Colonizing Mars

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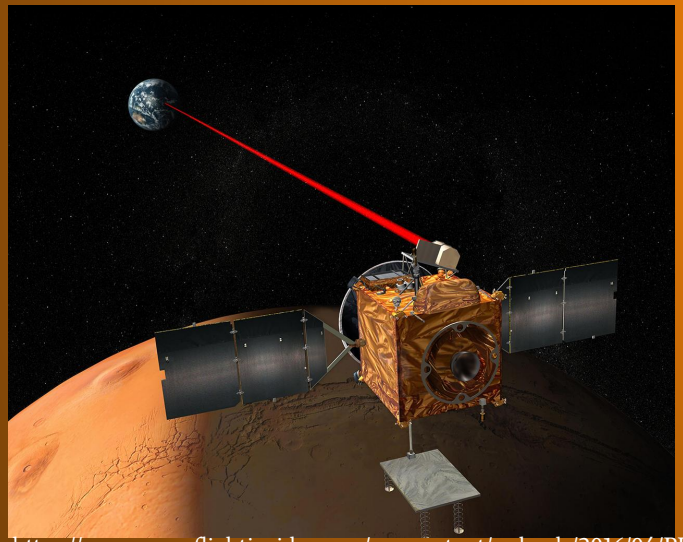
The realities of living on another planet

Logistics

- Distance between Earth and Mars ranges from 54.6 to 401 million kilometers (Space, 2012).
- Time for signals to reach Mars from Earth is between about 3 and 22.5 minutes.



https://www.spaceflightinsider.com/wp-content/uploads/2016/04/PIA07499-1-1.jpg

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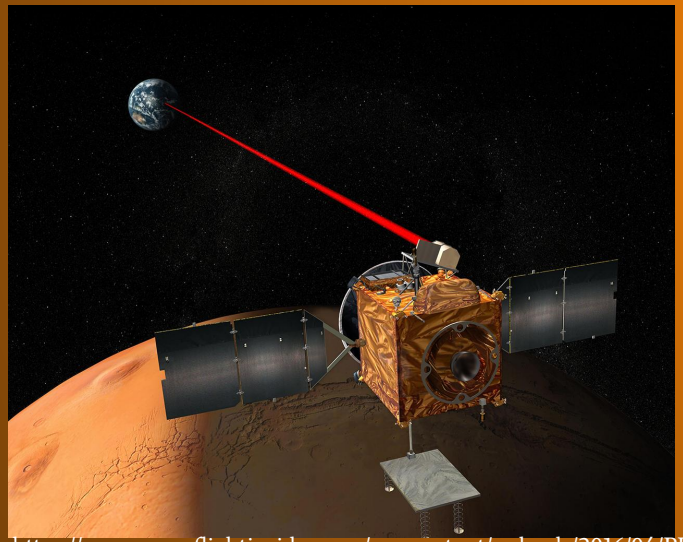

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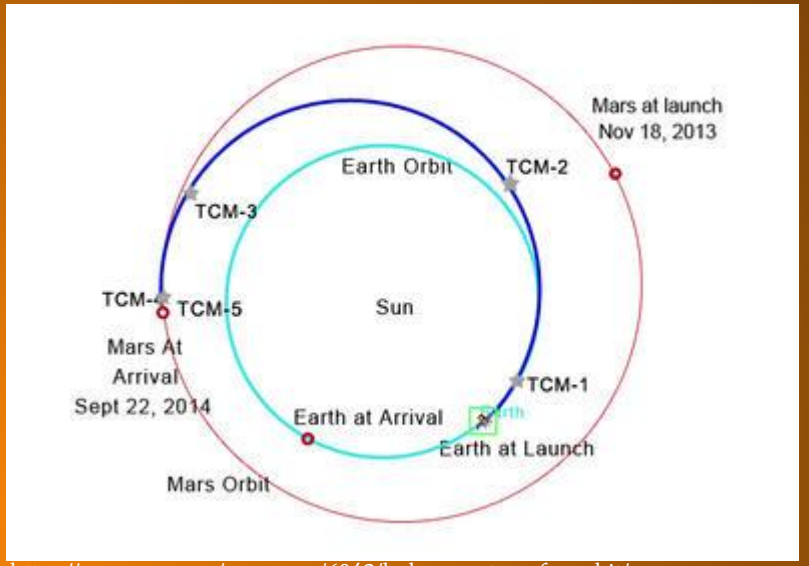
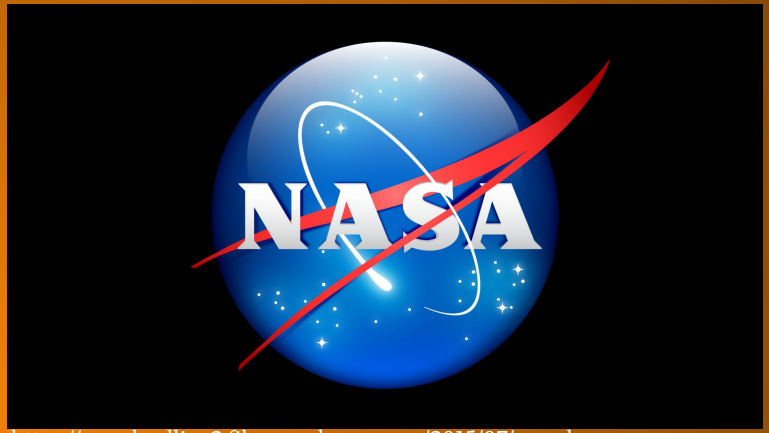


https://mars.nasa.gov/resources/6042/hohmann-transfer-orbit/

Hohmann Transfer Orbit (NASA, 2014)

- Elliptical path which optimizes the fuel efficiency when traveling between orbits.
- Used by current space agencies to reach Mars.
- Took Insight 205 days to reach Mars via this method (National Geographic, 2018).

Logistics



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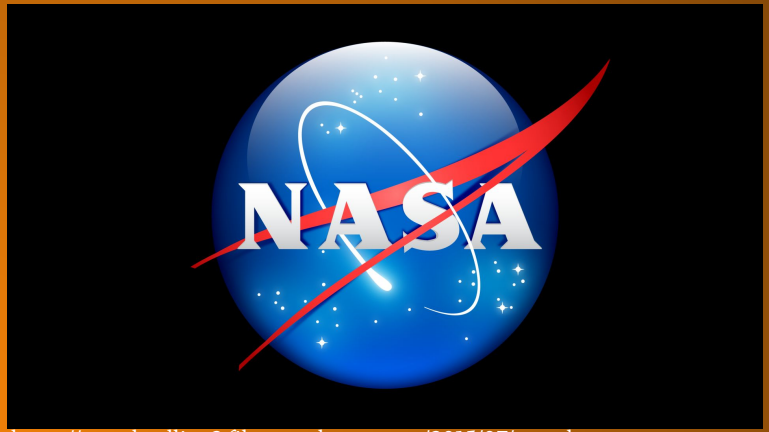
Logistics



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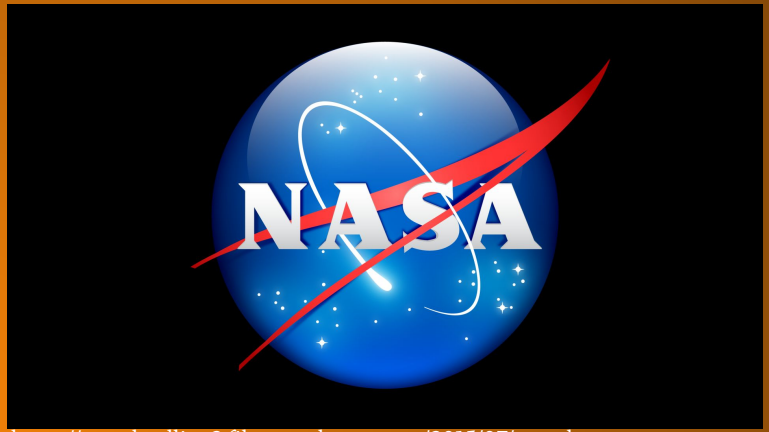
https://media.graytvinc.com/images/810*455/SpaceX+Graphic.jpg

Logistics

https://katapultengineering.com/wp-content/uploads/2015/10/mars-one-settlement-sticker.png



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- Dutch and Swiss Mars One lay out budget of 4 billion for one way Mars colony ship (MarsOne, n.d.).

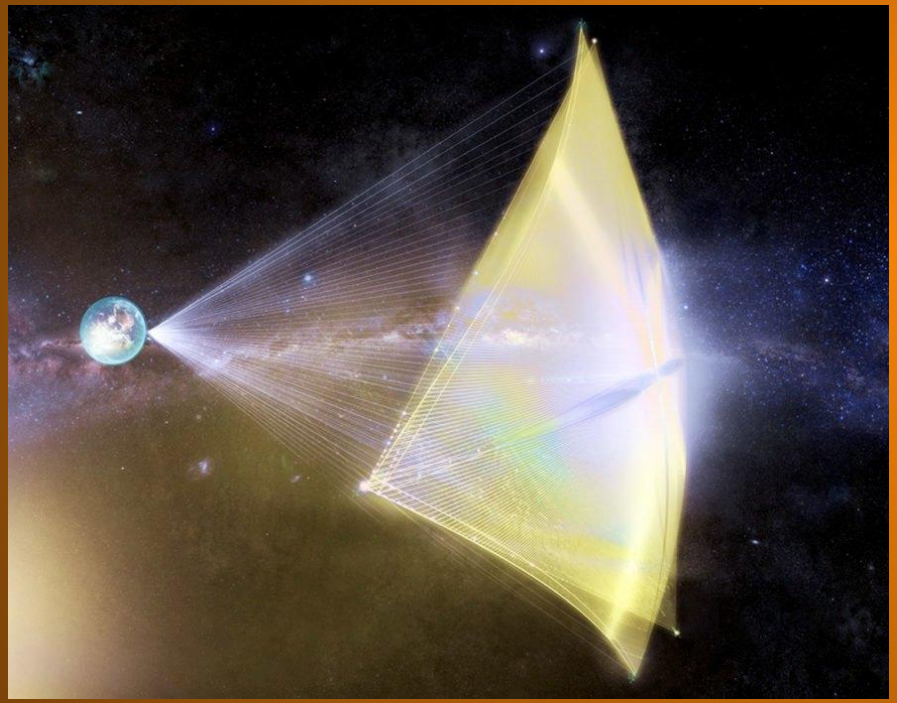
https://media.graytvinc.com/images/810*455/SpaceX+Graphic.jpg

Logistics

https://pixel.nymag.com/imgs/daily/vulture/2013/01/14/14_odyssey.jpg

The USS Lightsail..... maybe not.

Logistics



http://coma.kasi.re.kr/TAG/~thiemhoang/images/starshot.jpg

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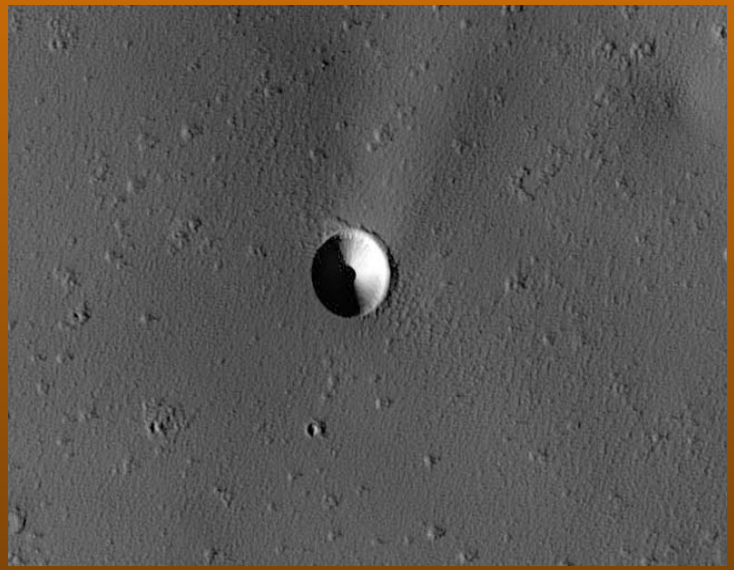
Settlement Locations?



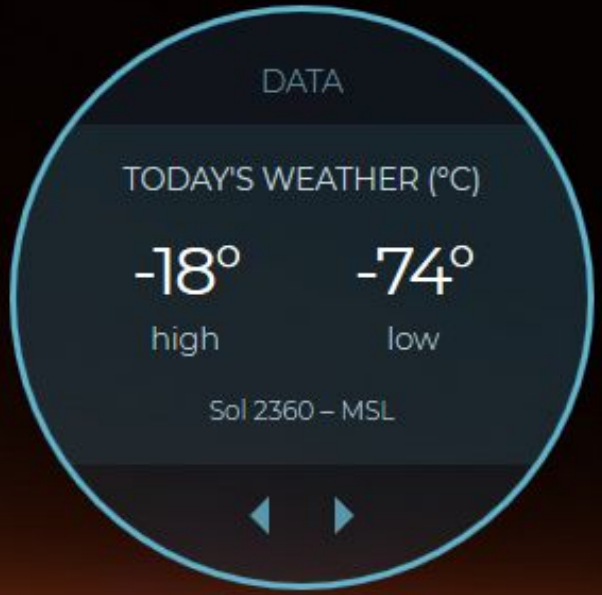
Equatorial Regions

Hellas Planitia

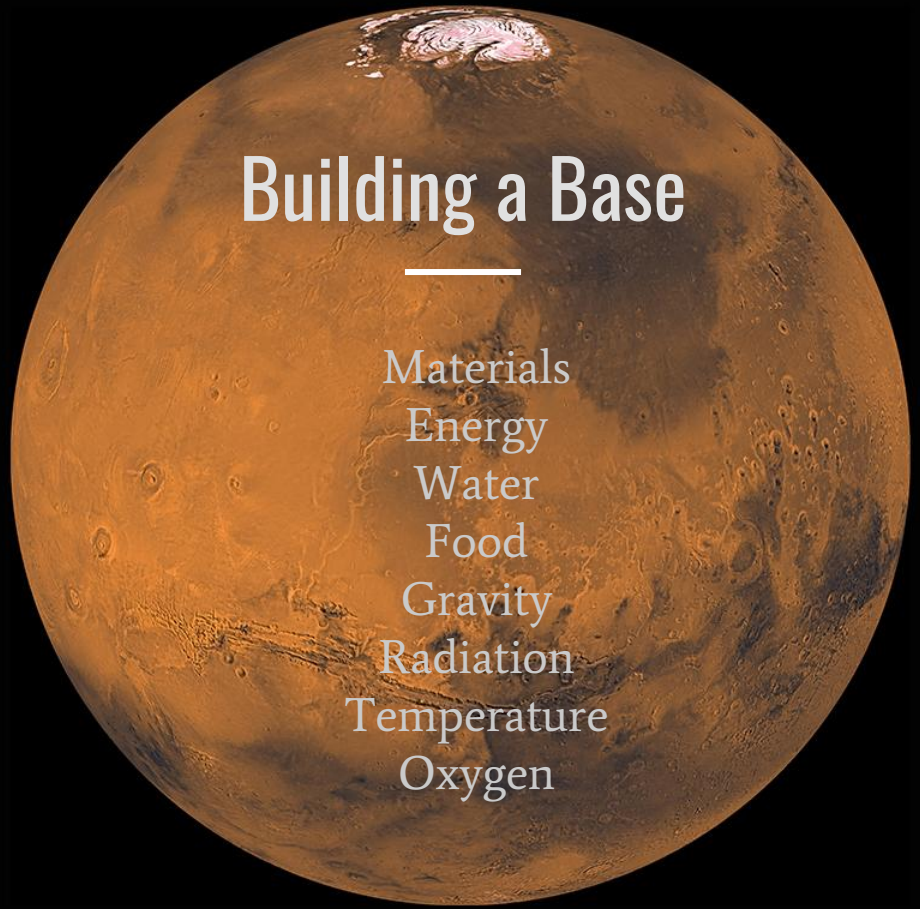
The Red Planet

Environment

- Gravity ~ 3.7 m/s^2
- Temperature ranges between -143 and 35 degrees celsius
- Atmospheric pressure ~ 0.6% of Earth's
- Year is 687 (Earth) days
- Martian day is 24.6 hours (NASA, n.d.)



https://mars.nasa.gov/#mars_exploration_program/6



Building a Base

Materials
Energy
Water
Food
Gravity
Radiation
Temperature
Oxygen

(NASA, 2016)

Building a Base: Notes

Very general considerations:

Materials: Some institutions (Swiss University: Ecole Polytechnique Federale de Lausanne) suggest would need 110 metric tonnes (~243,000 lbs) of material in order to build a sustainable base (Astronomy, 2019). NASA proposed it might be better to use the materials on the planet instead of importing new ones. Could fly in machinery in order to 3-D print things and make a paste out of surface sand to use as building material (NASA, 2019).

Energy: Solar panels (as seen on model) could be used to power the colony while the Sun is available. Subterranean would use reactors (Astronomy, 2019; NASA 2019).

Water: Would need to come up with a sustainable way to harvest the ice (make sure we don't run out) and filter it (make sure it's safe for human consumption). Could also recycle human wastes like on the ISS (NASA, 2019).

Building a Base: Notes

Food: Greenhouses (on model) in order to grow food. Want to make sure crops are properly rotated (similar to Earth) and diverse in order to avoid massive die off in case of infection from an unexpected pathogen (NASA, 2019). Maybe lab grown meat could be an option for protein instead of animal husbandry once this colony is set up (first has to be accepted by people on Earth + proven to be nutritious and such => still very early stage at this moment) (Stephens *et al.*, 2018).

Gravity: In order to avoid physical degradation (NASA, 2019).

Radiation: Need to create some kind of shield for the colony as a whole (NASA, 2019).

Temperature: Can get super cold. Need competent heating system (NASA, 2019).

Oxygen: A big consideration - definitely need that as humans. Mars' atmosphere has about 0.1% oxygen while Earth has ~21%. Definitely need to oxygenate the air inside the colony (similar to ISS). Ultimately hope to terraform Mars with plants in order to create a more oxygen rich atmosphere (NASA, 2019).

Effects on Human Health

Physical Effects

- difference in gravity would weaken bones and muscles.
- risk of osteoporosis and cardiovascular problems.
- severe radiation risks that can influence cognitive processes, deteriorate cardiovascular health, inhibit reproduction, and cause cancer.

Psychological/Social Effects

- Social isolation
- Confinement
- Loss of privacy
- Messed up sleep cycles
- Lack of Mental Health Services

What can be done to mitigate these factors?

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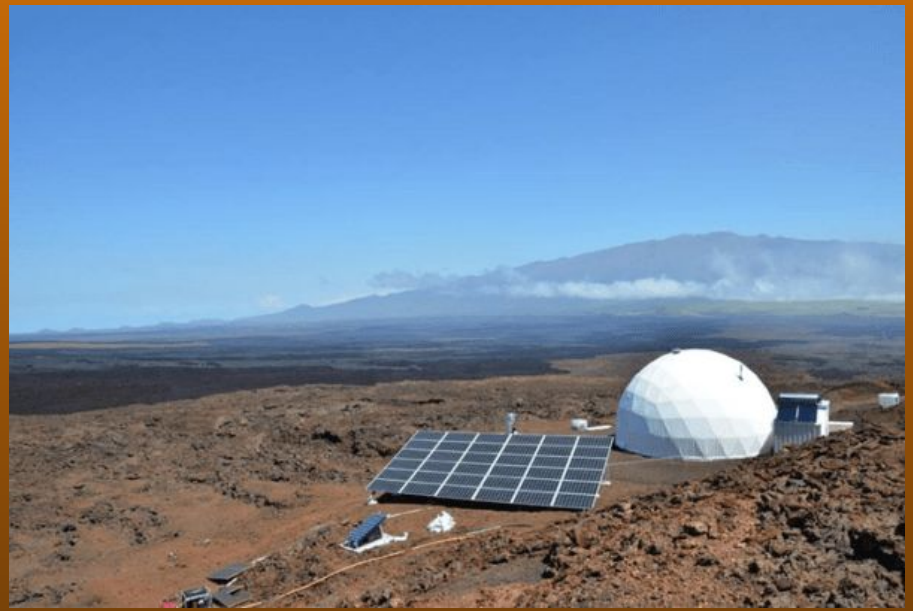
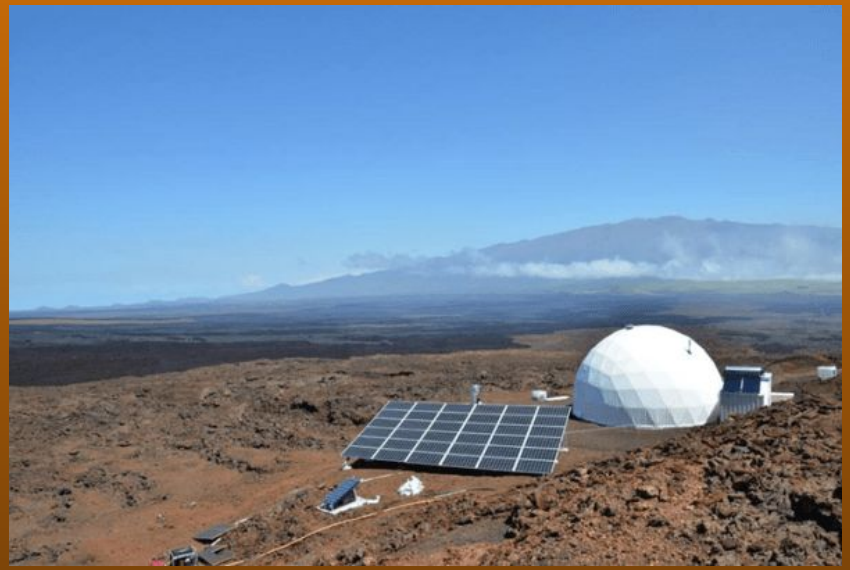


Hawaii Space Exploration Analog and Simulation

What can be done to mitigate these factors?



Hawaii Space Exploration Analog and Simulation(https://hi-seas.org/

Caving!! (https://en.wikipedia.org/wiki/ESA_CAVES)

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