the crew of Apollo 17 returned, but human exploration of the Moon has, since that day, taken a long break.

I. The Moon

Among the solid planetary bodies of the solar system, the Earth is the largest by size, and the Moon, with a diameter of 3476 km (3.7 times smaller than the Earth's), the ninth. Its volume represents 2% of the Earth's volume and its surface area 7.4%, which is the surface area of Africa and Australia combined.

It orbits the Earth in an elliptical orbit at an average speed of 1 km/s. Its period of revolution of 27.3 days being equal to that of its rotation, it always presents the same hemisphere towards the Earth (visible face), the other being unobservable (hidden face). In reality, the Moon shows a slight apparent rocking motion from the Earth, due to its speed variation and the fact that its axis of rotation is not perpendicular to the plane of its orbit. This reveals areas beyond the North or South limb: 59% of its total surface can be observed.

There are two types of regions on the Moon: light regions called *Highlands*, and dark regions called "lunar seas". The *Highlands*, which cover 83% of the Moon, or 70% of the visible face, are very old with an average age of more than 4 Gyr.

The landing sites for the Apollo missions were chosen according to many criteria. For example, the sites selected had to be located on either side of five degrees of the equator, a higher latitude requiring more fuel for the trajectory. In addition, the sites had to be as flat as possible to reduce glide path manoeuvres and the exploration terrain so as not to interfere with the radar of the lunar module. Finally, the site had to be of significant geological interest. That's why the first landing site selected for Apollo 11 was the Sea of Tranquility.

II. The return to the Moon

Unlike the Cold War context of the 1960s, which led to the space race, the next return to the Moon will be an international cooperation. With the rise of private companies such as SpaceX, Airbus, Thales, etc., space exploration is no longer restricted to government agencies. For this return to the Moon, the European Space Agency is currently working on the implementation of a lunar base. Switzerland also plays a key role with the creation of the IGLUNA programme, an initiative of the Swiss Space Center within the framework of ESA_lab: the cooperation of several European universities to develop future technologies useful in extreme environments, such as on the Moon. The field campaign took place in a glacier in Zermatt, the *Petit Cervin*, a glacial cave at an altitude of 3883m, for two weeks. Students at EPFL and the Zurich University of Applied Sciences (ZHAW), for example, have collaborated in the field of food. The goal: to find an alternative to freeze-dried sachets through aeroponics, a form of soil-free cultivation.



Figure 2: The ESA Director General present for IGLUNA (ESA_lab)

The return to the Moon has never been so close after 47 years of lunar inactivity. Humanity is finally ready to increase the number of lunar walkers, which is currently 12. To do this, science crosses borders. We are finally ready to aim for the Moon and show Oscar Wilde that he is wrong: Shoot for the Moon, you will land on the Moon, and not among the stars!¹

¹ References: 50th Anniversary First Man on the Moon, Collective; Swiss Space center (spacecenter.ch); The Apollo missions and the return to the moon, Chloé Carrière.