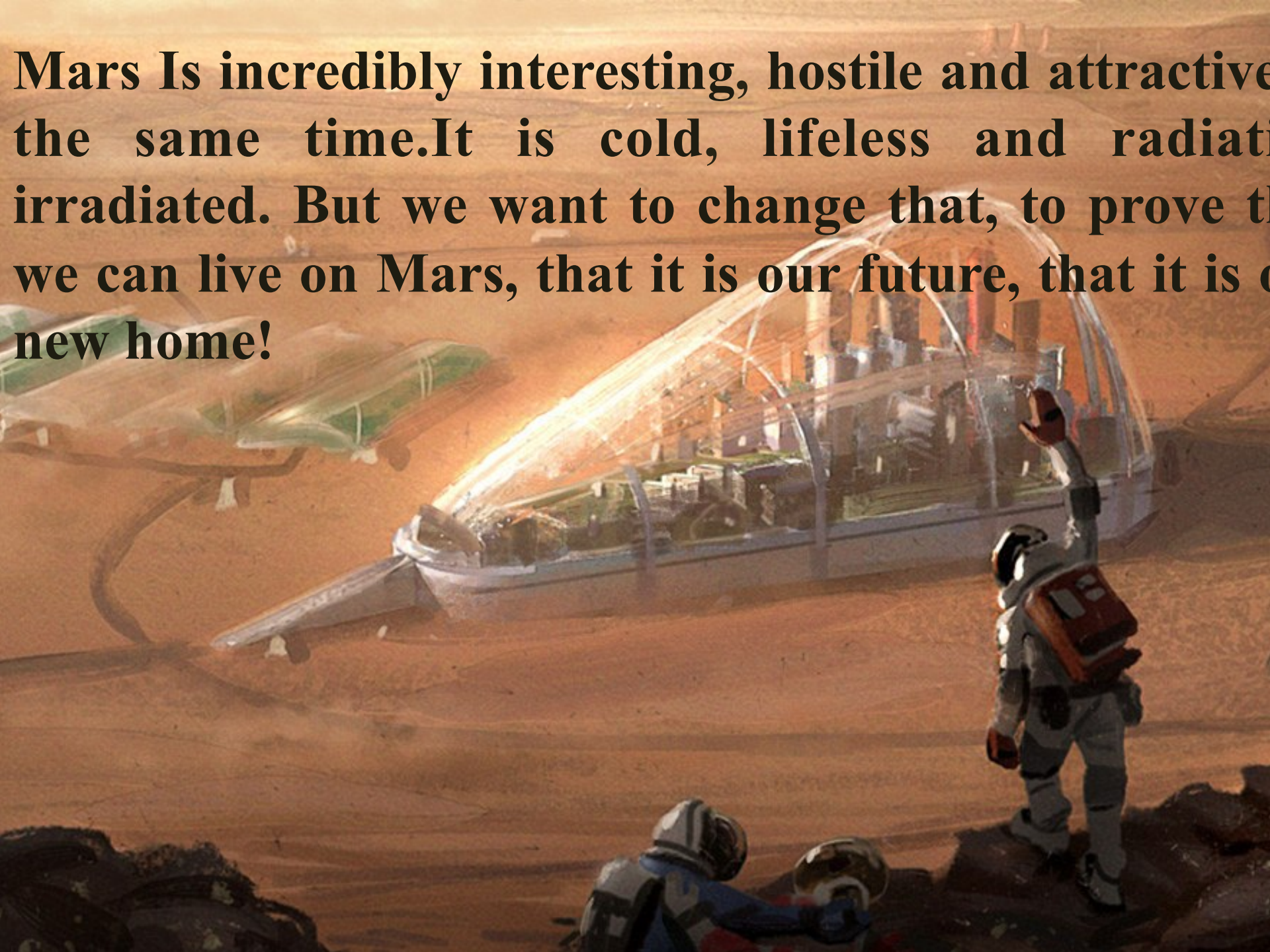
MarsLab

Team: Atanas Simov, Mihail Serafimov, Nikola Slavov, High Mathematical School
Teacher: Silvia Zaharieva, High Mathematical School, Varna, Bulgaria
Mentor: Dr Veselka Radeva, Planetarium, Naval Academy, Varna, Bulgaria

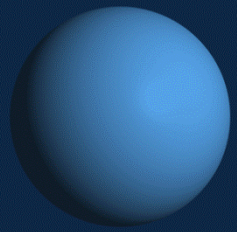

Mars Is incredibly interesting, hostile and attractive
the same time.It is cold, lifeless and radiati
irradiated. But we want to change that, to prove th
we can live on Mars, that it is our future, that it is o
new home!

MARS FACTS / MARS

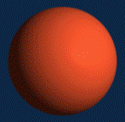
4th Planet From the Sun

#JOURNEYTOM
mars.nasa

MARS FACTS / SIZE



EARTH
7926 miles

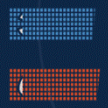


MARS
4220 miles

MOON
2159 miles

#JOURNEYTOMARS
mars.nasa.gov

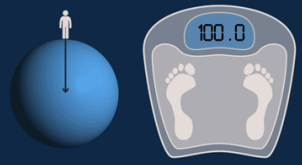
MARS FACTS / YEAR

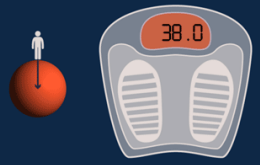


A year on Mars is almost twice as long as a year on Earth.

#JOURNEYTOMARS
mars.nasa.gov

MARS FACTS / WEIGHT



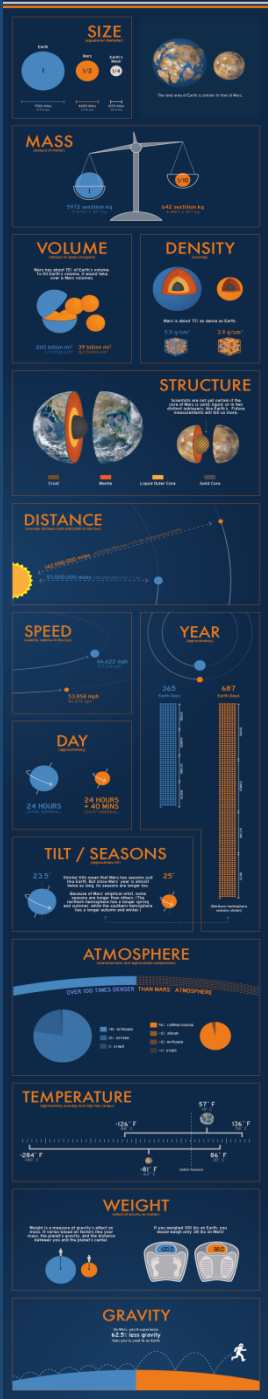


If you weighed 100 lbs on Earth,
you would weigh only 38 lbs on Mars!

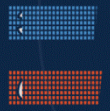
#JOURNEYTOMARS
mars.nasa.gov

MARS QUICK FACTS

FOR MORE INFO, VISIT: MARS.NASA.GOV



MARS FACTS / YEAR

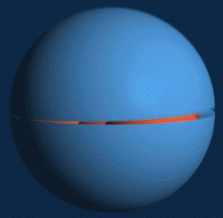


A year on Mars is almost twice as long as a year on Earth.

#JOURNEYTOMARS
mars.nasa.gov

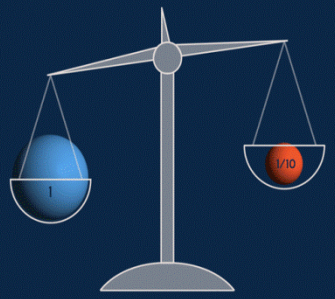
MARS FACTS / VOLUME

It would take more than six of Mars to fill the volume of Earth.



#JOURNEYTOMARS
mars.nasa.gov

MARS FACTS / MASS



Mars has about one tenth of the mass of Earth.

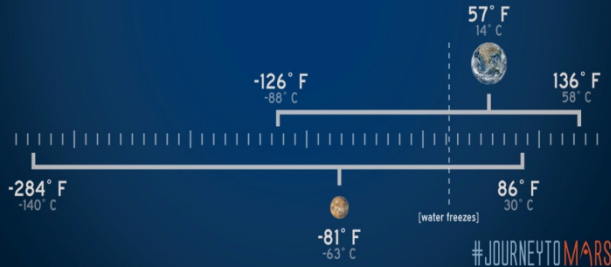
#JOURNEYTOMARS
mars.nasa.gov

MARS FACTS / GRAVITY

On Mars, you'd experience 62.5% less gravity than you're used to.

#JOURNEYTOMARS
mars.nasa.gov

MARS FACTS / TEMPERATURE

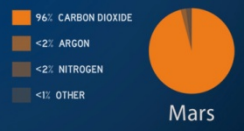


#JOURNEYTOMARS
mars.nasa.gov

MARS FACTS / ATMOSPHERE

OVER 100 TIMES DENSER THAN MARS' ATMOSPHERE

Earth



Mars

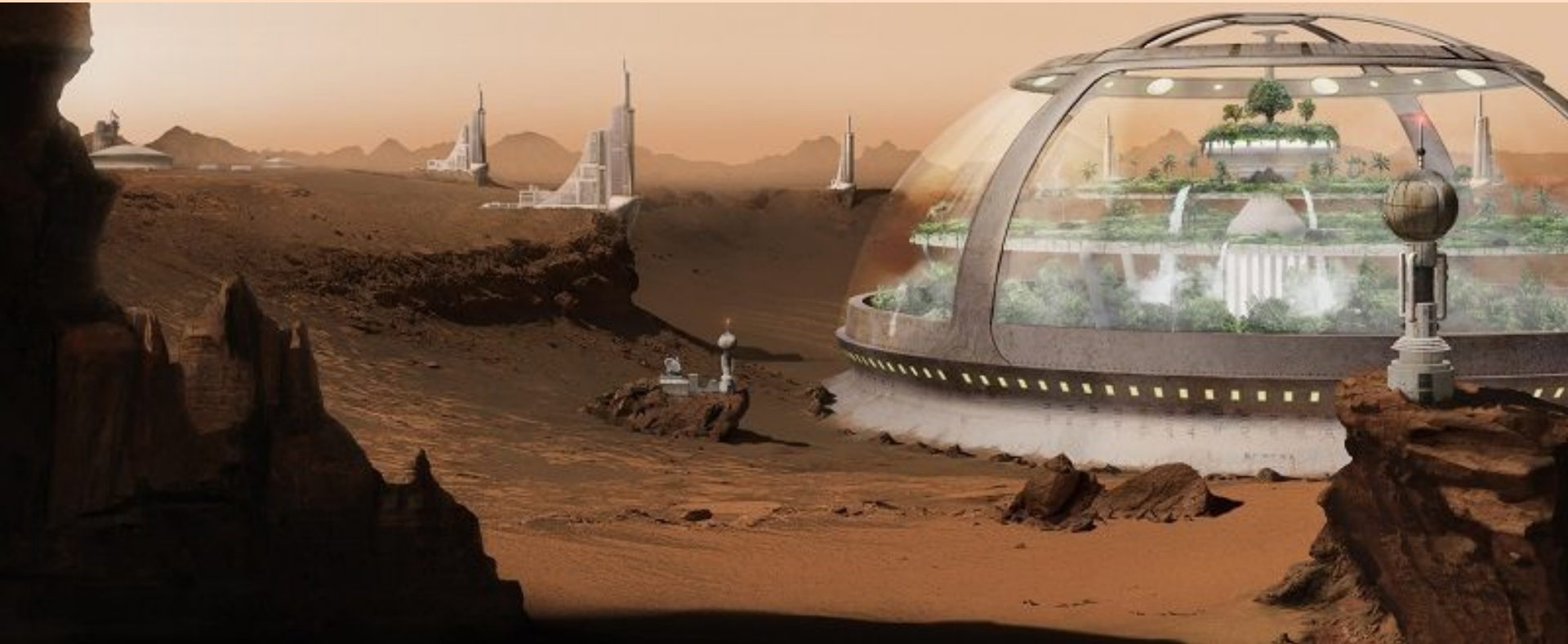
#JOURNEYTOMARS
mars.nasa.gov

- Goals:

-landing on Mars, first with robots;

-building the bases with the robots;

-Sending people to inhabit the bases

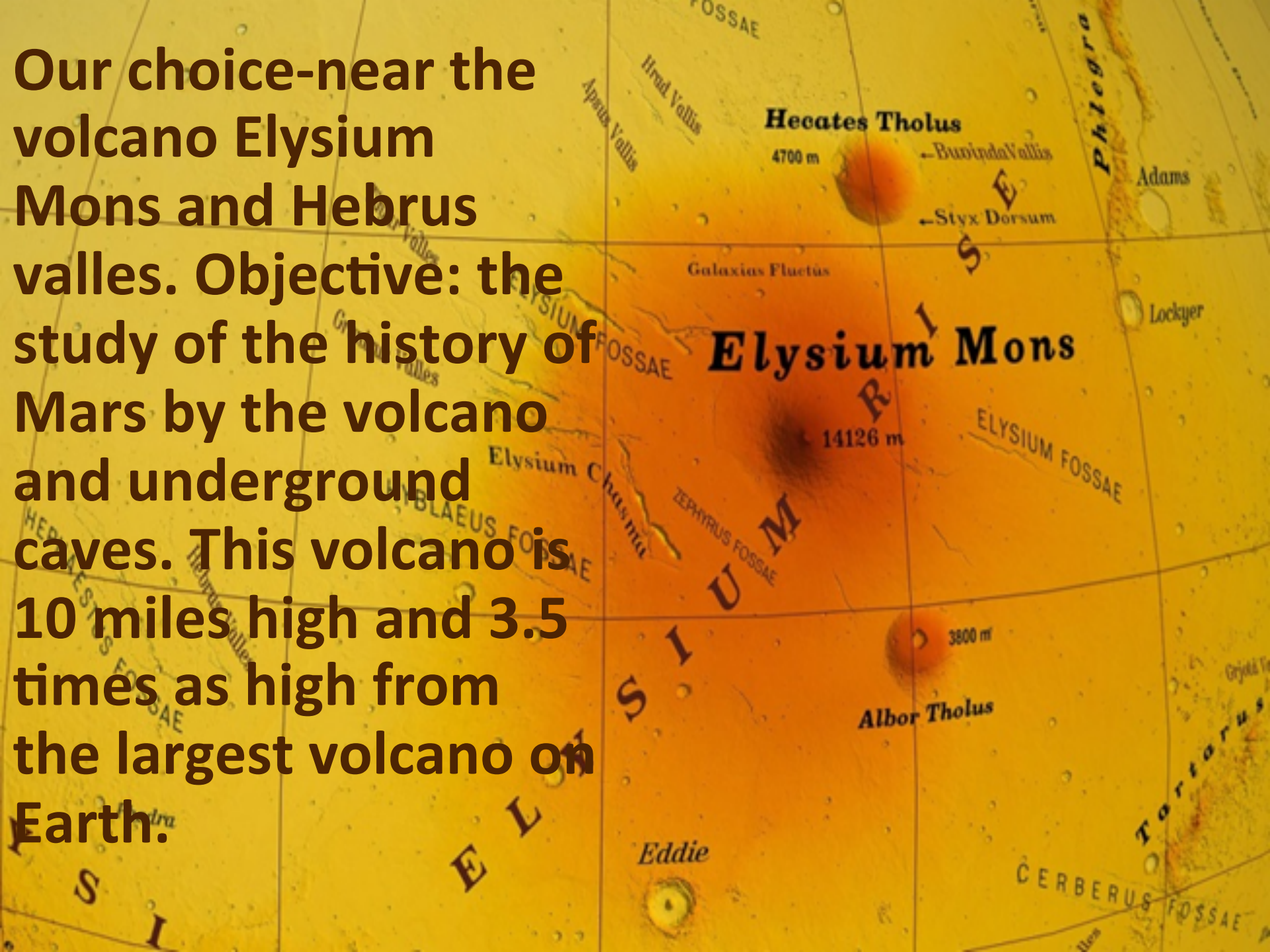



Beggining of exploration mission, linked with finding
rganic components(water, methane);
creating of satellite network for observations and
ommunications with Earth..

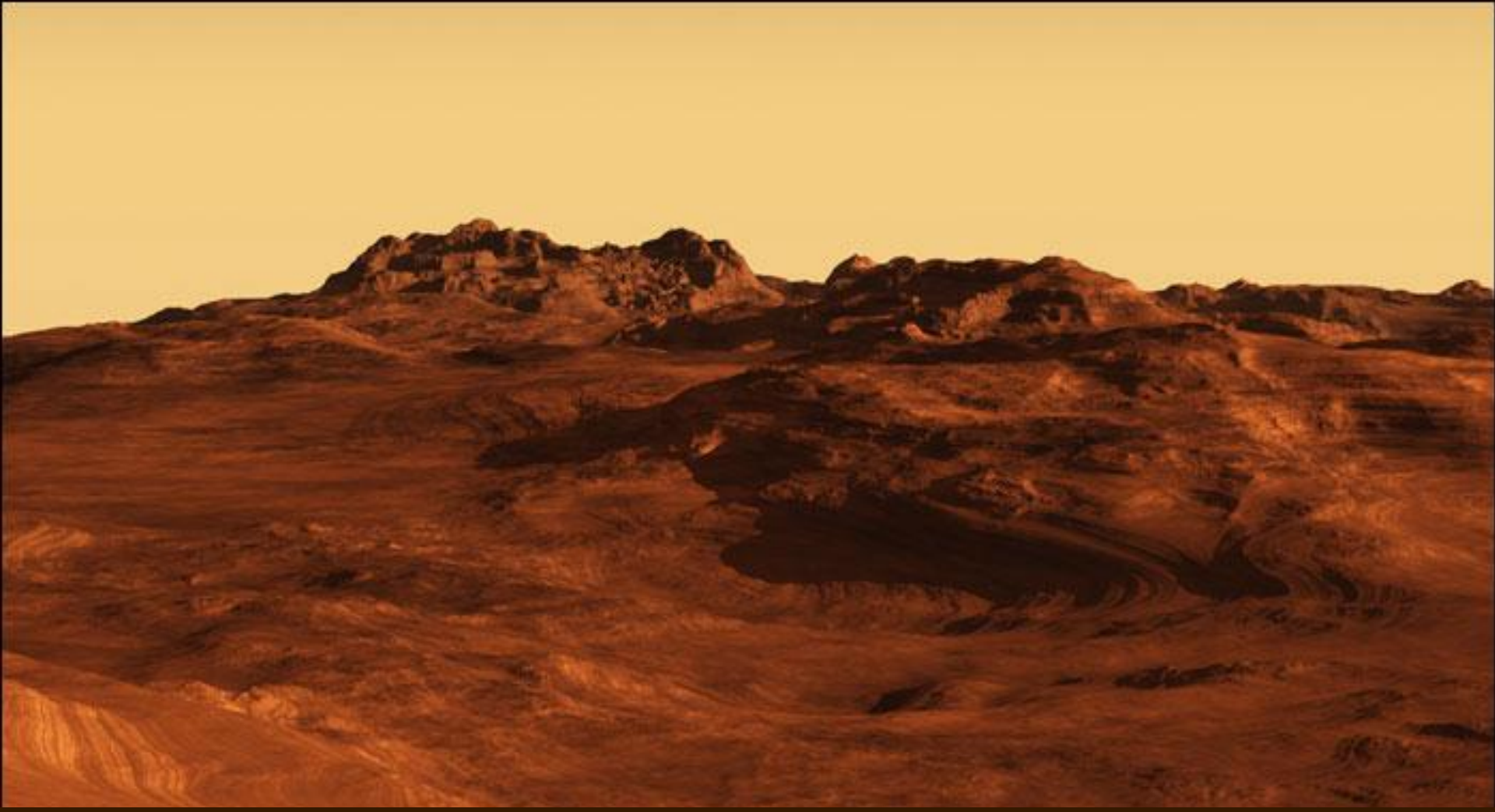
Science, research and exploration

Research of the planet from orbit. Missions to search for water, the exploration of the Martian atmosphere for organics and methane and the study of the past of the planet.

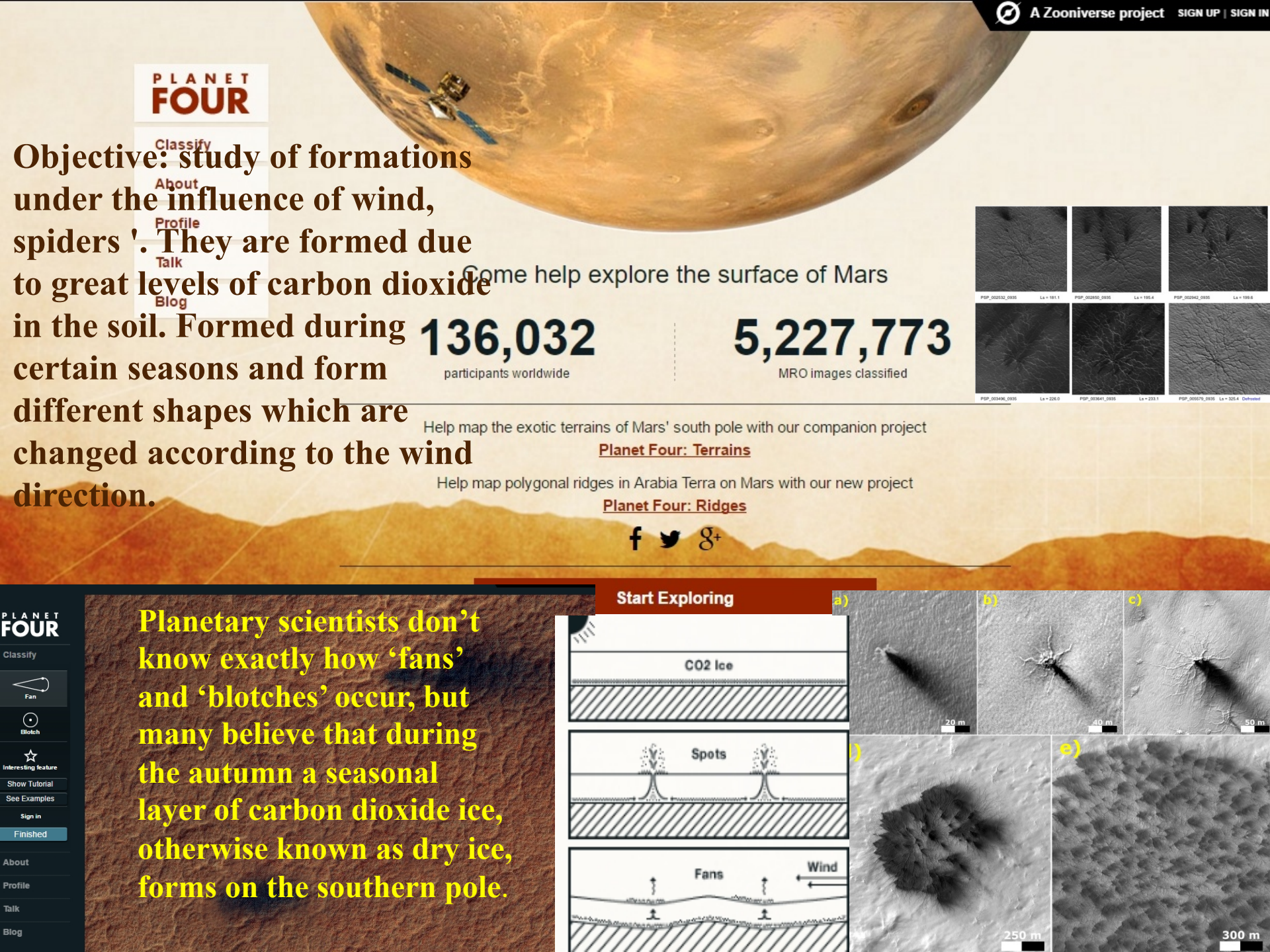
Landing's location



Our choice-near the volcano Elysium Mons and Hebrus valles. Objective: the study of the history of Mars by the volcano and underground caves. This volcano is 10 miles high and 3.5 times as high from the largest volcano on Earth.



his is a valley near Elysium Mons, which according to Mariner 9 was the potential for eruptions in its recent past. The lava from the volcano has formed tunnels underground. It is possible that ice underground



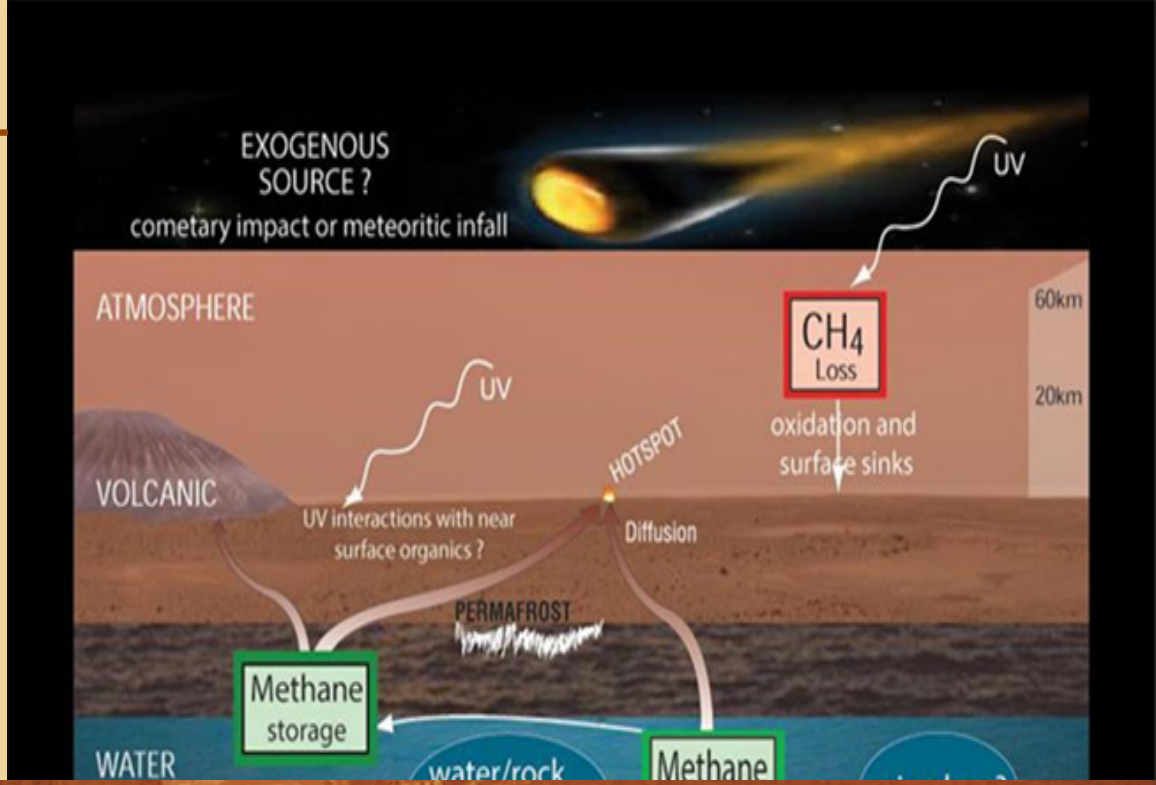
Objective: study of formations under the influence of wind, spiders '. They are formed due to great levels of carbon dioxide in the soil. Formed during certain seasons and form different shapes which are changed according to the wind direction.

Planetary scientists don't know exactly how 'fans' and 'blotches' occur, but many believe that during the autumn a seasonal layer of carbon dioxide ice, otherwise known as dry ice, forms on the southern pole.

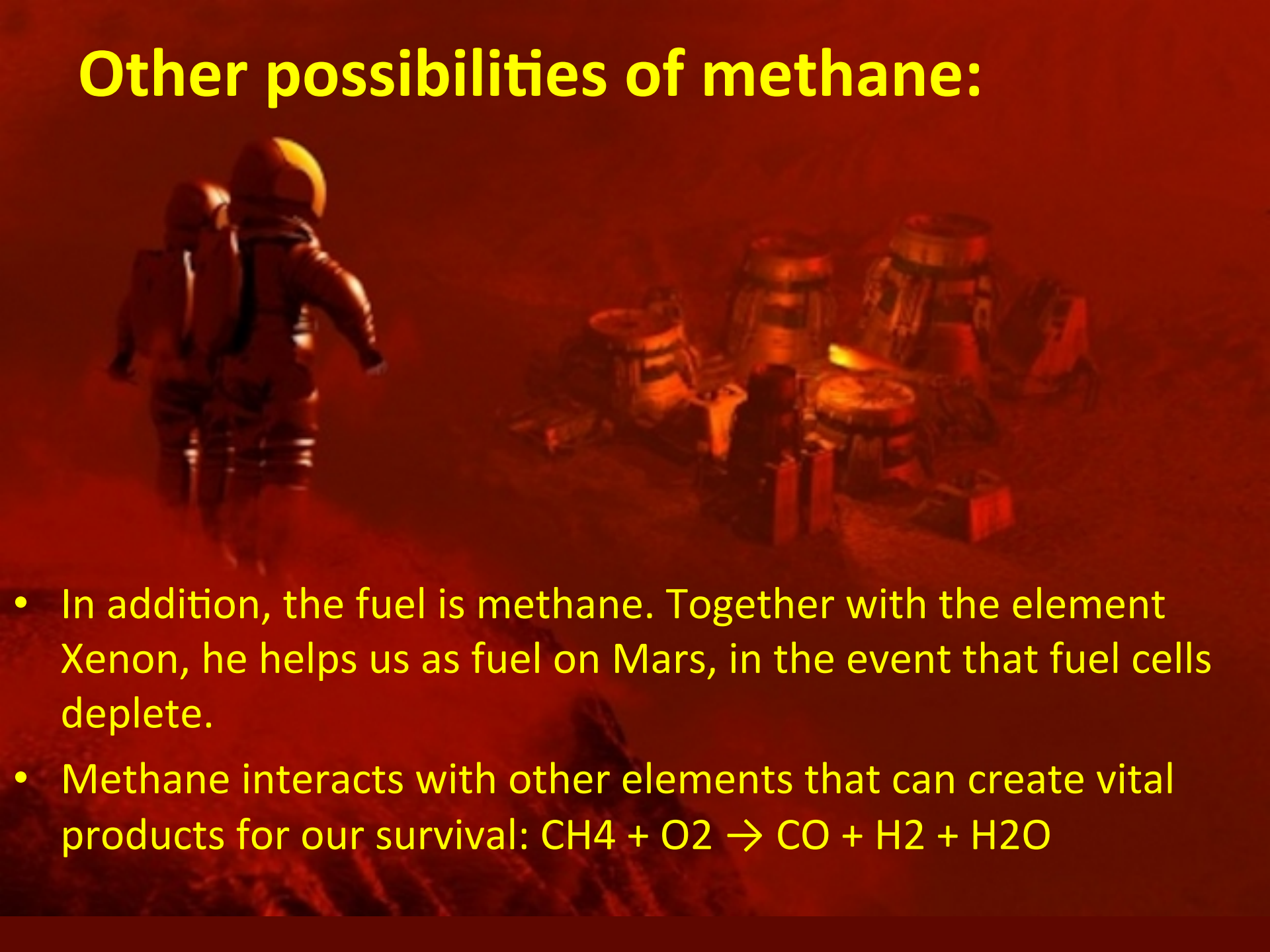
Objective: the detection of methane

Methane is a gas without odor and color with a melting temperature of-182 degrees and the boiling point: -165 degrees. A key role in the search for life on Mars.

Methane is released from living organisms such as bio-gas in the excretion of substances. This is noticeable in almost every living being on Earth and also is in the melting of the polar ice caps.

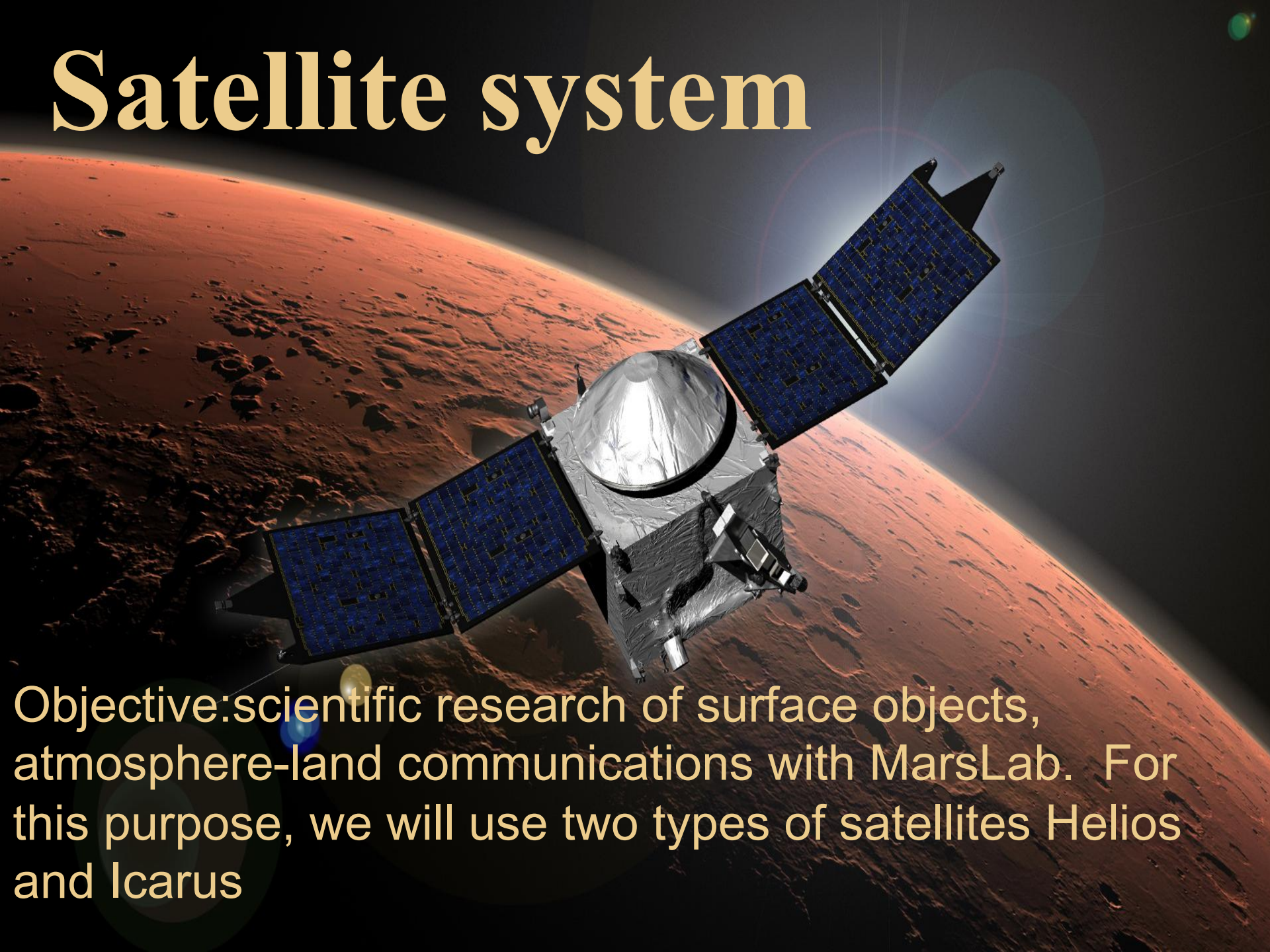


Other possibilities of methane:



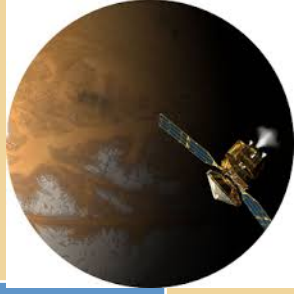
- In addition, the fuel is methane. Together with the element Xenon, he helps us as fuel on Mars, in the event that fuel cells deplete.
- Methane interacts with other elements that can create vital products for our survival: $CH_4 + O_2 \rightarrow CO + H_2 + H_2O$

Satellite system



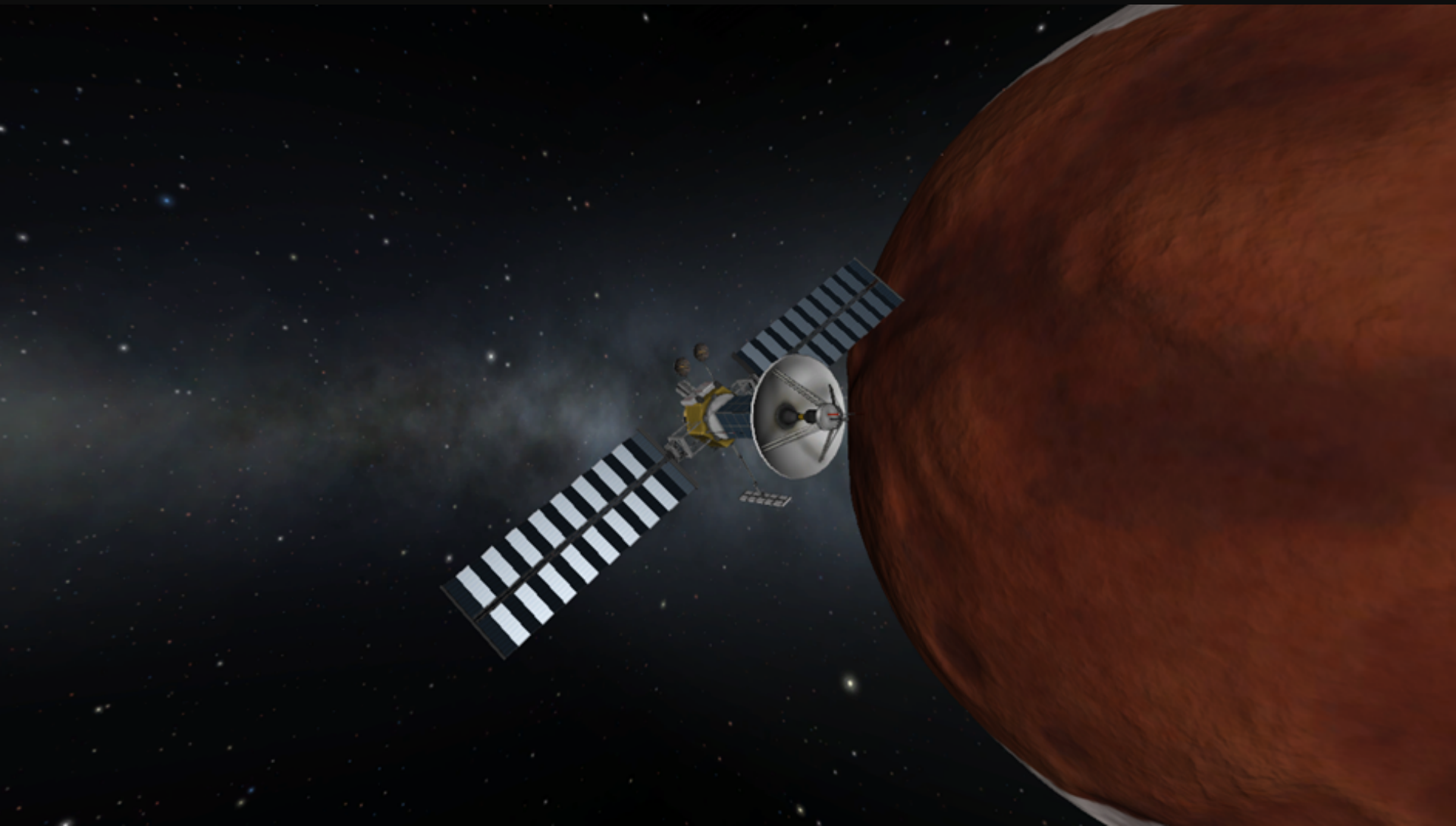
Objective:scientific research of surface objects, atmosphere-land communications with MarsLab. For this purpose, we will use two types of satellites Helios and Icarus

Characteristics of satellites

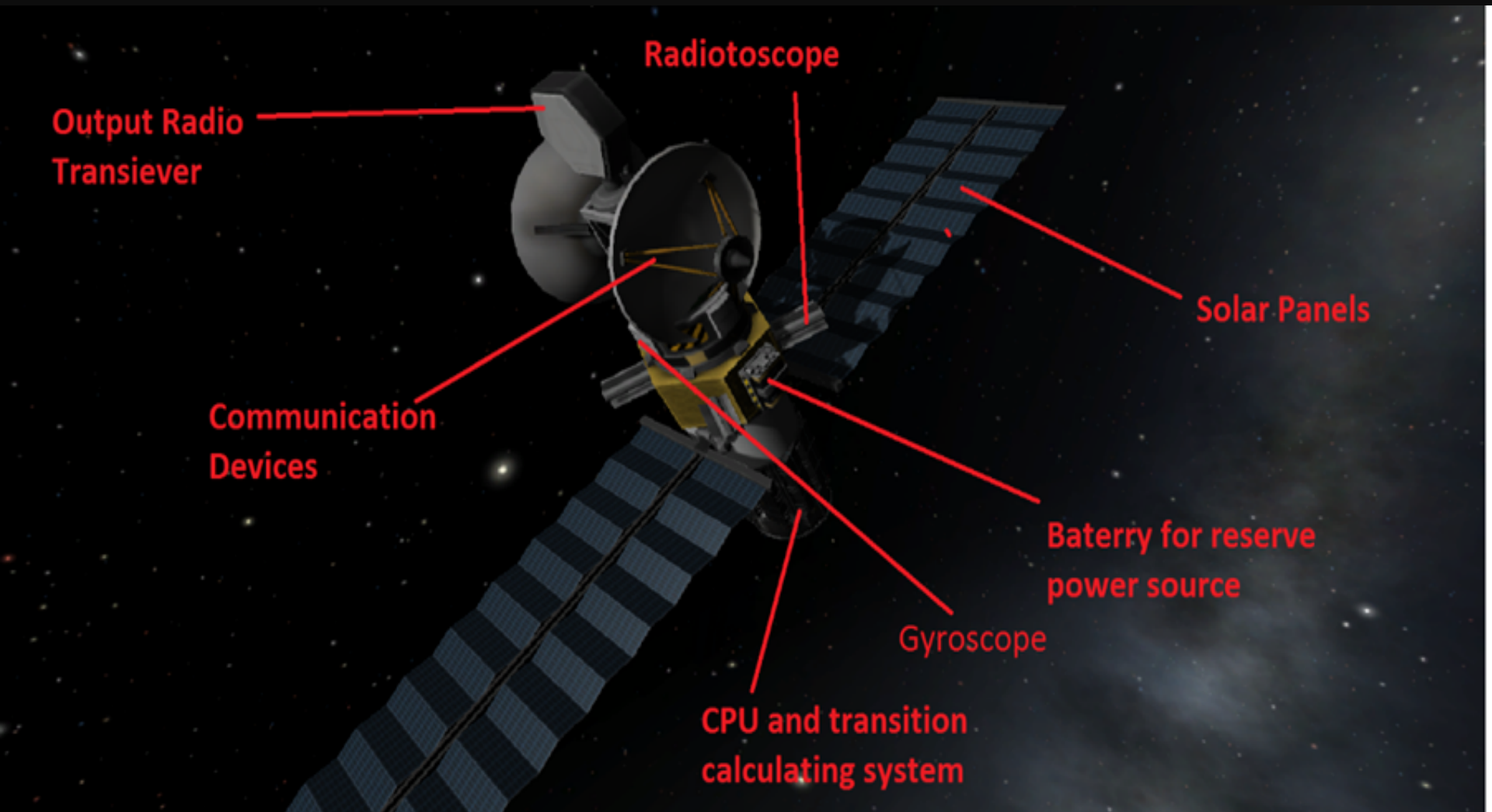


Name of the satellite	Icarus	Helios
Size	8x5 meters	8x7 meters
Number	3	2
Weight	759 кg	1203 кg
Instruments	Seismometer, accelerometer, barometer, atomic clock, communication devices, camera	Communication systems, ultra-violets cameras, sensors for measuring radiation
Activities	Observations on the people and the base meteorological purposes and photos	Shortening of the radio signals from Mars to Earth and back again
Location	Areo-centric orbit	Heliocentric orbit

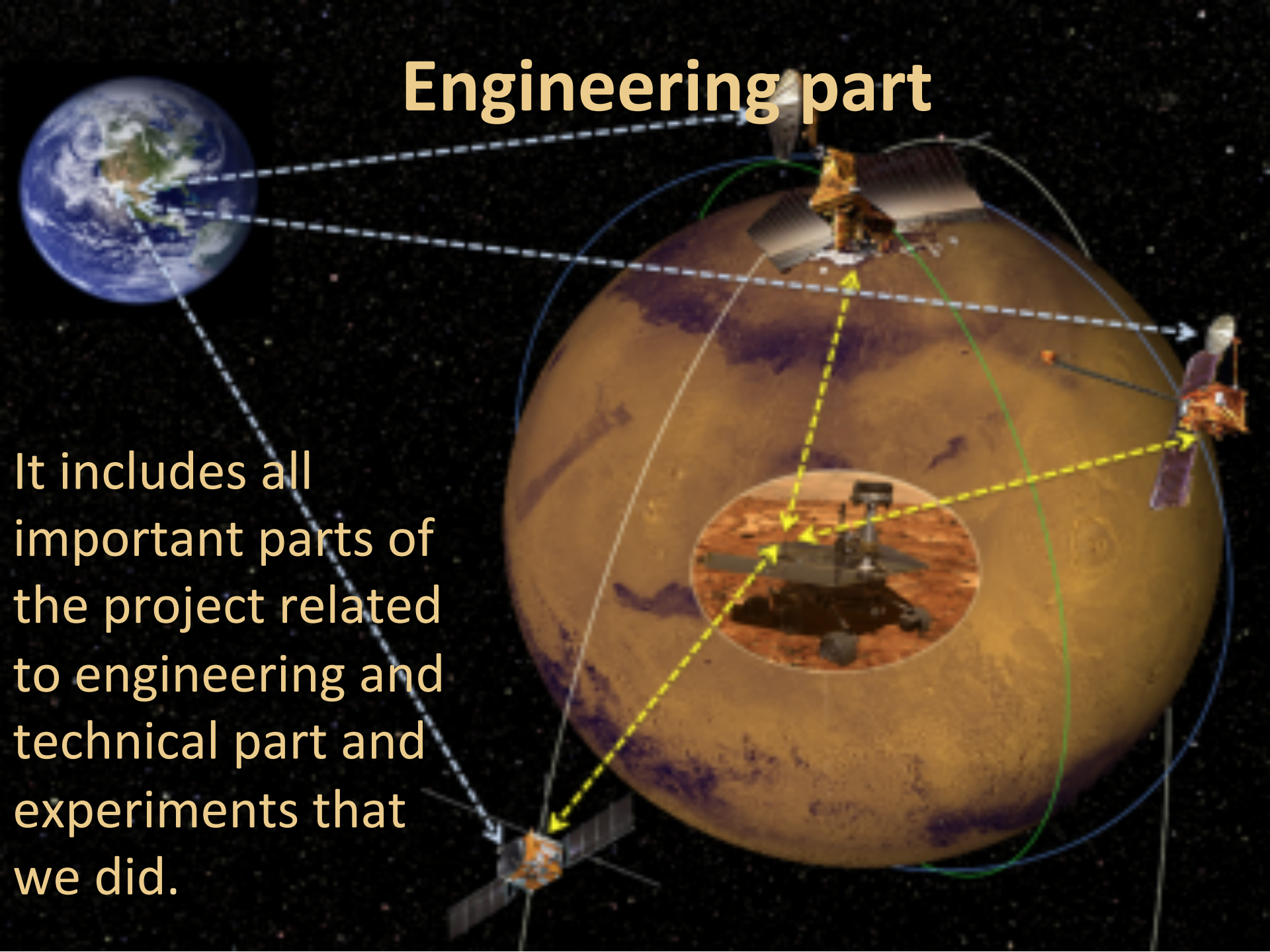
The satellite's computer model of Icarus author: Atanas Simov



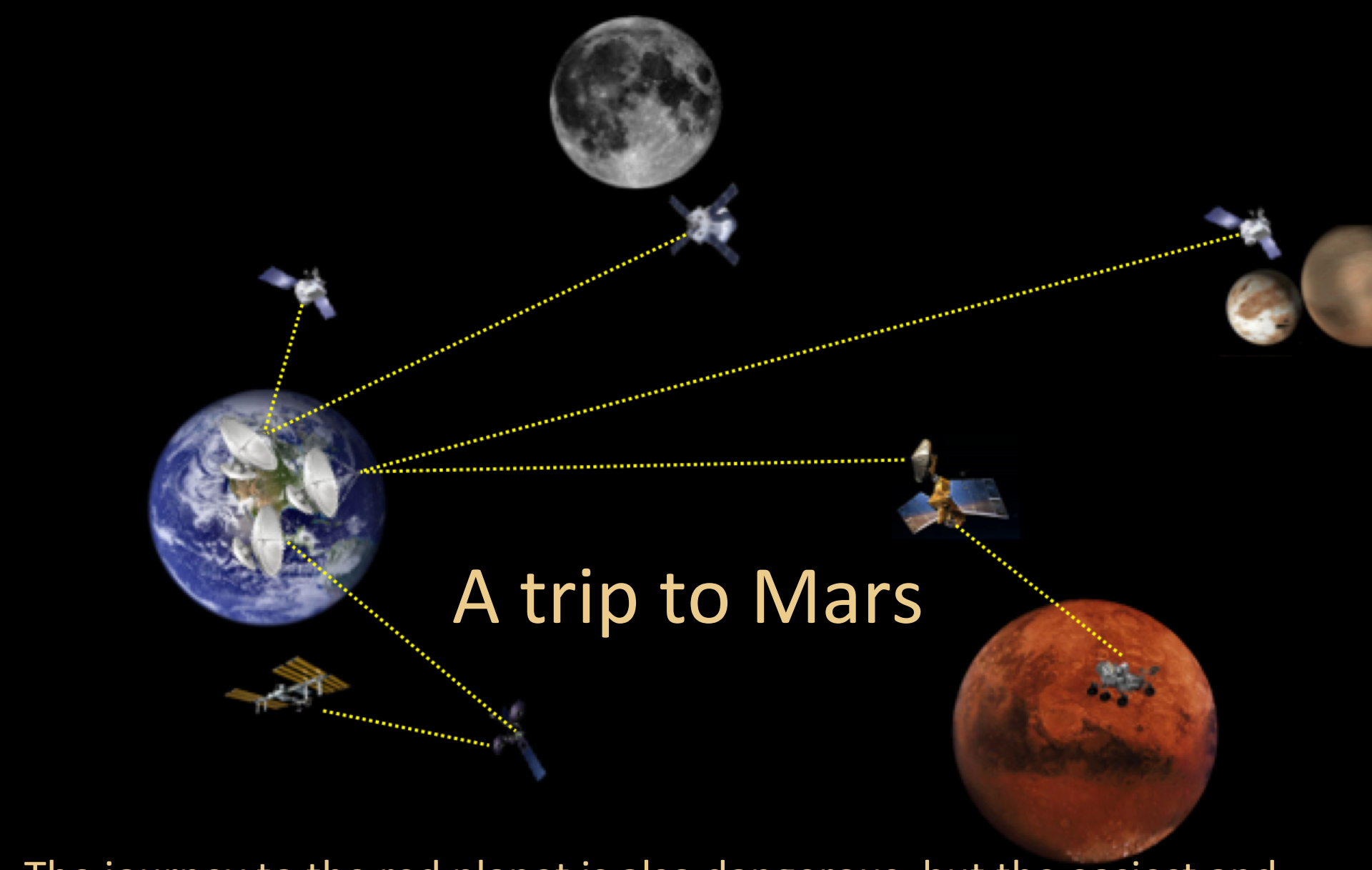
Computer model of the satellite Helios author: Atanas Simov



Engineering part



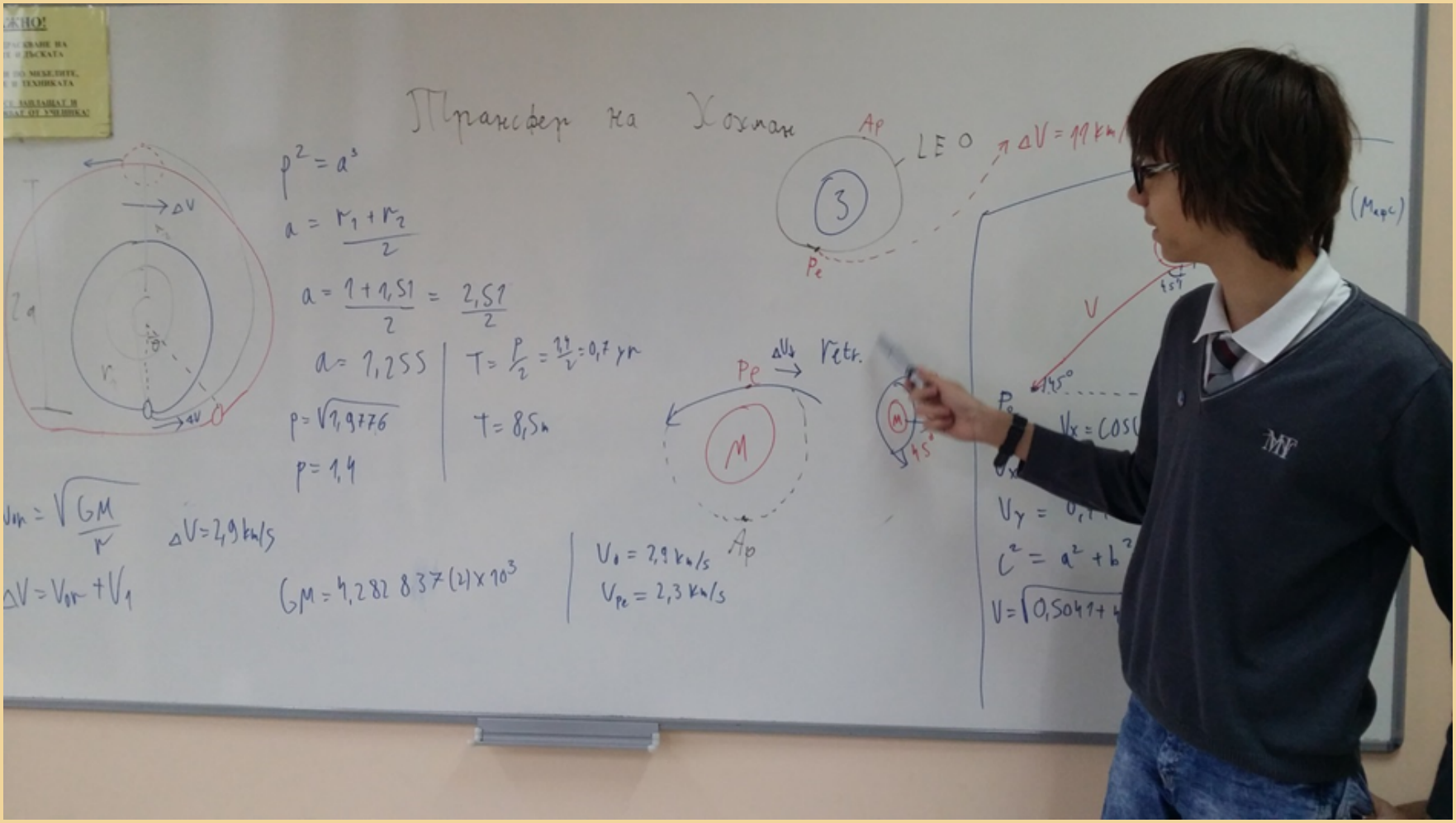
It includes all important parts of the project related to engineering and technical part and experiments that we did.



A trip to Mars

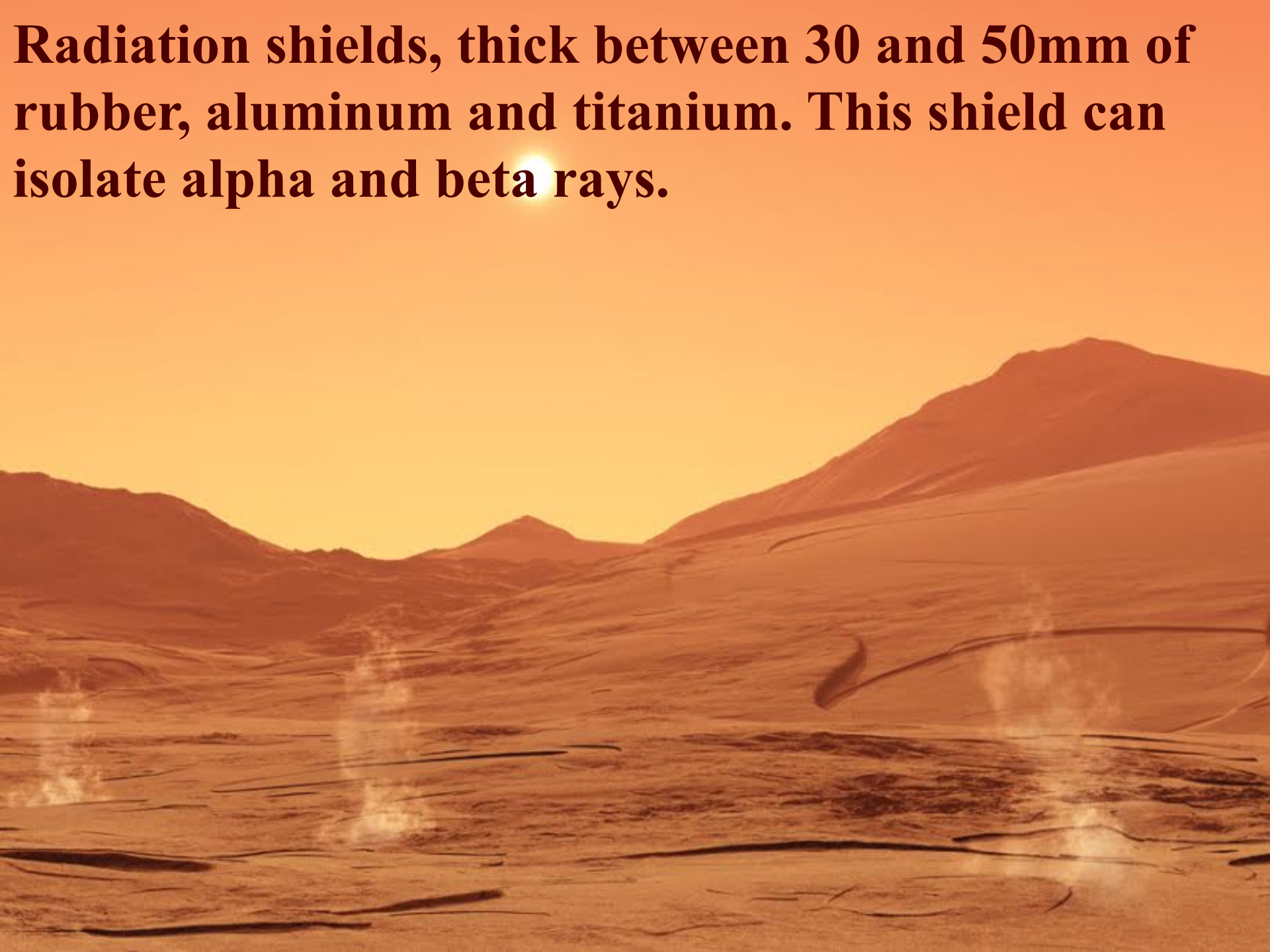
The journey to the red planet is also dangerous, but the easiest and quickest way is Hohmann transfer. To prove it we made calculations on it.

The trip to Mars will take about 8.5 months through the Hohmann transfer. That would the most-efficient way of getting to Mars. For it we need only 9 km/sec change in velocity

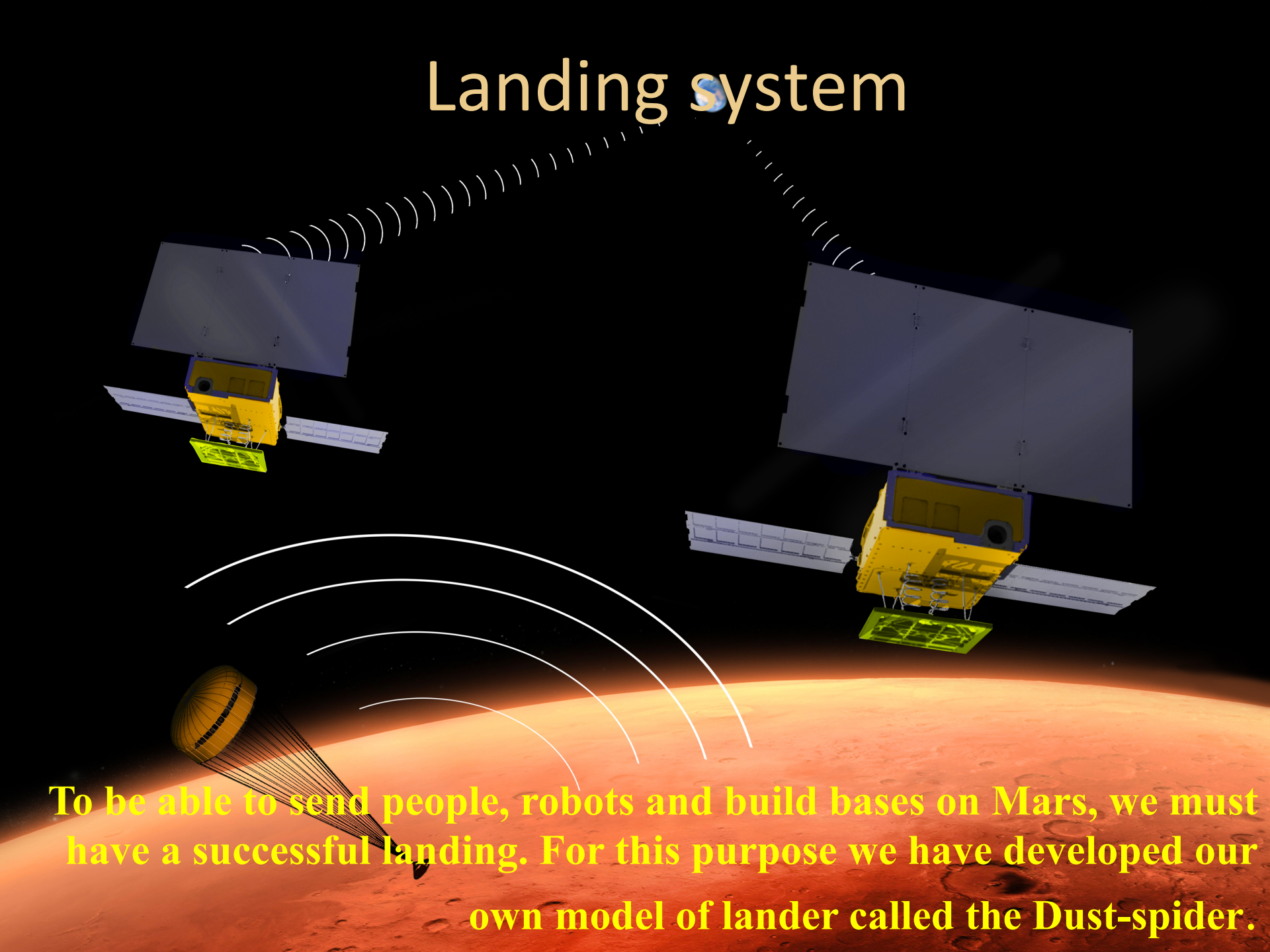


A proposal to solve the problem of Radiation

Radiation shields, thick between 30 and 50mm of rubber, aluminum and titanium. This shield can isolate alpha and beta rays.



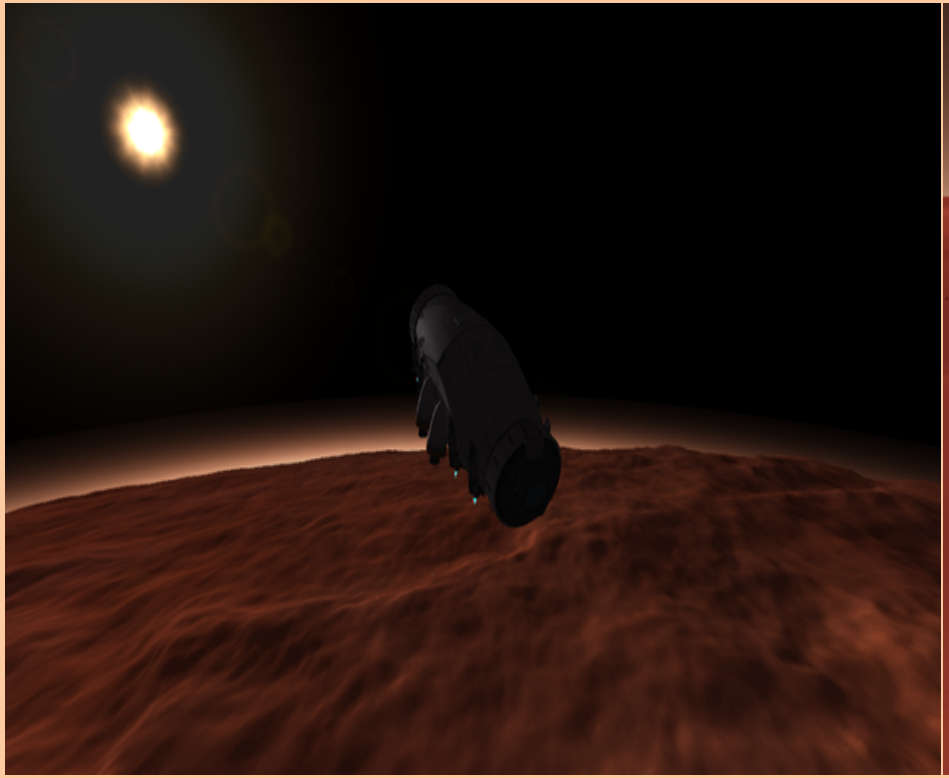
Landing system



To be able to send people, robots and build bases on Mars, we must have a successful landing. For this purpose we have developed our own model of lander called the Dust-spider.

It has a relatively big, as it has 8 legs and 4 renegade accelerator. His objective is to carry the parts of the base, which will build robots. As it, the robots and the base are made of lightweight parts, landing will facilitate even more. Possesses with parachutes for a smoother landing. Even if it falls faster than expected, it will survive due to its 8 legs.

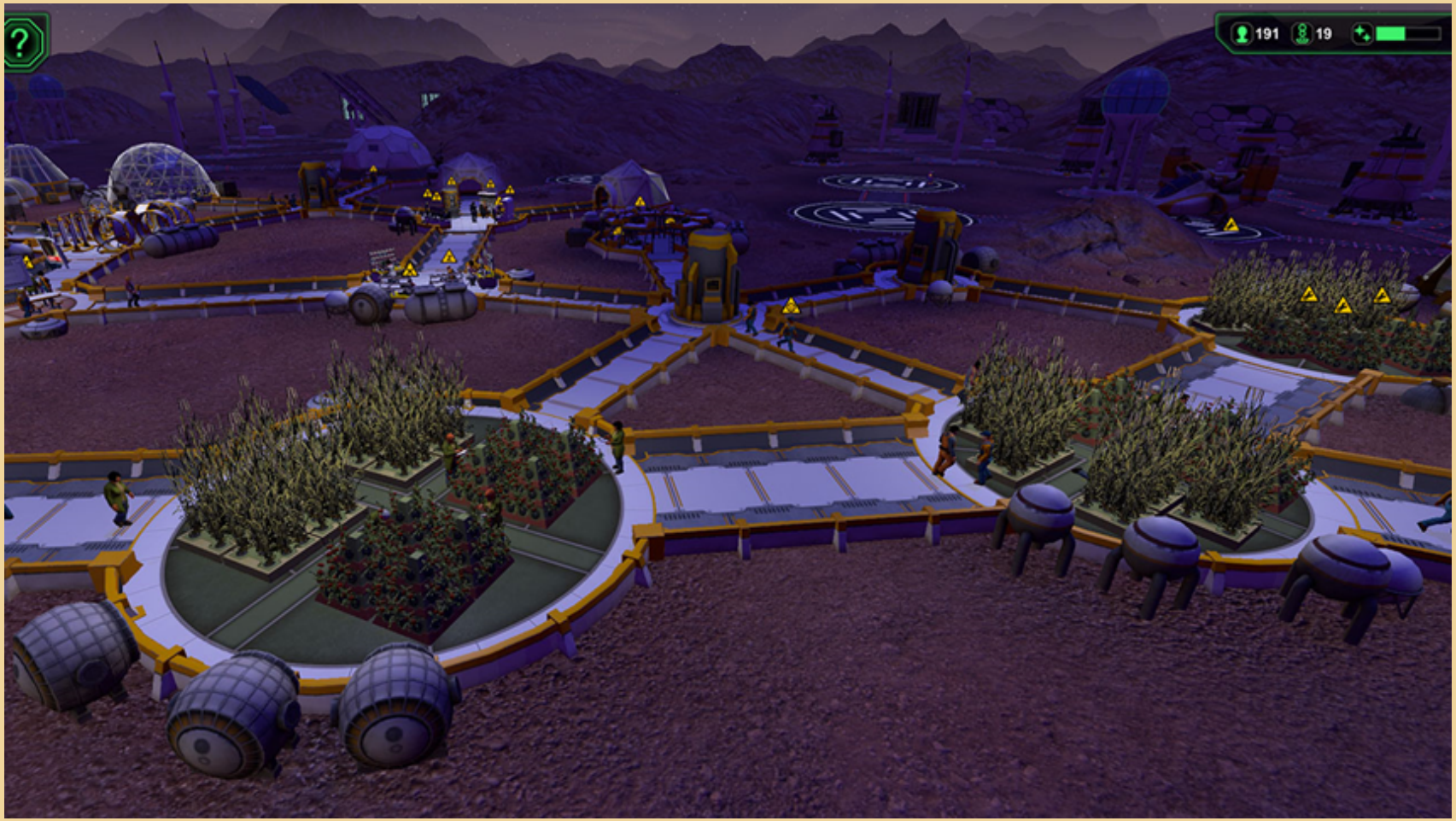
Images of the lander



Base: MartianLab

The base is the place where all of people on Mars will live, protected by the radiation, cultivating plants and will produce chemical elements

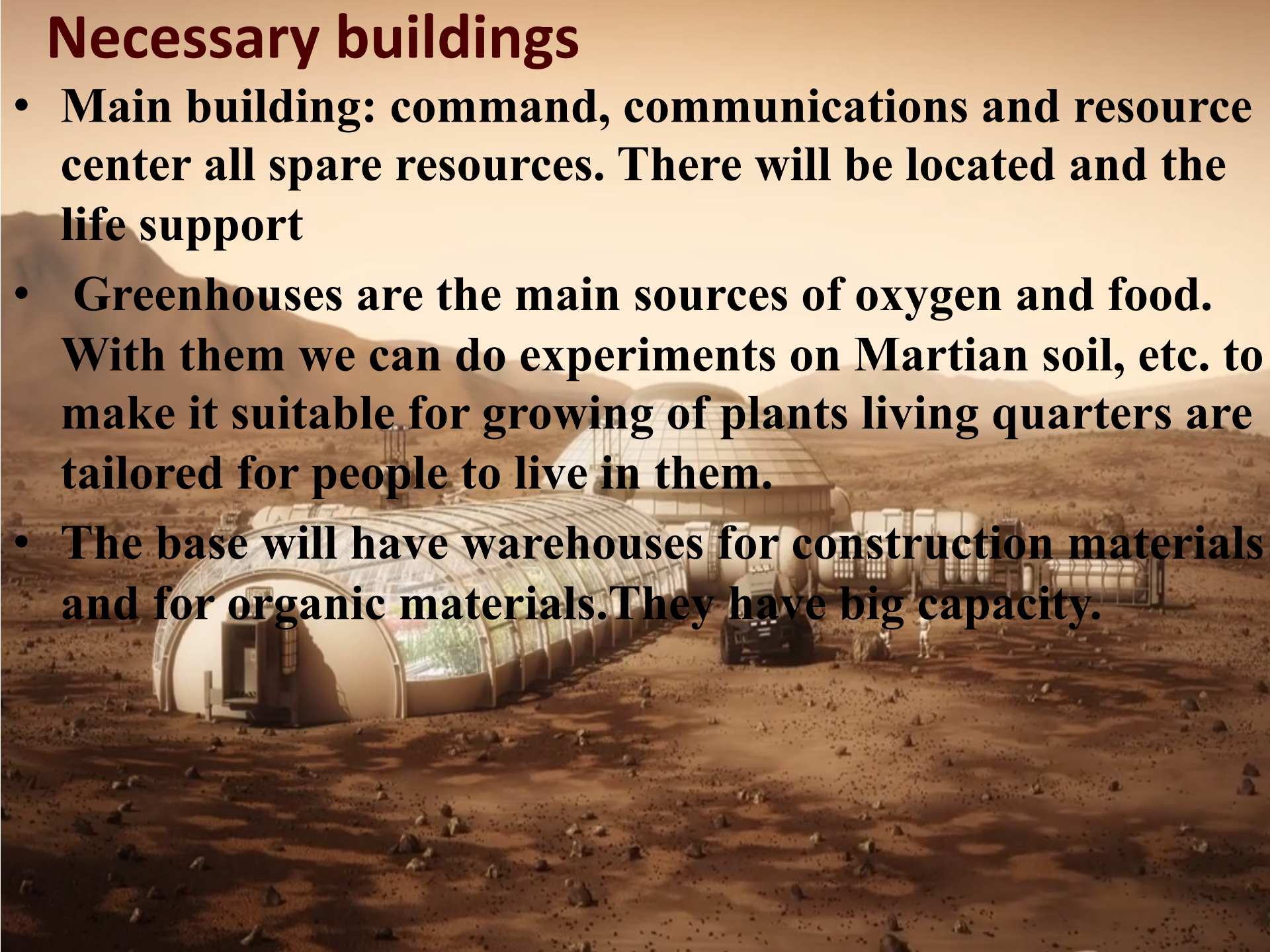
Our model of martian base



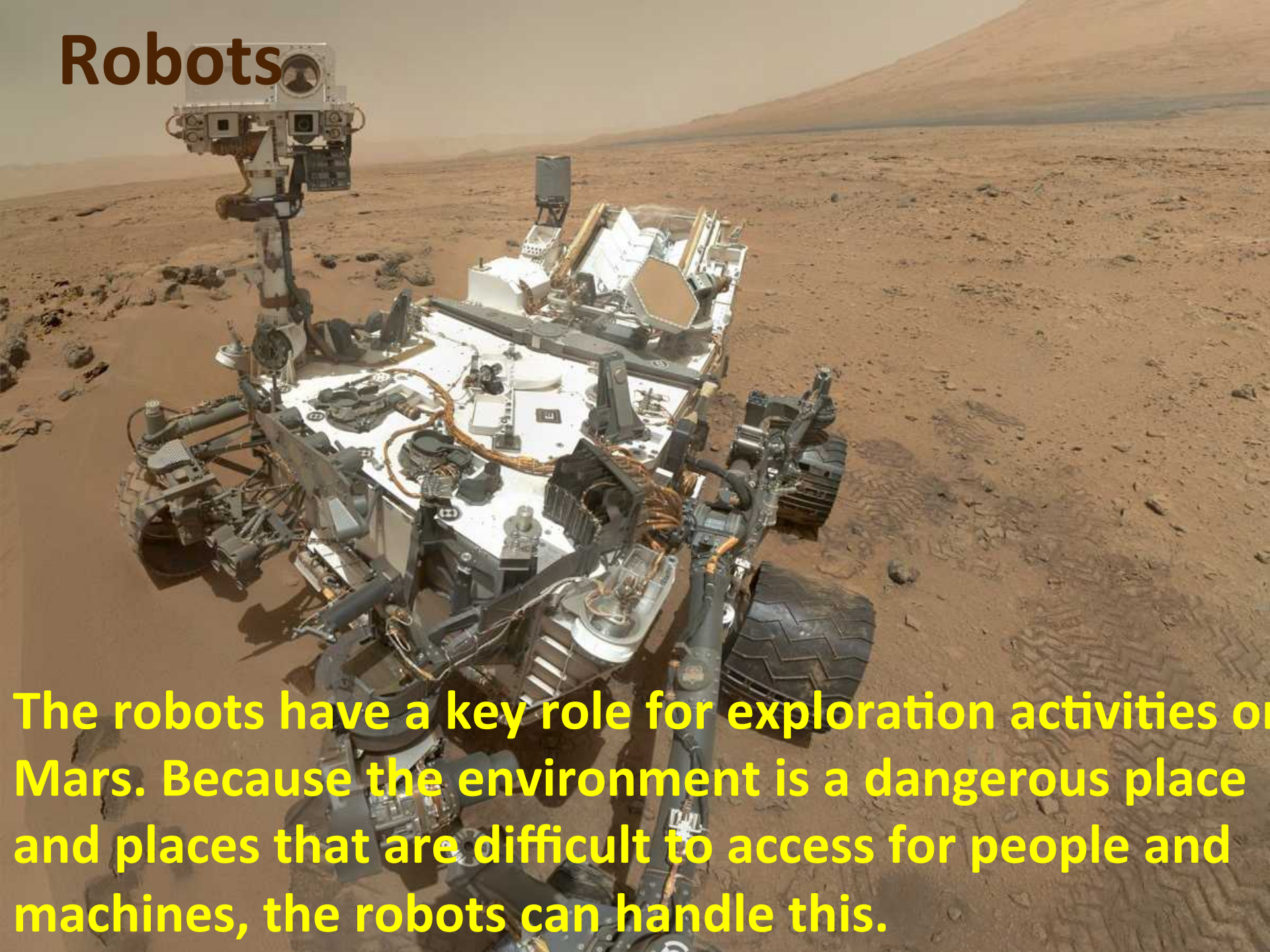
Used software: PlanetBase

Necessary buildings

- **Main building: command, communications and resource center all spare resources. There will be located and the life support**
- **Greenhouses are the main sources of oxygen and food. With them we can do experiments on Martian soil, etc. to make it suitable for growing of plants living quarters are tailored for people to live in them.**
- **The base will have warehouses for construction materials and for organic materials.They have big capacity.**



Robots



The robots have a key role for exploration activities on Mars. Because the environment is a dangerous place and places that are difficult to access for people and machines, the robots can handle this.

We built two types of MartianRovers-Vernor and Spector. The big one is Vernor – its function is mainly carrying heavy loads, support for construction of the base and exploration of the Martian surface.

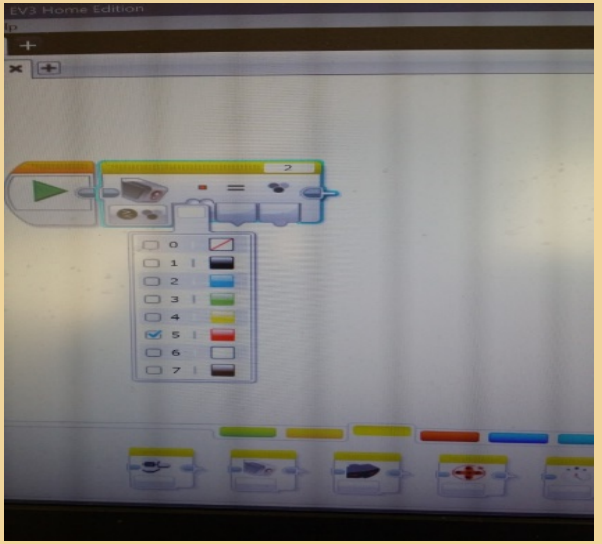
Spector

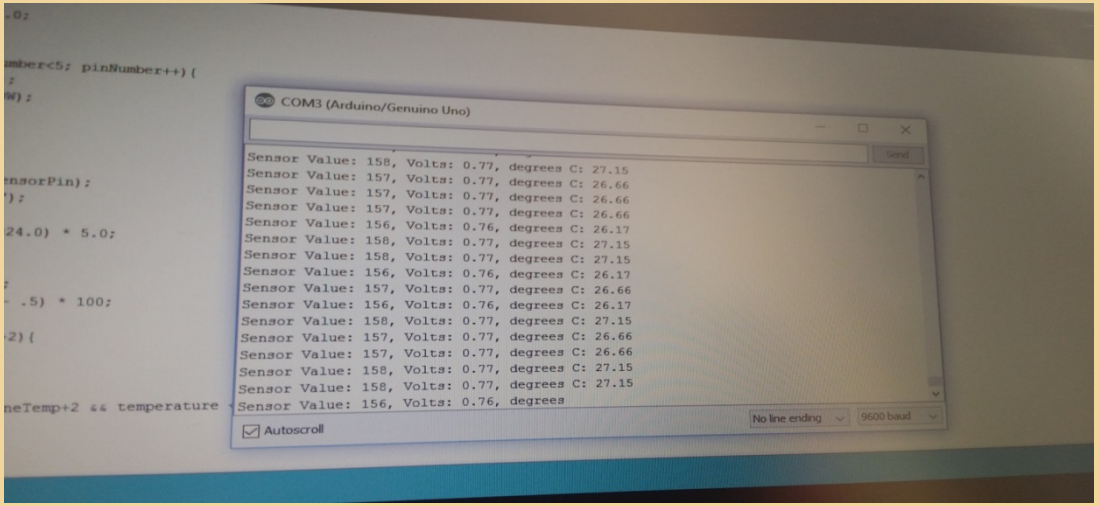
Spector is much smaller, and its task is to explore the canyons, underground caves and holes, where it is suspected that there may be water preserved from the past on the red planet.

Scientific instruments

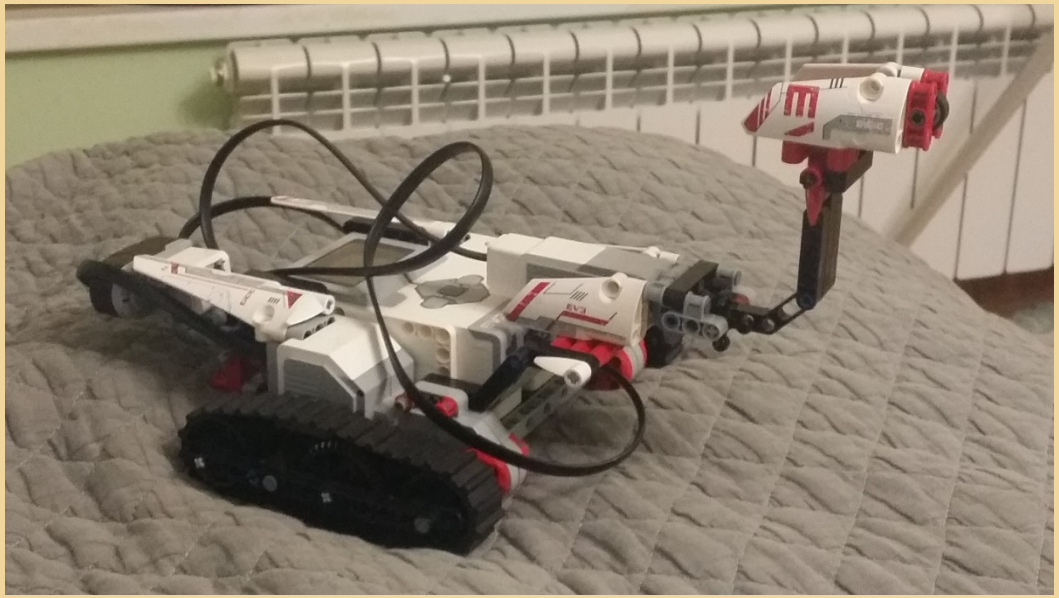
Both Rovers are equipped with scientific tools for research of the environment. Spector has 3 scientific gadgets-drill, hammer and mechanical arm.

Data from the color sensor of the Mars Rover Spector

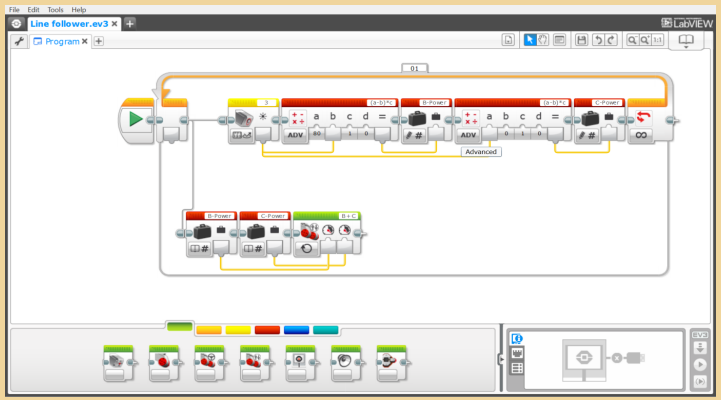


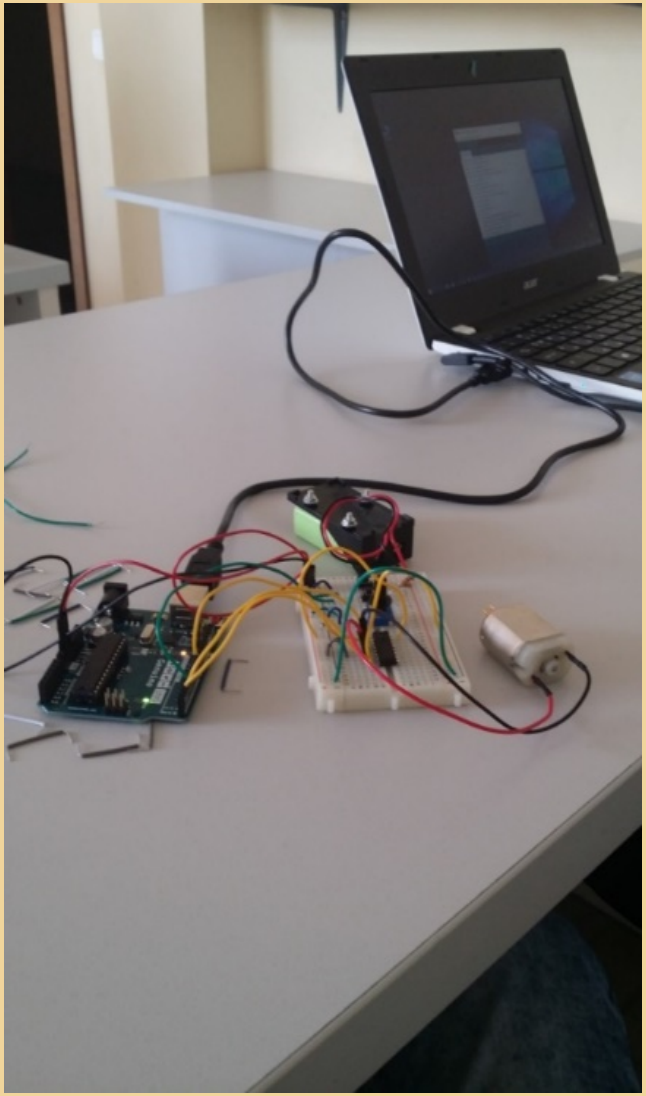


Results from the measurement of the ambient temperature.



The Program Lego Digital





The Arduino boards, by which alone the system of motors of LEGO – models of the Mars Rovers

Agroculture

The survival of Mars is of great importance for the future of the red planet. One of the biggest problems might be food. Meal as our initial supplies are limited, so we will have to learn to produce our food.

Since the Earth's soil is too heavy and expensive for interplanetary missions, you'll need to use the Martian. We did the experiments to prove that the growth of terrestrial plants in that kind of environment under the needed conditions is possible.


Despite the approximate composition of the mixture in the soil with this test experiment, we proved that plants can develop roots even in Silicon oxide. This means that on Mars, over the necessary conditions, the plants can grow.
© 2010 by Ben Huset

SiO_2	55,5%
Al_2O_3	16,6%
Fe_2O_3	7,5%
CaO	2,45%
Na_2O	0,11%
MgO	0,90%
P_2O_5	0,35%

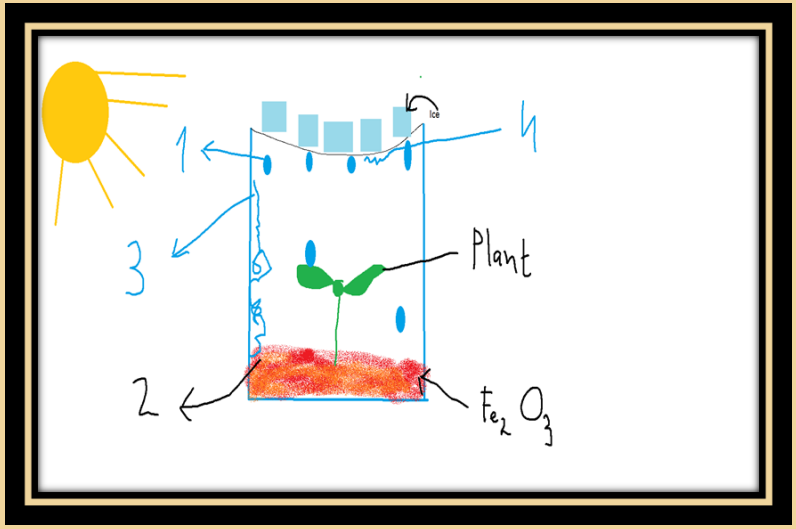
SiO_2	44%
Al_2O_3	7%
Fe_2O_3	16,5%
CaO	5,6%
MgO	7%
P_2O_5	0,9%
$Na_2O, K_2O, TiO_2,$	19%

Composition of Martian soil (left) and our test soil(right).

Plants grown by us in a martian soil

The AtmoMachine

Another way is to use the burning of hydrogen in oxygen environment. This reaction creates water, but require more resources and time.



Bacteria, developed on the basis of Fe3O4 in soil and the moisture in the air in the AtmoMachine.

Personal contribution to the team

1.Making of two exploration rover with authors engineering
2.Making the system for extraction the data from the sensors and the satellites;
3. Astrobotany experiments;
4.Making of the AtmoMachine;
5.Taking part in the Harvard project- ZOONIVERSE;
6.Making of a functional lego motor using Arduino;
7.Solving the Hohmann transfer equation;
8.3D models for the bases and inner structures;
9.Programming of the scientific sensors;
10.Solving chemistry equations for martian soil;
11.Making the design of the lander;
12.Working on the software Arduino;
13.Filming videos, using on-board cameras on the drones;
14.Creating a bacteria colony.

Videos

Current models of robots, can be seen in the films uploaded on the Internet:

https://www.youtube.com/watch?v=F1lnZOLzmao

https://www.youtube.com/watch?v=TJi-A5rdcQ8

https://www.youtube.com/watch?v=nq5ZBsfDOKY

Conclusion

This project provoked us to solve specific problems and to find the best possible solutions. We made models of the Mars rovers, have created software to manage sensors in a possible Martian rover apparatus. We grew as a Martian botanists plants in soil, somewhat similar to the Martian to find out which of them are appropriate for the red planet.

Work on the project to create the MarsLab for us was a challenge – to create the Rovers and do a lot of experiments learn more about the red planet and the possibility of terraforming and settlement.

We are confident that in the coming decades will see a real working MarsLab on the red planet, much like our first school of Martian laboratory.

The future starts now and this is one of our fir attempts to reach Mars – now with this projec in the future – in a true MarsLab.

THANK YOU FOR YOUR ATTENTION!