

# Project proposal: Mission Asclepios

## Student space mission analogue

*“My intention is to build up a permanent base station on the Moon”,* says Jan Wörner, Director General of the European Space Agency<sup>1</sup>. Plans are to go back to the Moon by 2024 and to establish a sustained presence by the 2030s. International collaboration and sustainability will be keys to achieve this goal. Yet, the future space engineers and researchers who will be working on this lunar base are not prepared for this endeavor. Indeed, they are still students, or younger, and the system does not provide any education on space missions and how to establish a lunar outpost. This is where Mission Asclepios comes into play: a do-it-yourself space mission made for students. Mission Asclepios will provide a one-of-a-kind support for students who wish to get involved in human exploration and participate in an analogue mission, by teaching the basics of mission control, designing a potential Moon base and actually performing a simulated mission, in an Isolated and Confined Environment (ICE). The project will gather data and lessons learned for future space missions.

**Space@yourService**, an EPFL non-profit organization, has for mission to promote space sciences to EPFL students and the general public<sup>2</sup>. Thus, the organization will be providing support and coordination to this interdisciplinary project.

Analogue missions are field tests in locations that have physical similarities to the extreme space environments. They are a preparation for near-term and future exploration to asteroids, Mars, and the Moon. Analogues play a significant role in problem solving for spaceflight research<sup>3</sup>:

- Not all experiments can be done in space – there is not enough time, money, equipment, and manpower;
- Countermeasures can be tested in analogs before trying them in space;
- Procedures can be experimented;
- Ground-based analog studies are completed more quickly and less expensively.



Figure 1: HI-SEAS I, simulation of habitat on Mars.

<sup>1</sup> ESA website, teach with the moon.

<sup>2</sup> Statuts de l'association, article 3.

<sup>3</sup> NASA, About analogue missions.

Why use an analogue mission for educational purposes? Human exploration is often a source of inspiration and interest for many people, especially students. At this time, interdisciplinary projects are put in place so that students can develop their technological skills in space exploration. Nevertheless, the human aspect of such missions is usually neglected. Analogue missions are a way to test the technical skills, but also to develop the management, communication and psychological aspects. Students will be able to work in teams and become familiar with group dynamics. The mission will also introduce them to working in a stressful environment where failure is not an option. Then, they will be able to connect with many diverse researchers in the space area, for their future careers. Finally, this type of project could be covered by medias and inspire the future generations to pursue STEM studies. Therefore, this mission will provide the space industry with up-to-date engineers, an innovative and skilled workforce, who is able to work under pressure, and inspire the future generation to continue this endeavor.

## Our project: Mission Asclepios

### 1. The name and logo

In classical mythology, *Asclepios* refers to the son of *Apollo* and the ancient Greek god of medicine and healing. This name was chosen to refer to Apollo's legacy, and hint at NASA's next Moon mission *Artemis*<sup>4</sup>, Apollo's sister. As the mission will focus on the human aspect of space missions, we chose the ancient god of medicine and healing as a symbol.

Our logo was designed from scratch to symbolize the purpose of our mission. Details can be found in Annex A.

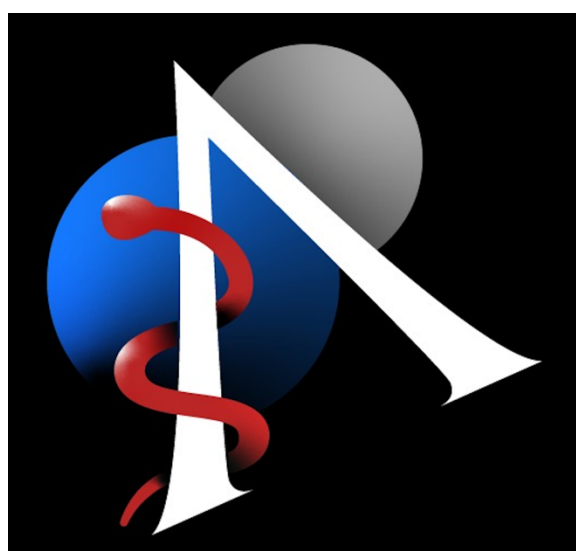


Figure 2: Logo, Mission Asclepios

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<sup>4</sup> NASA, Artemis program

## 2. Description of the project

Mission Asclepios is a scientific project aiming at simulating a short-term mission on another celestial body (like the Moon or Mars) which will take place within next year (2020) in a remote location, Switzerland or abroad, that still needs to be defined (although proximity would be an plus for organizational and financial purposes). Organized by the EPFL association Space@yourService, it will allow different laboratories to make *in situ* experiments. Even if the fields of study of the laboratories should be related to the space domain, the range of possibilities stays widely open: from psychology to robotics, from medicine to astronomy, and much more. The team will be split in three groups:

- Engineers: responsible for the technical aspects of the project. In charge of the conception of the habitat and the development of the experiments that will be tested during the mission.
- Ground control: responsible for the organizational aspect of the project. In charge of the experiments' proceedings (especially during extra-vehicular activities) and the daily organization of the astronauts' team acting as the unique point of contact during the whole mission. They make sure the *in situ* team is safe and working through the procedure.
- Astronauts: in charge of the realization of the experiments, they will also be part of those experiments, especially for the psychological aspects of the mission. Their backgrounds should be diverse, one or more should hold a first aid certificate and they will be trained to basic survival necessities.

The main goal of this project is to simulate as realistically as possible a mission on another celestial body, with in mind the work of the European Space Agency on building a Moon village. Thus, this implies a precise coordination between different entities, and a control of every aspect of the project to ensure the smooth running of the mission, especially regarding the astronauts' safety.

Two isolation experiments will be done throughout the year. The first one, a short-isolated simulation, will confirm and enhance our procedures for the longer simulation. The difference between indoors and outdoors isolations will be studied.

- The first simulation will be done in a building (isolated from other individuals) during a week-end in February.
- The second simulation will be done outdoors, in a Mountain Cabin for instance, for 7 days (from the 13<sup>th</sup> until the 19<sup>th</sup> of April<sup>5</sup> 2020).

## 3. Technical details

Technical details are numerous, few of them are listed here. The crew, composed of 6 people (gender balanced), from various backgrounds, will be isolated with restricted comfort and supplies. Communication will be permanent and restricted to Mission Control, through walking talkies for example. Space suits and helmets will have to be worn outside during EVAs. There will be no showers at disposal, hygiene tasks will be done with dry shampoo, hand sanitizer, etc... The power used during the mission will be measured (and limited) to see how much a crew consumes for such a mission.

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<sup>5</sup> Temporary dates, subject to change.

Water and food will obviously be restricted as well. Protocols will be written by Mission Control. No phones will be used to contact families, only emails. A logbook will be done by each “astronaut” to collect their feelings/emotions throughout the mission.

The selection of the crew will be done scientifically with the help of former astronauts and psychology professors. The students enrolled in this mission will take part till the final reports due date in the beginning of July.

#### 4. Collaboration and international partners

Although the project will be run by students, mentors and professors will be supervising the mission throughout the year. Experiments will be done during the simulations and will likely end-up as scientific papers, gathering data and lessons learned for future space missions. The following people have already confirmed their participation.

##### a. Mentors

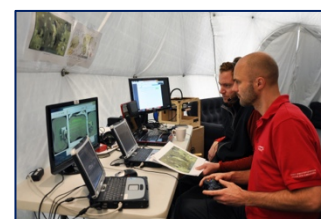
- **Prof. Claude Nicollier**

Claude Nicollier is a former ESA Astronaut and works as a professor at EPFL. He is a member of the Swiss Space Center in Lausanne. Claude has accepted to be a mentor for the crew for Mission Asclepios.  
Contact: [claudenicollier@epfl.ch](mailto:claudenicollier@epfl.ch)



- **Angelo Vermeulen**

Angelo Vermeulen was the crew commander of NASA HI-SEAS I. He gave us insights and advice on the requirements we need to build such a simulation.  
Contact: [angelo@sead.network](mailto:angelo@sead.network)



- **Prof. Caroline Pulfrey**

Caroline Pulfrey is a professor at the University of Lausanne and EPFL in Social Psychology. She has agreed to help us on the psychological aspects of Asclepios, through guidance and contacts.  
Contact: [caroline.pulfrey@unil.ch](mailto:caroline.pulfrey@unil.ch)



##### b. International Collaboration

- **The Austrian Space Forum**

The Austrian Space Forum is a network of space experts in collaboration with national and international institutions from science and industry working at the cutting edge of scientific research. It is one of the leading institutions conducting Mars analog missions. They have offered us a spot on their next Mission Analogue Basic Training in November.



- **SAGA Space Architects**

SAGA is a new design practice working on making space livable for future space travelers by approaching the design of habitats from a human perspective. Their next project is called LUNARK: they plan on running a Space mission analogue in Greenland.

They have agreed to help us out with designing some space-worthy interior and finding some cheap but convincing solutions.

**SAGA**  
Space Architects

- **Cabinet NB, Lausanne**

Cabinet NB is a cabinet of psychology and psychiatry located in Lausanne. Dr. Nicolas Belleux, head of the cabinet and psychiatrist/psychologist FMH, has agreed to help us out concerning the crew selection process, by providing psychological tests.



- **UKAM (UK analog mission)**

UKAM is simulating isolated manned space flight missions and providing this practical experience to students by creating an interdisciplinary and international collaboration.

Konstantin Chtereov, co-founder and specialized in space psychology, has agreed to help us concerning the crew selection process, and to come to Lausanne for the final interviews.

**UKAM**

c. Researchers and start-ups

- **LyF Rescue Drones**

LyF Rescue Drone is an EPFL start-up, which has for goal to autonomously detect a person using a beacon during an extreme situation such as a mountain avalanche. Thanks to the drone's abilities (computer vision, agility, research strategy...) the search is efficient by deleting the human rescue factor, and the search time is decreased. Applications to such rescue drones are large, from the detection of avalanche's victims to the rescue of astronauts in perdition on another planet.

The team has agreed to perform a test of their rescue drones for astronauts during Mission Asclepios.



- **Dr. Sophie Goemaere**

Dr. Sophie Goemaere is the project manager of Divergent at the University of Gent. She has been conducting psychological research during the NASA HI-SEAS missions.

She has offered to run a study on the importance of communication between the crew and Mission Control, to see how variations in ground control's communication style (autonomy-supportive or controlling) could predict variations in the crew's perception of this communication, and their sense of autonomy.





- **Dr. Kim Lê Van**

Kim Lê Van is a sociologist in Lausanne specialized in interpersonal communication patterns. She has impressed interest in running an experiment concerning Mission Control interpersonal communication during the 7-day simulation.



- **George Lordos**

George Lordos is a PhD Candidate at MIT in the department of Aeronautics and Astronautics and focuses on the establishment of a city on Mars.

He expressed interest in running an experiment during our simulation.



d. Partners

- **Swiss Space Center**



The Swiss Space Center contributes to the implementation of the Swiss Space Policy. It provides a service supporting academic institutions, RTOs and industry to access space missions and related applications and promote interaction between these stakeholders. One of its tasks is to provide education and training and to promote public awareness of space.

One project run by the SSC is IGLUNA, an ESA\_Lab demonstrator, targeting development of technologies to be used in an extreme environment such as the Moon. Mission Asclepios will be established in synergy with IGLUNA and will be monitored by the SSC team.

Contact: [martine.harmel@epfl.ch](mailto:martine.harmel@epfl.ch)

- **EPFL Space Center and LASTRO**

eSpace and LASTRO are two EPFL laboratories specialized in space engineering and astrophysics.

Mission Asclepios will be monitored and guided by these two centers, providing mentors and advice.

Contact: [alexandre.lucas@epfl.ch](mailto:alexandre.lucas@epfl.ch)



e. Other

The project will be discussed in various forums such as the Moon Village Association and Space Generation Advisory Council.

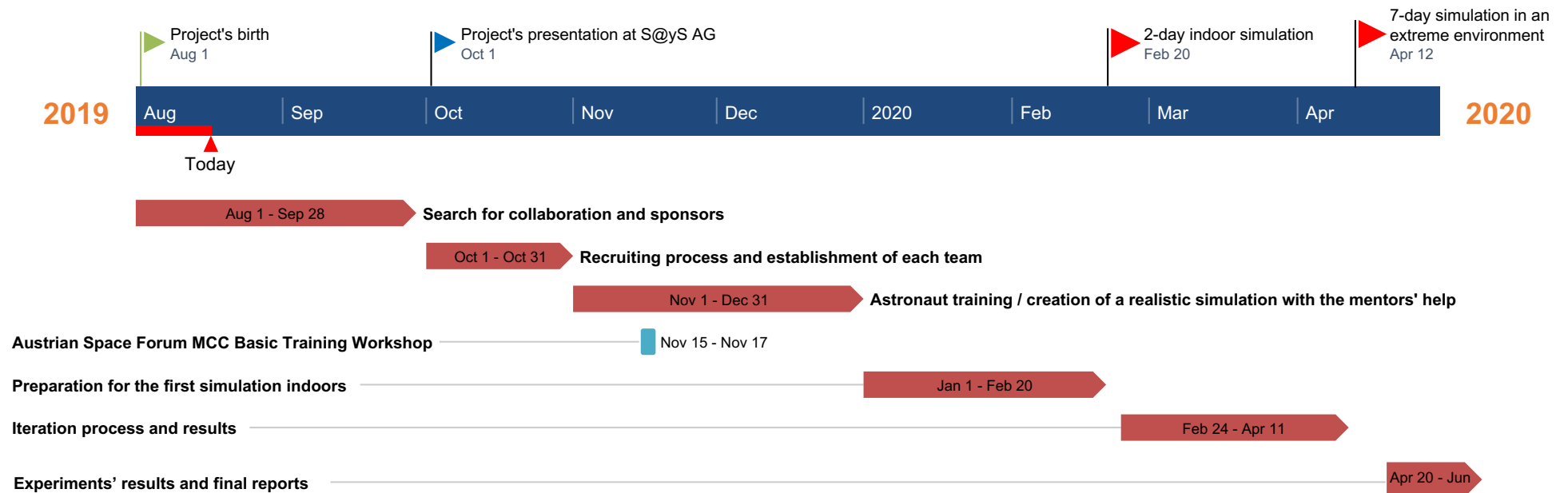
f. Envisioned collaborations

Other collaborations are envisioned, especially for experiments which could be done during the simulation: EPFL Robotic Laboratory, International Space University, Geosciences Basel University, and Manchester University. We are currently in discussion with those institutions.

## 5. Project plan



# Mission Asclepios



Simulations' dates are subject to change.

## 6. Budget envisioned

Total Activity Expense	11 000,00 CHF
Description of Expense	Amount expected
Mission Asclepios	
Rental for simulations	3 000,00 CHF
Communication and monitoring	1 200,00 CHF
Space suits	300,00 CHF
OewF Analogue Mission Basic Training	500,00 CHF
Supplies	1 000,00 CHF
Experiments	2 000,00 CHF
Crew training	1 000,00 CHF
Design	1 000,00 CHF
Media and advertising	1 000,00 CHF

Figure 3: Budget for the test pilot

## 7. Contacts

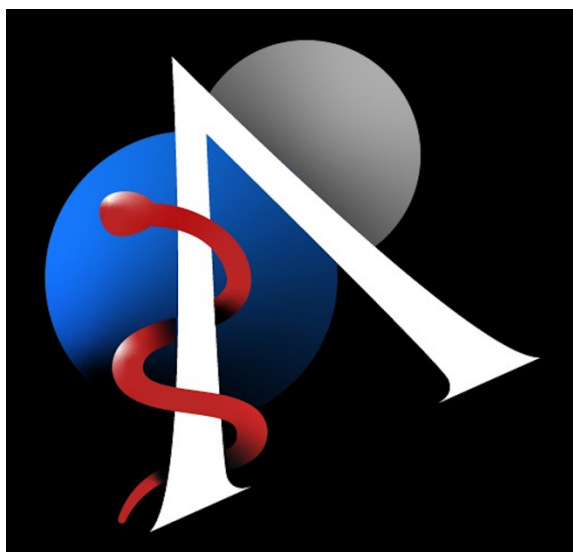
- President Space@yourService and coordinator:  
Chloé Carrière, EPFL Bachelor 5 Physics ([chloe.carriere@epfl.ch](mailto:chloe.carriere@epfl.ch))
- Scientific writer Space@yourService and coordinator:  
Marcellin Feasson, EPFL Bachelor 5 Physics ([marcellin.feasson@epfl.ch](mailto:marcellin.feasson@epfl.ch))

Other:

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George Lordos	<a href="mailto:glordos@mit.edu">glordos@mit.edu</a>



## ANNEX A



*Figure 4: Logo Asclepios*

Explanation Logo