



# Journey to Mars via Global Space Collaboration

Dr. Dava Newman, NASA Deputy Administrator

#JOURNEYTOMARS @DavaExplorer

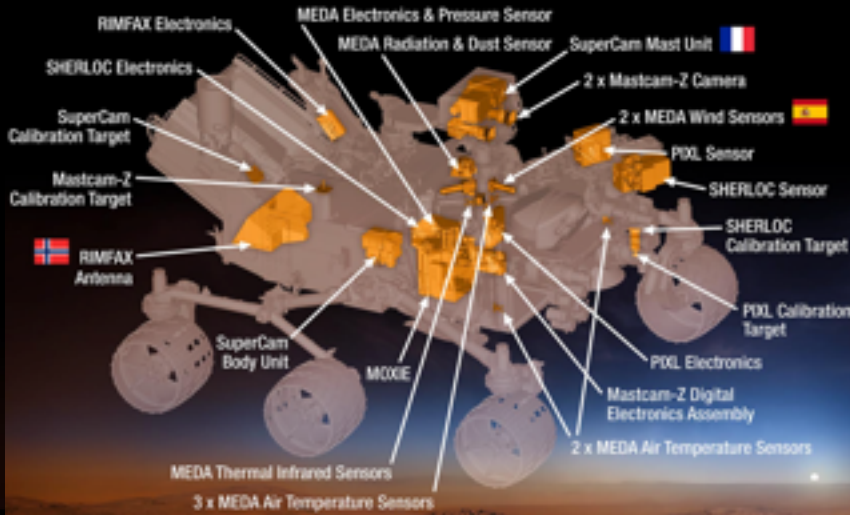
# INTERNATIONAL COOPERATION

## A Cornerstone of NASA's Activities

National Aeronautics and  
Space Administration



### Mars 2020 Rover



[mars.nasa.gov](http://mars.nasa.gov)



**The Global Exploration Roadmap**  
August 2013

ISECG  
International Space Exploration  
Coordination Group

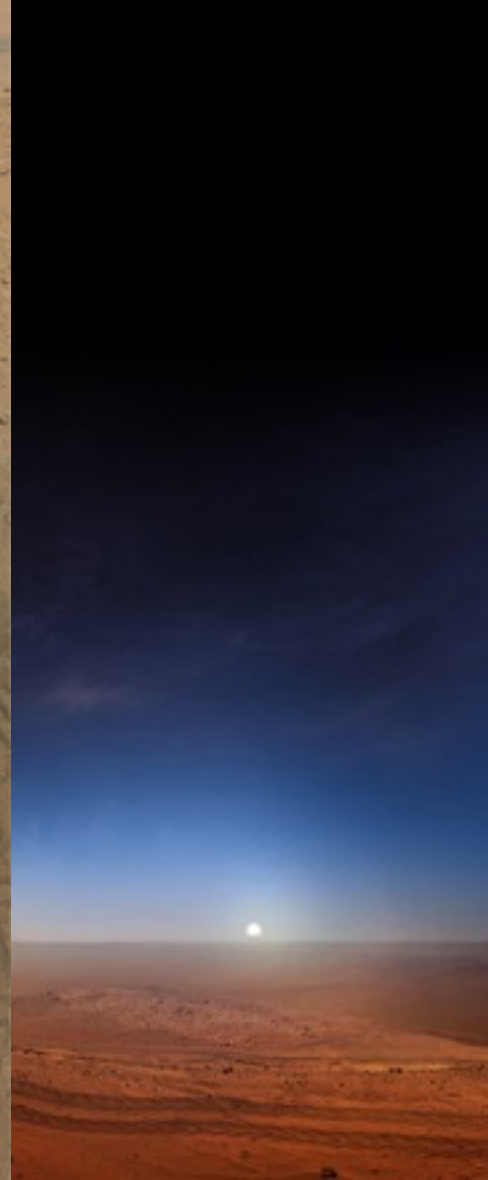
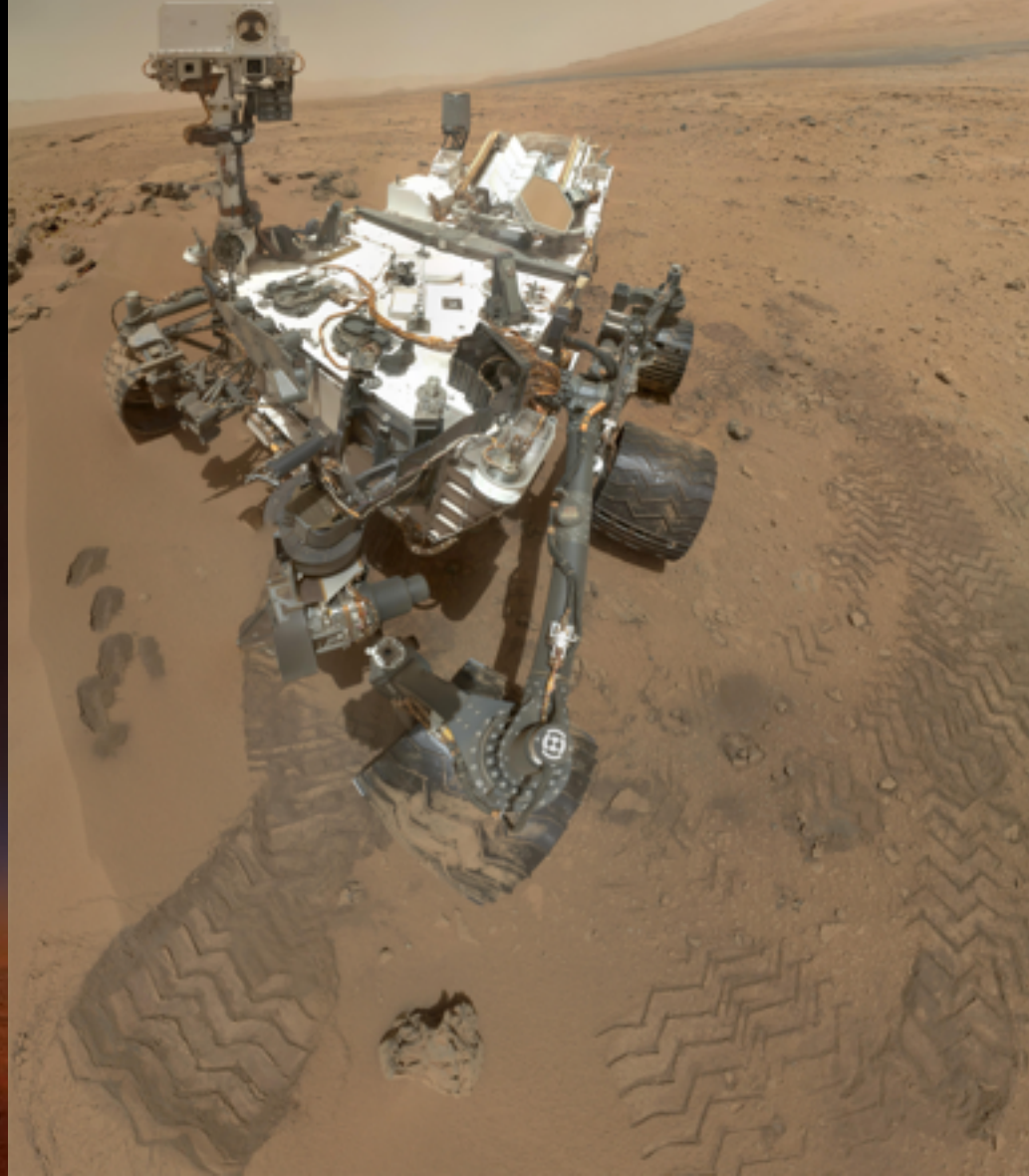
The poster features a large, glowing orange and yellow sun or planet in the background. It displays the logos of 15 international space agencies: ASI (Agenzia Spaziale Italiana), CNES (Centre National d'études Spatiales), CSA (Canadian Space Agency), CSIRO (Commonwealth Scientific and Industrial Research Organisation), DLR (Deutscher Luft- und Raumfahrt Establishment), ESA (European Space Agency), ISRO (Indian Space Research Organisation), JAXA (Japan Aerospace Exploration Agency), KARI (Korea Aerospace Research Institute), NASA (National Aeronautics and Space Administration), Roscosmos (Russian Space Agency), CNSA (China National Space Administration), UAE Space Agency (United Arab Emirates Space Agency), and UK Space Agency.



*Do not go where the path may lead,  
go instead where there is no path and  
leave a trail.*

- Ralph Waldo Emerson

National Aeronautics and  
Space Administration



#JOURNEYTOMARS

# JOURNEY TO MARS

National Aeronautics and  
Space Administration



HUBBLE SPACE  
TELESCOPE

INTERNATIONAL  
SPACE STATION

SPACE LAUNCH  
SYSTEM

ORBITERS

LANDERS

TECHNOLOGY  
EXPLORATION  
SCIENCE

DEIMOS  
PHOBOS

MARS  
TRANSFER  
HABITAT

COMMERCIAL  
CARGO AND CREW

ORION  
CREWED  
SPACECRAFT

SOLAR  
ELECTRIC  
PROPULSION

ASTEROID  
REDIRECT  
MISSION

MISSIONS: 6-12 MONTHS  
RETURN: HOURS

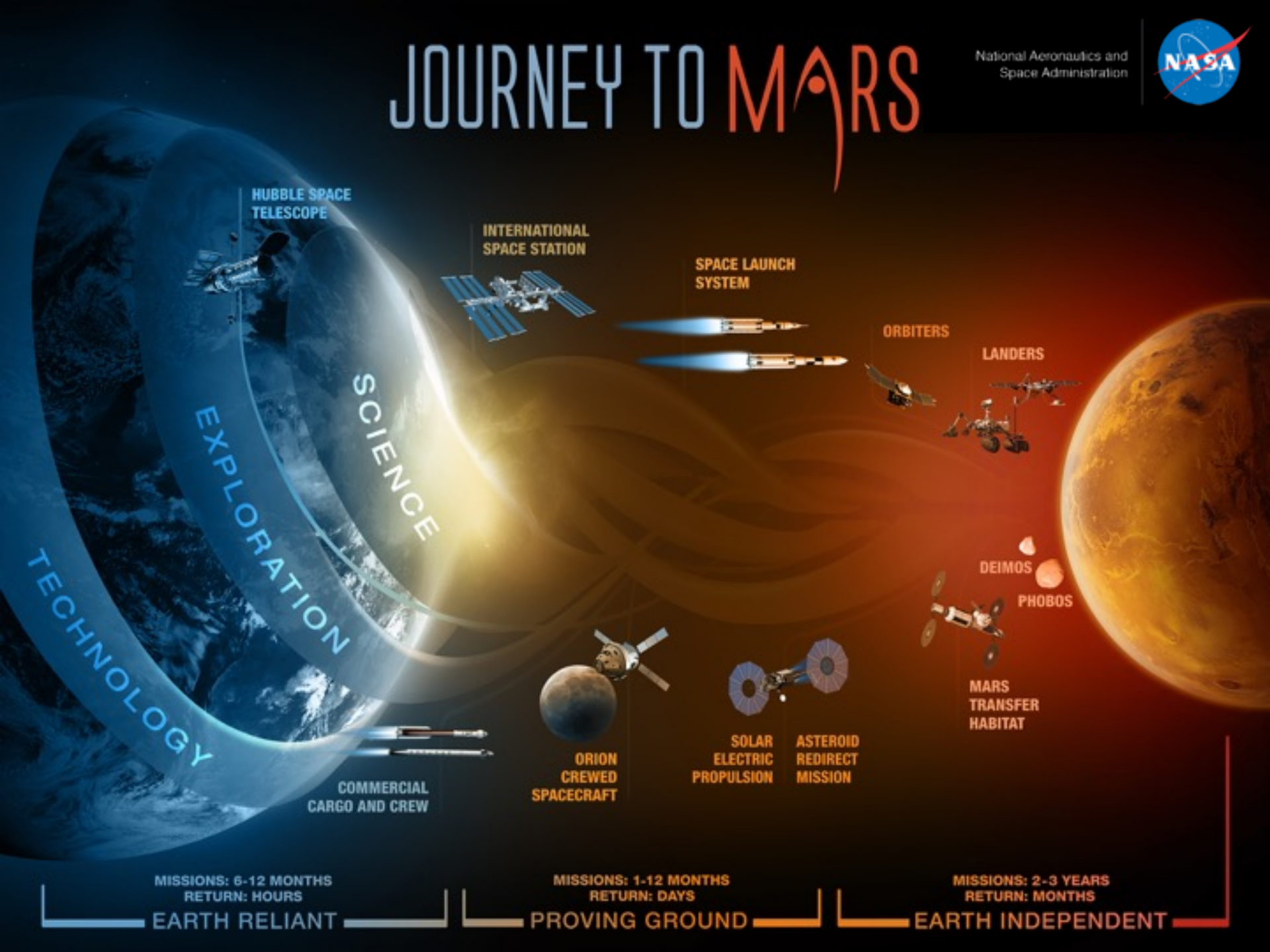
EARTH RELIANT

MISSIONS: 1-12 MONTHS  
RETURN: DAYS

PROVING GROUND

MISSIONS: 2-3 YEARS  
RETURN: MONTHS

EARTH INDEPENDENT





# 16 Years of Human Habitation on the International Space Station (ISS)

National Aeronautics and  
Space Administration



# INTERNATIONAL SPACE STATION

## Public-Private Partnerships



*SpaceX Dragon*



*Orbital ATK Cygnus*



*Russian Soyuz*



*JAXA HTV*



# INTERNATIONAL SPACE STATION

## Off the Earth, For the Earth



### YEAR IN SPACE

#### KEY QUESTIONS:

- How will astronauts perform mentally and physically after a year in space?
- What changes are there to brain structure and sensory/motor abilities?
- How do bodily fluids shift?
- How are visual acuity and eye health affected?
- How do the blood vessels change?
- What is the risk of osteoporosis (brittleness of bones) and bone fracture?
- How do microorganisms within the body change?



### TWINS STUDY

#### KEY QUESTIONS:

- Does space travel accelerate atherosclerosis?
- How do an individual's genes affect fluid shifts and vision degradation?
- How does space travel affect the genes, chromosomes, DNA and RNA?
- How does space travel affect the immune system?

ARTWORK: NATIONAL SPACE BIOMEDICAL RESEARCH INSTITUTE



# Space Launch System (SLS)

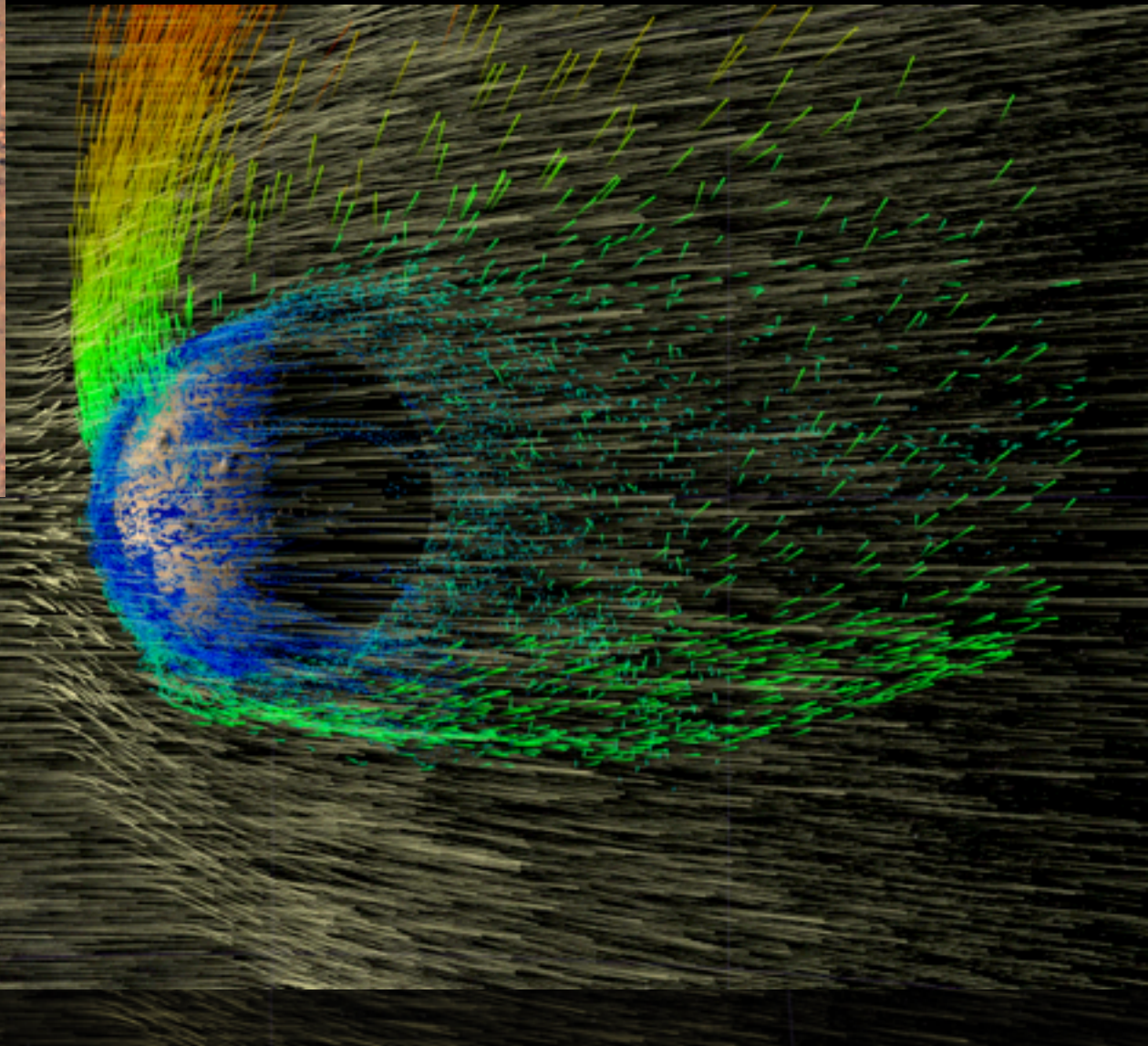
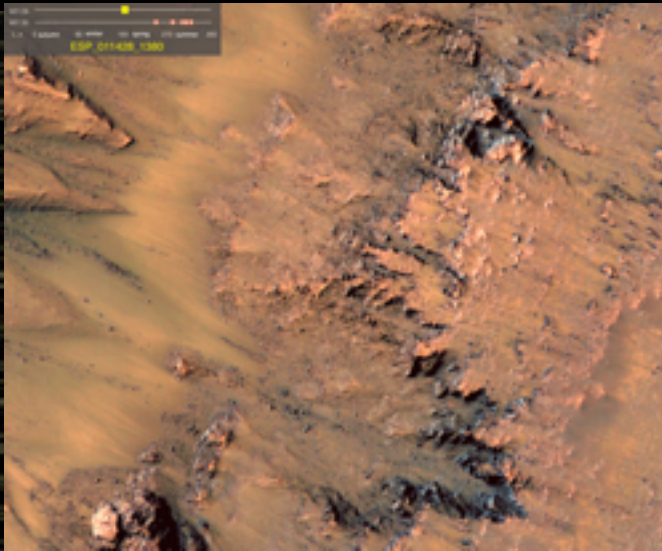
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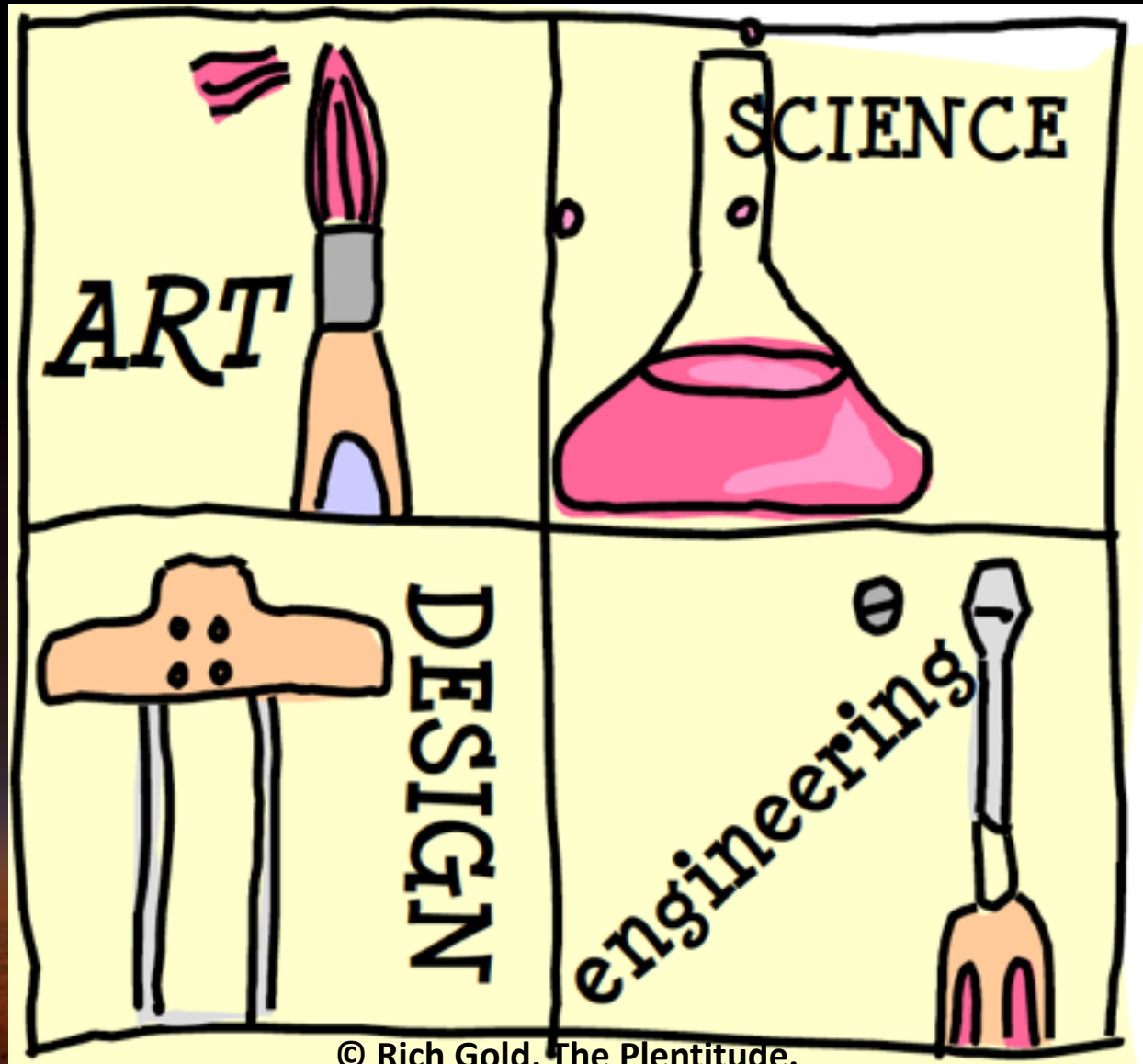
# Mars: Flowing Water & Atmosphere Loss

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# STEAMD

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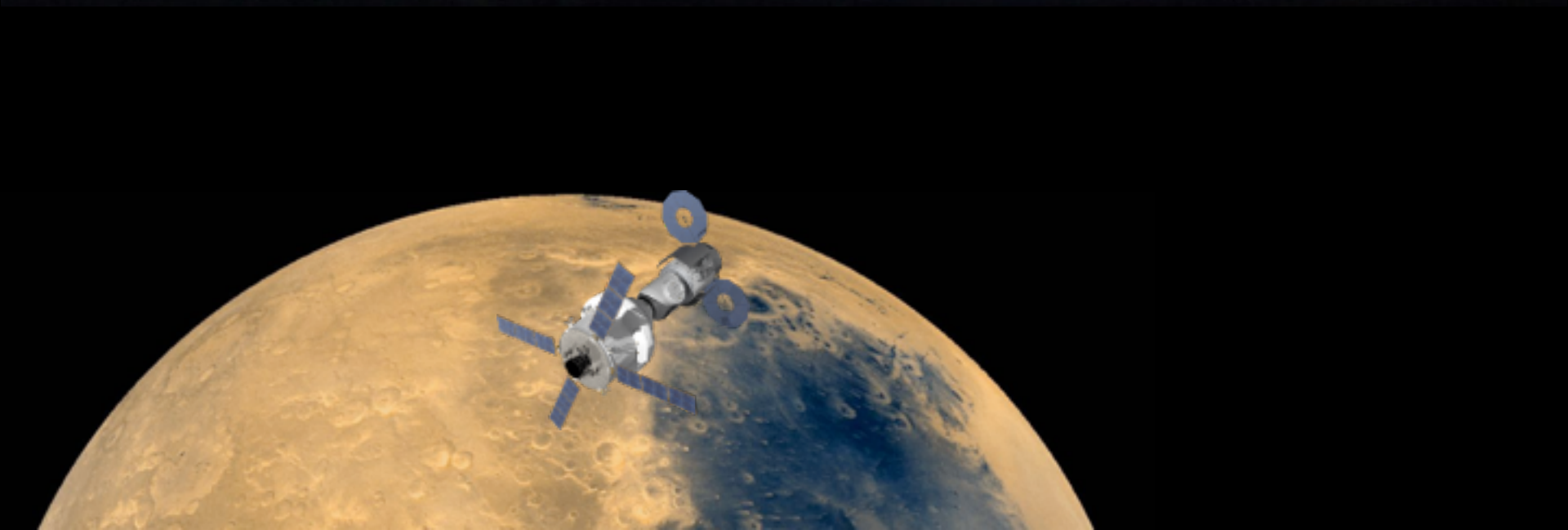


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#JOURNEYTOMARS



# ISS – Deep Space – Mars



# Spaceship Earth

## It's the Only One We Have!

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# Global Journey to Mars

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Space Administration



THE EVOLUTION OF A MARTIAN