Exploring Mars

With Human Missions

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HUMANS ON MARS

- *Mars is the proving ground where we will discover whether humanity can become a multi-planet species*

  - Arthur C. Clarke (Scientist, writer)

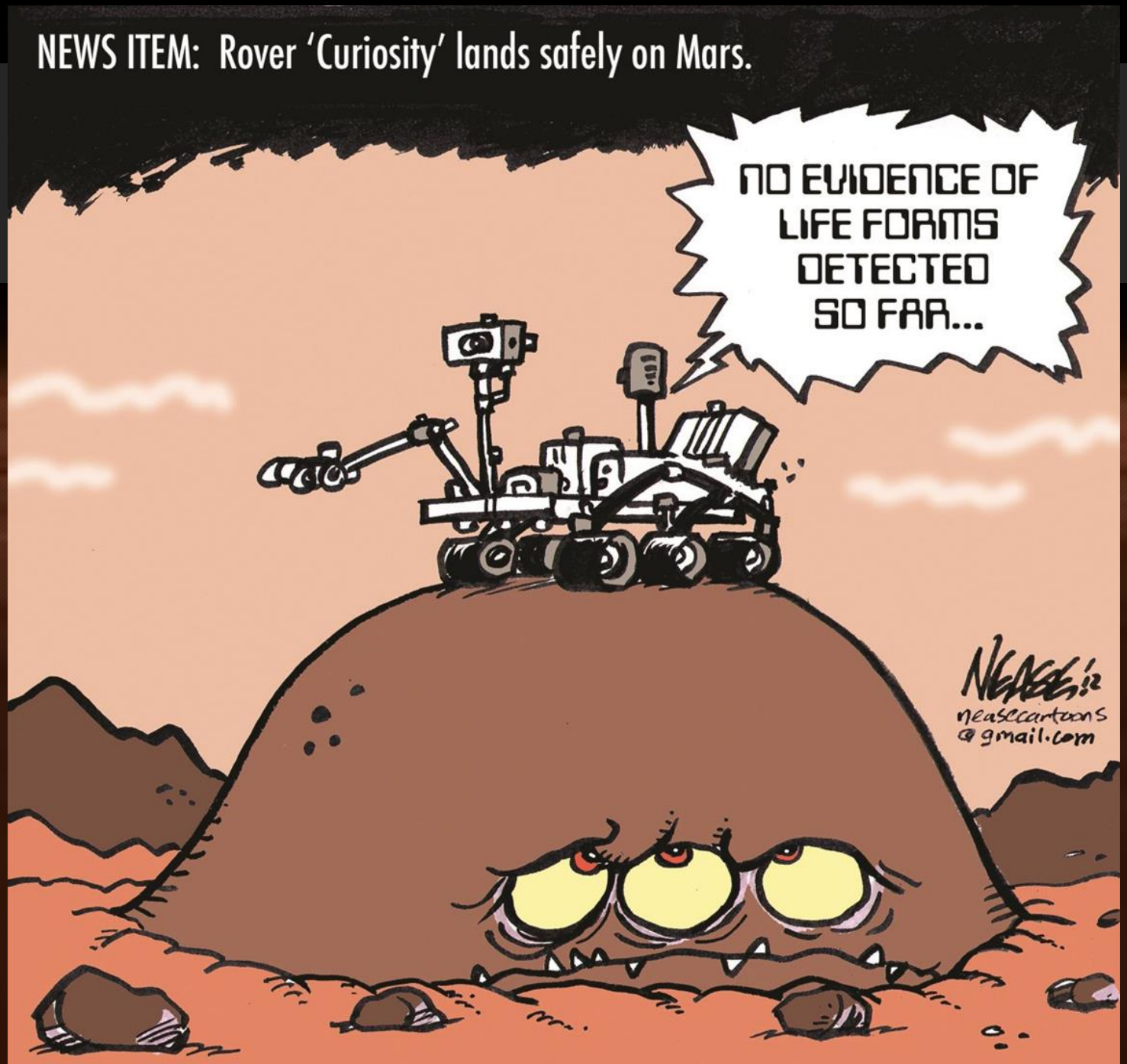
- *Humanity was born on Earth. Are we going to stay here? I suspect—I hope—the answer is no. —Ann Leckie*

Why?

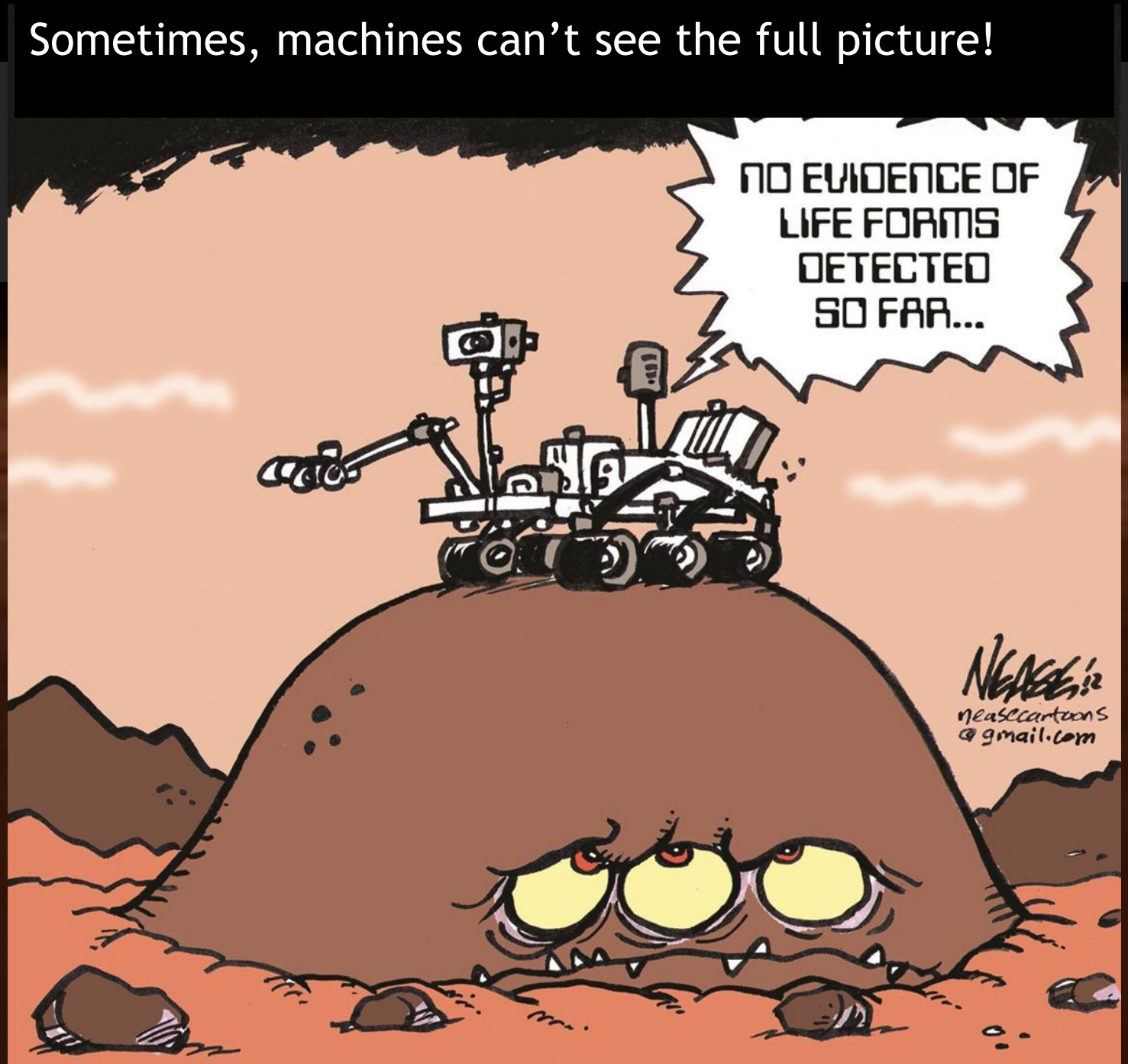
- Humans can do some serious exploration! We have barely scratched the surface!
- Can perform complex experiments: Geology, chemistry, astrobiology? All together!
- Real-time decision making: Considering several factors, in unanticipated situations: Instinctive decisions – *Remember Apollo 13!*

Why?

- *Exploration enables science and science enables exploration*
- New land, new opportunities! Future colonization: We have to start somewhere!
- Humans have good brains and rovers have good tools, together they can explore new landscapes!


NEWS ITEM: Rover 'Curiosity' lands safely on Mars.
NO EVIDENCE OF LIFE FORMS DETECTED SO FAR...
neascartoons@gmail.com

Sometimes, machines can’t see the full picture!



Challenges?

- Absence of a livable natural environment
- Narrow window of return: the commitment to launch is a commitment to three years in space.. (Remember Martian?)
- Large communication time-lag (20-40 minutes): Emergency decisions!
- Necessary to develop systems with high reliability and robustness: Habitat, harvesting Martian resources (using microbes?)


"NO TRAVEL INSURANCE"??
WHAT DO YOU MEAN,
"NO TRAVEL INSURANCE"??!!
MARS LANDER
CARTOONSTOCK
.com
Search ID: kscn5626

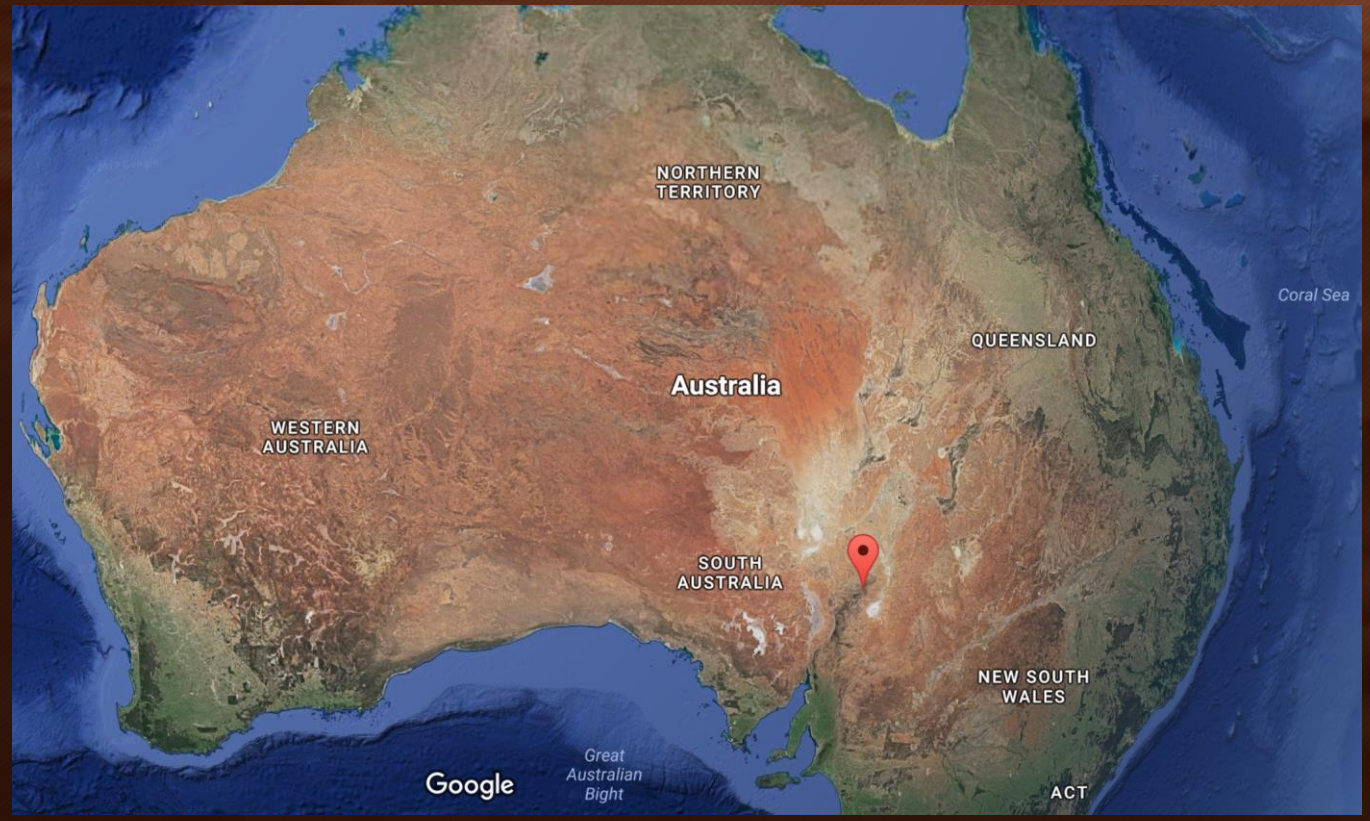
Just one of the many challenges!

Preparation

- How should the first mission look like? How to setup the first base? Carrying raw materials vs mining? 3D printing, Martian farming.
- Crew composition
- Human-machine (rover) interaction for the best exploration

Mars Analogue Expedition in Australia (2014)

- In Arkaroola dessert of Southern Australia:



Why here? Geology, Biology, Terrain

- its many scientific features of interest to planetary geologists, geomorphologists, and astrobiologists
- a diversity of different terrains, materials and surfaces ideal for engineering tests

- Mock landscape exploration
- Rover maneuverability tests
- Human + Rover interaction: Mock Extra-habitat Activities
- Geological evidences + fossil hunting

Martian Ocean!

Martian water flow

Site selection:

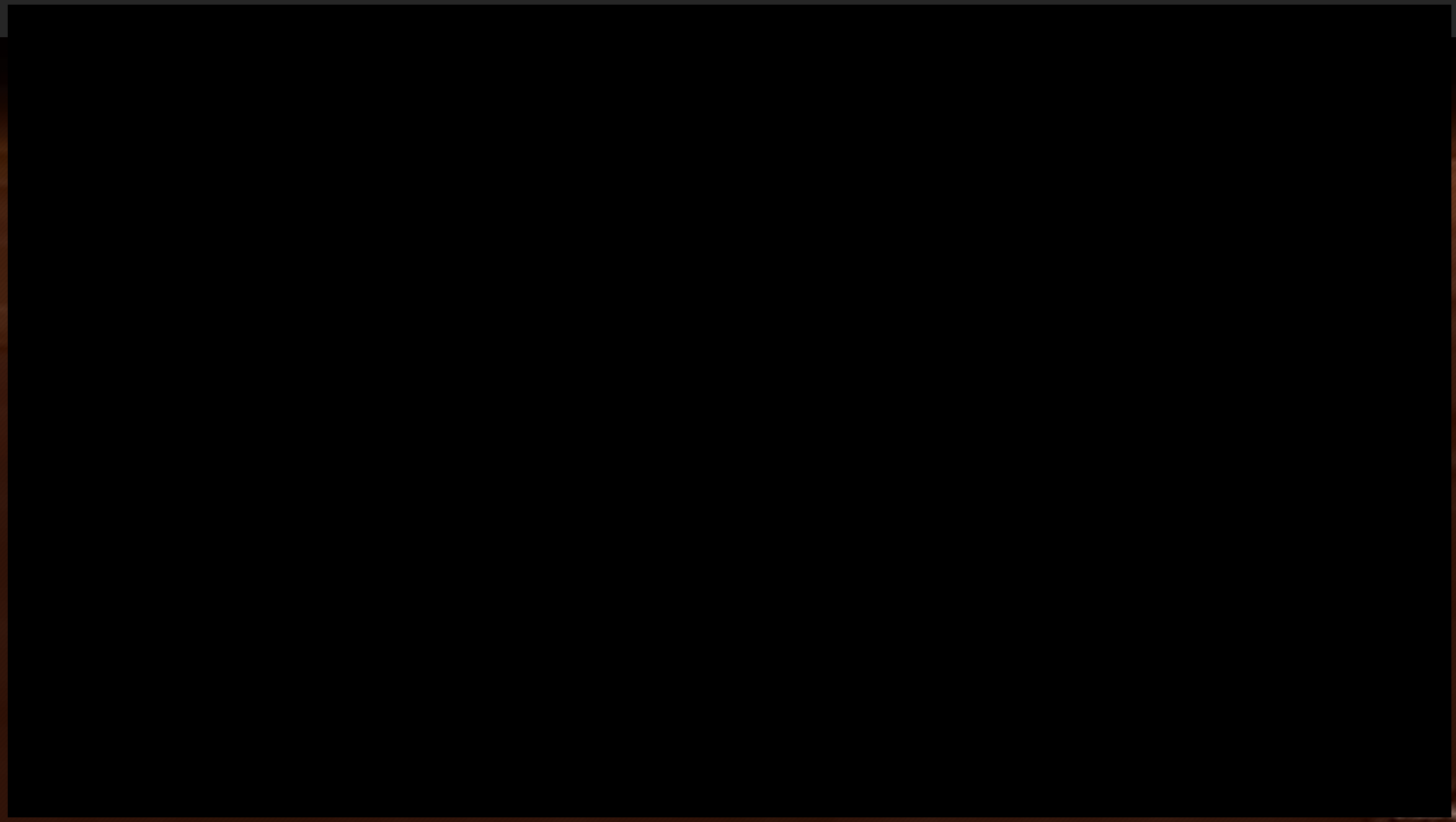
Pebbles! Ancient flowing water?


This pink fine grained quartzite rock (sand grains cemented by silica) has numerous examples of small ripple marks.
Here the quartzite is more than a kilometre thick, yet the water was only ever a few metres deep; the seabed kept
slowly sinking as sediments accumulated, maintaining shallow water in which wave action caused ripples in the sand.

Fossils: Almost a billion year old!

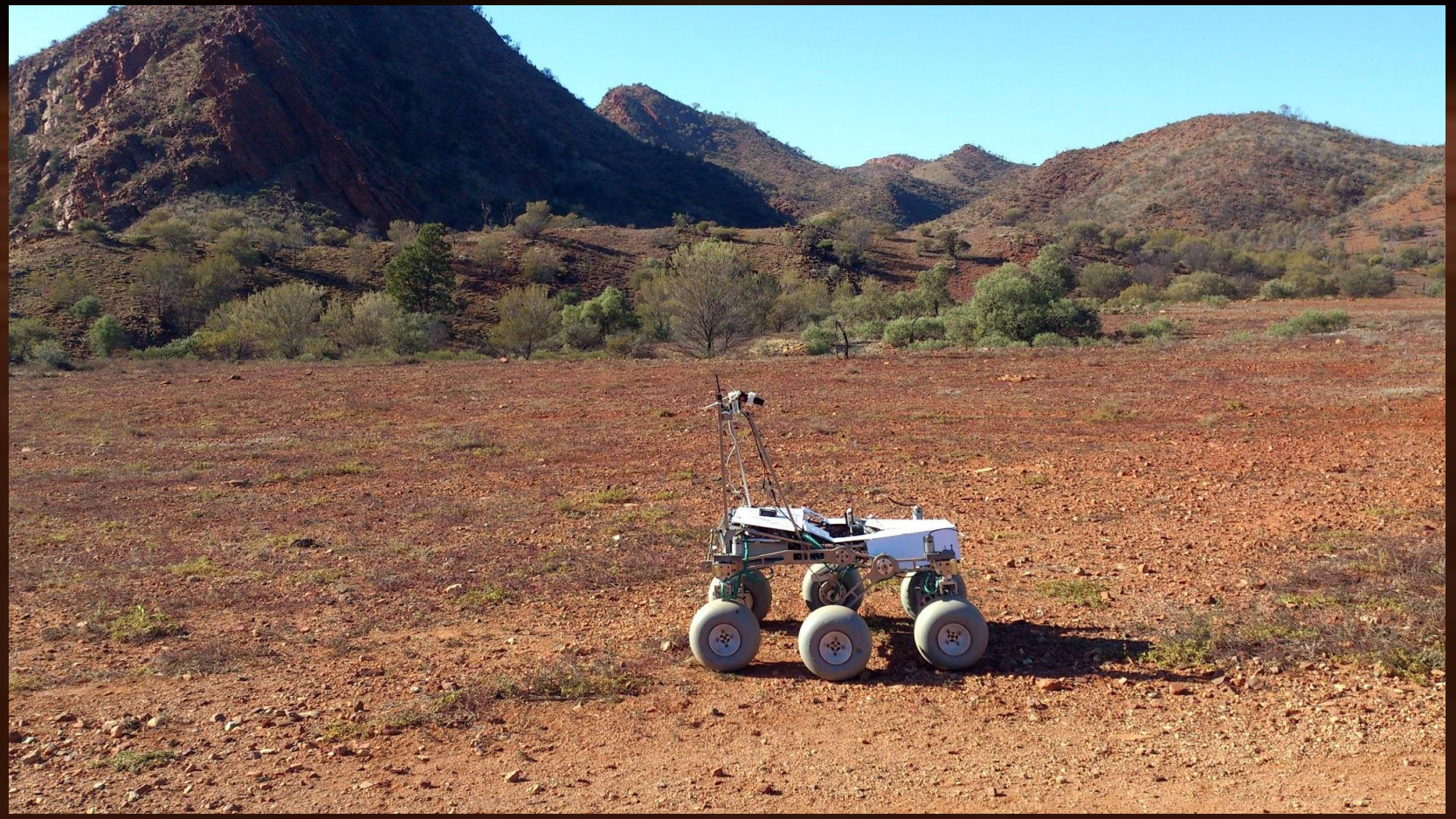
Our oldest fossils: Stromatolites

Our oldest fossils: Stromatolites



Expedition: Mock landscape survey


VISEC

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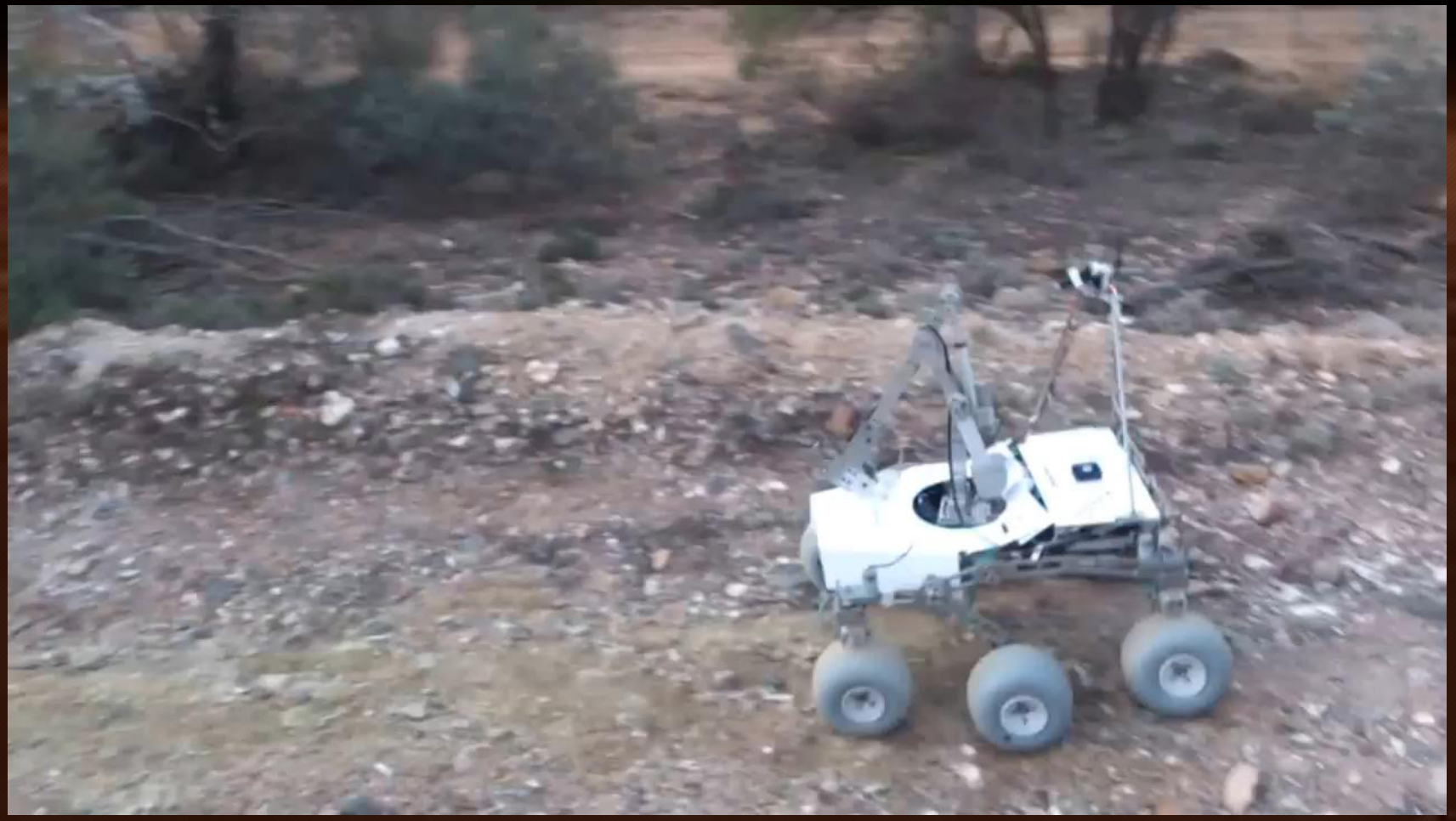
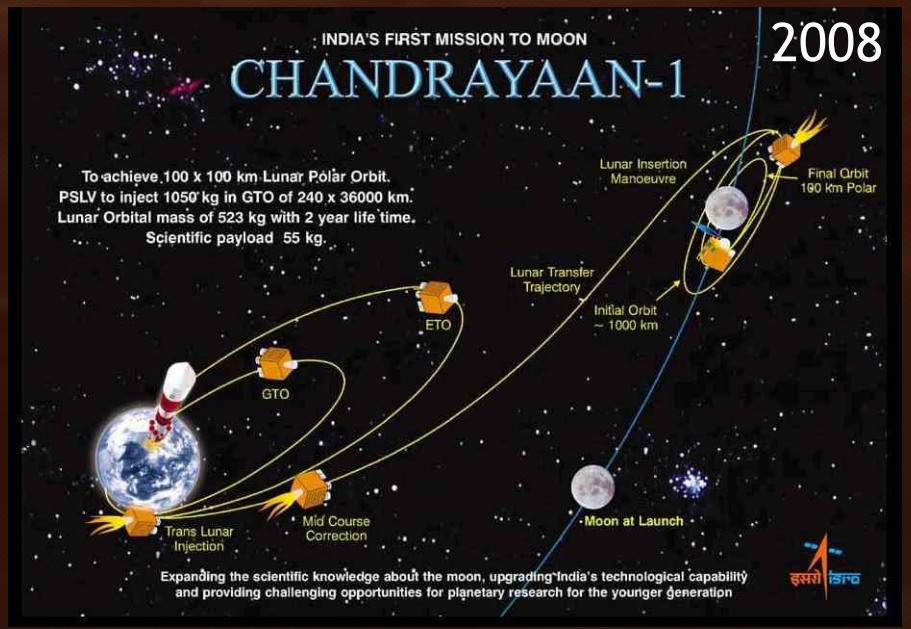
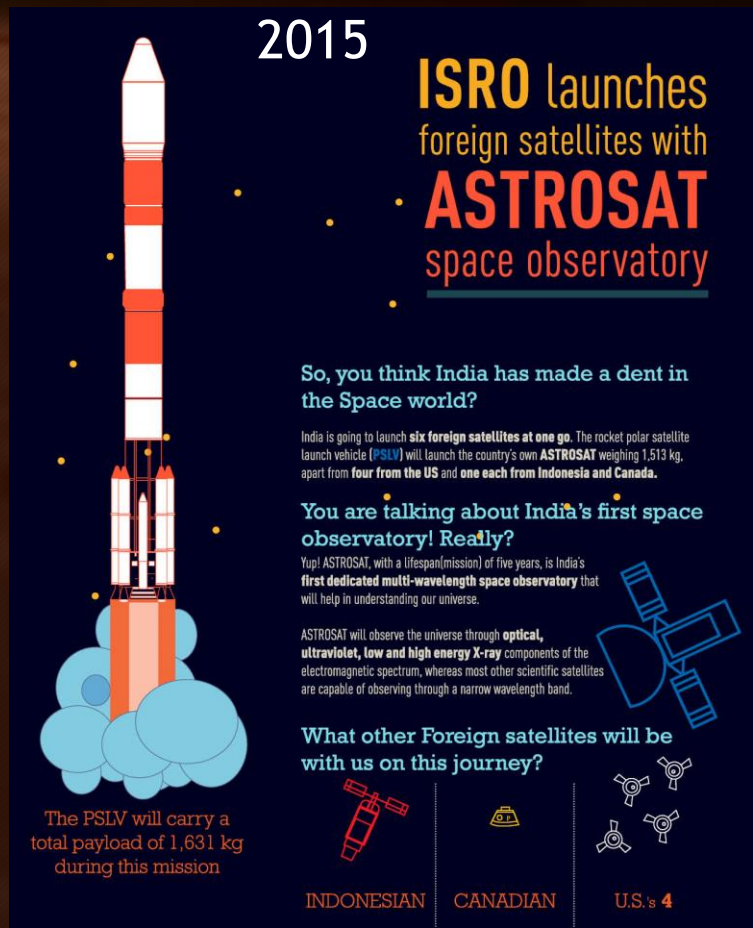
Rover video



Indian Space Program:

- Started in 1962
- With humble beginning
- Sent several earthbound satellites: Communication, weather, survey : agriculture, resource mapping





Indian Space Program:

- Mission to Moon: Chandrayaan: Lunar orbiter + lander probe
- Mission to Mars: Dec 1st 2013 -> Sept 24, 2014
- One of the cheapest launch facility for small satellites in space market
- Recent record of 104 satellite launches in one go

  (101 nanosatellites)

Mangalyaan: Mission specifics

Mangalyaan

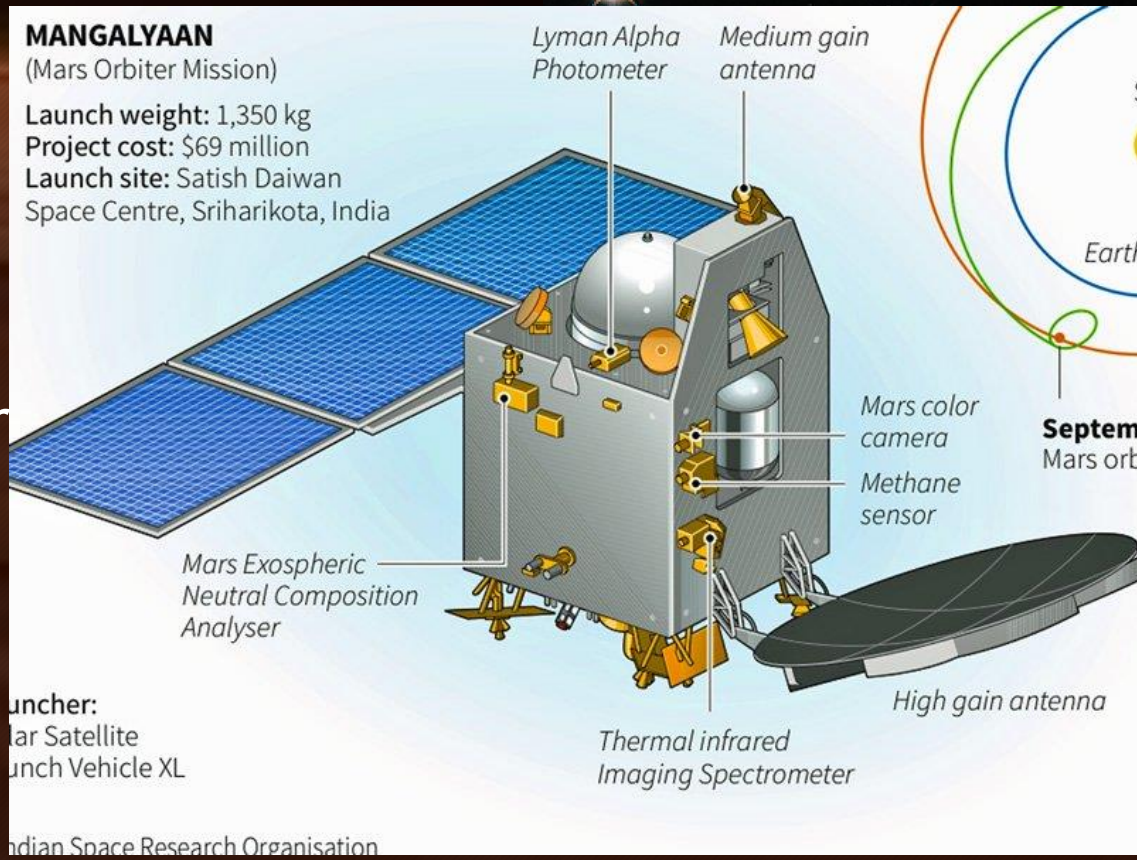
Objectives:

- Technological: Orbital maneuvers, Deep space communication, autonomous operations in mars capture orbit
- Scientific: Terrain mapping, mineralogy, atmospheric composition, methane

Mangalyaan

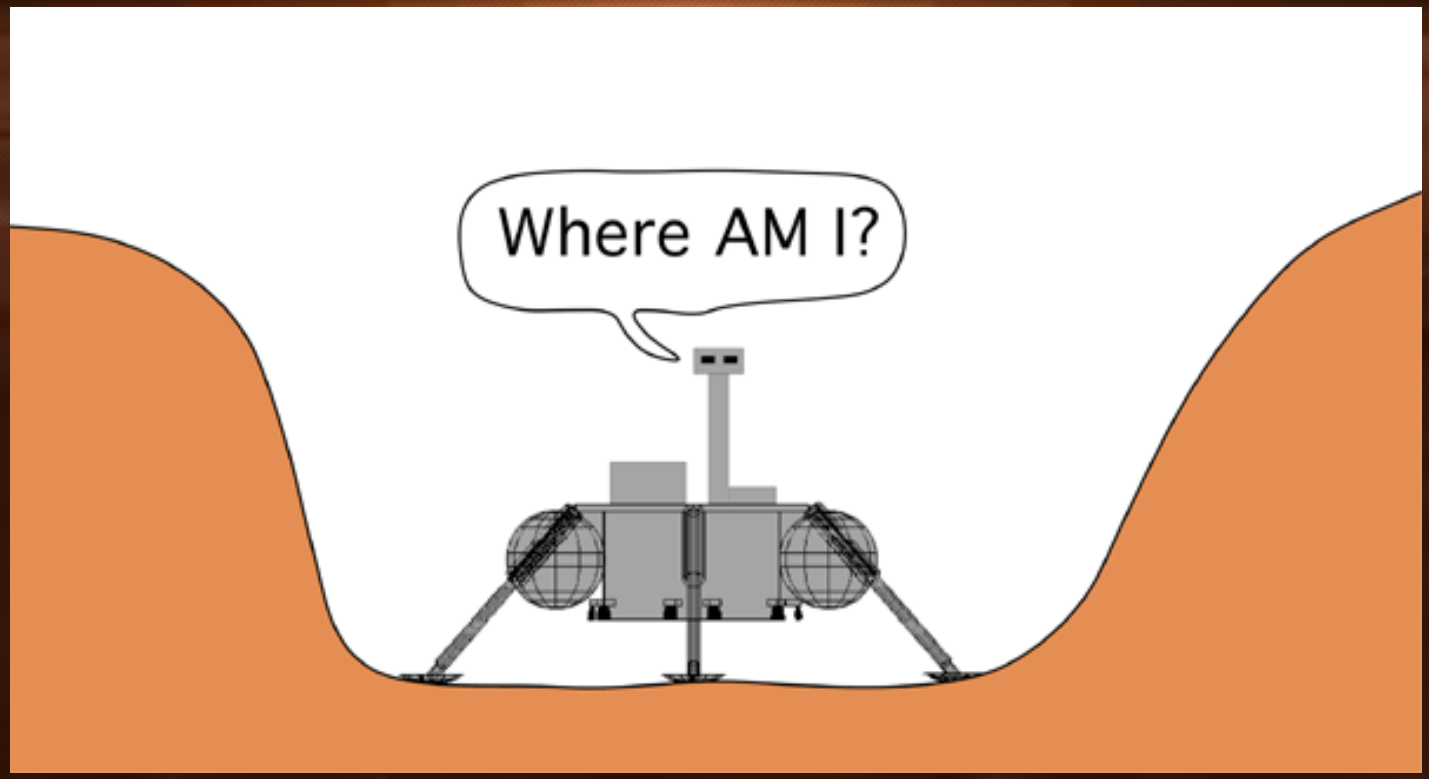
Instruments:

- Mars Color Camera
- Methane Sensor for Mars,
- Lyman Alpha Photometer
- Mars Exospheric Neutral Composition Analyzer
- Thermal Infrared Imaging Spectrometer



ISRO: Future Plans

- Chandrayaan - 2 : Lunar mission: will include a rover
- Aditya: Solar observatory in space: 1.5 million km from earth (at L1 location)
- A Mars rover (Hopefully soon!)


Where AM I?