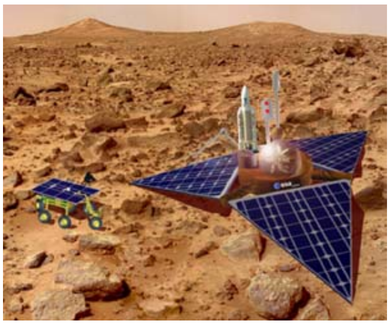
PREMars : Plant & Rocket Experiment on Mars

Introduction



The technologies necessary to support a human Mars mission need to produce life-sustaining resources (food,water, and fuel) using the Mars local environment. PREMars demonstrates these technologies by launching a rocket using fuel generated by ISPP techniques and by growing a plant in a greenhouse using only local soil, atmosphere and water. The mission is designed using technologies that have been in use for over 100 years and is also designed for student involvement

Mission scenario

SOL 1-5 : LANDING

Landing site : 40˚ - deployment and search for water

SOL 5-15 + 15- 25 : WATER ACQUISITION

I. Material acquisition : atmospheric CO_2 and water form lander or rover

II. Water extraction in the chemical factory

SOL 25-50 : GREENHOUSE & FUEL PRODUCTION

I. a Greenhouse : soil analysis, atmosphere, T˚and pressure adjustment

I.b Greenhouse : plant growing

II. Chemical factory : Fuel production

SOL 75 : END OF MISSION

Greenhouse sterilization and rocket launch.

Mars water model

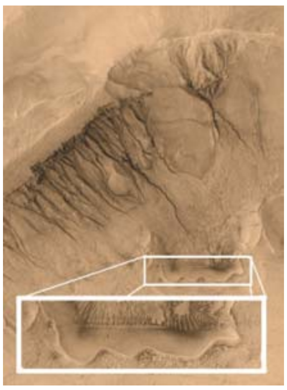


Fig.2. Gullies in a crater wall, Malin 2002

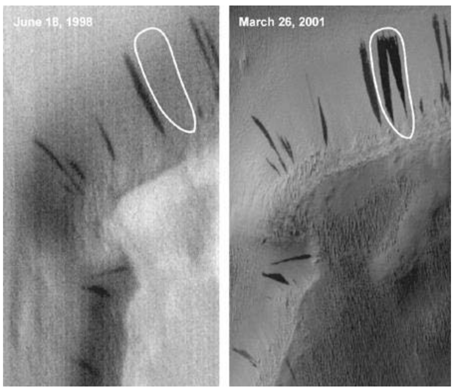


Fig.3. Recent surface flows, left June 18, 1998 and right March 26, 2001

Martian water distribution still uncertain. Therefore, this mission has been designed in a modular way that can work with any model.

Mars Express will give use more information soon.

PREMars flight concept

Landing mass	< 200 kg
Power provision	: 11 m2 solar cells producing 4560 Wh/day
Drilling system	: 10 core extraction of 0.25 kg
Chemical factory	: 10 kg 4000Wh/day for 1kg fuel production
Greenhouse	: 45 days plant growing 1 kg Martian soil + 0.5 L of water
Rocket	: 2kg (empty) + 1kg fuel (ethylene C_2H_4) flight height 40 km after 110 s

Martian ground containing frozen water is acquired by the drilling system mounted on the lander or a rover. This water will be used by the plant and for fuel production. Should the water collection fail, the mission continues with backup water from earth.

After soil analysis, water purification and atmosphere creation, the plant growth can be initiated. Nine seeds of *Arabidopsis Thaliana* will be used for the mission including six backup seeds.

Chemical factory

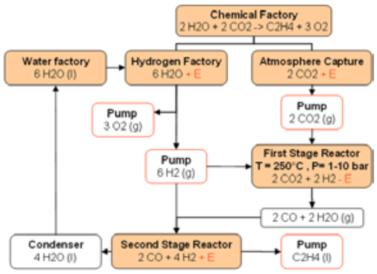


Fig 4 Schematic diagram of the Chemical factory

Water is acquired from Martian ground.

CO_2 is captured from atmosphere.

Factory produces C_2H_4 + O_2 for the rocket and O_2 for the plant.

Conclusion

A plant growth and fuel production (ISPP) demonstration is necessary before sending humans to Mars. This can be achived in low weight/low cost mission like PREMars.

This experiment would not only pave the way for future sample return and human missions, but also provide a massive opportunity for public interest and outreach.

The significance of sending a life form on another planet will impact the human species as few events in the past have done.

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