

A photograph of a Martian landscape. The foreground is a reddish-brown, rocky terrain with several dark, angular rocks scattered across it. In the middle ground, a dark, winding path or channel cuts through the landscape. The background shows a vast, flat expanse of the Martian surface under a hazy, orange-tinted sky. The overall scene is desolate and arid.

On Colonizing Mars

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**MASTER ON NUMERICAL
METHODS ON ENGINEERING**

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WHY COLONIZE MARS?

TWO MAIN REASONS



“All civilizations become either spacefaring or extinct”
- Carl Sagan

“[...]as we set sail we ask God's blessing on the most hazardous and dangerous and greatest adventure on which man has ever embarked.”
May 25, 1961 JFK's Speech to Congress.

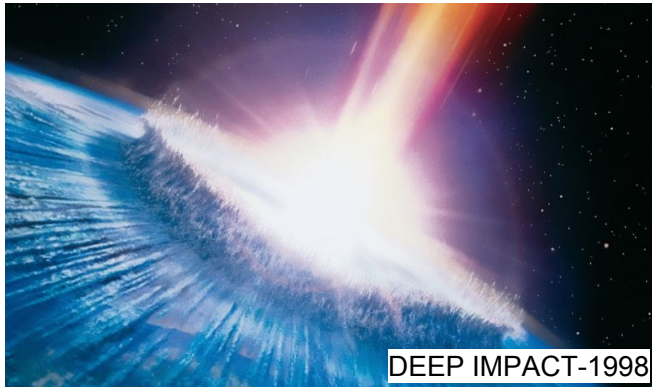
INSPIRATION:SPACE EXPLORATION INSPIRES HUMANKIND



People watching television following the firm Apollo 11
Milan, July 1969 Credit Publifoto/Olycom

HIGH PROBABILITY OF GLOBAL EXTINCTION EVENT

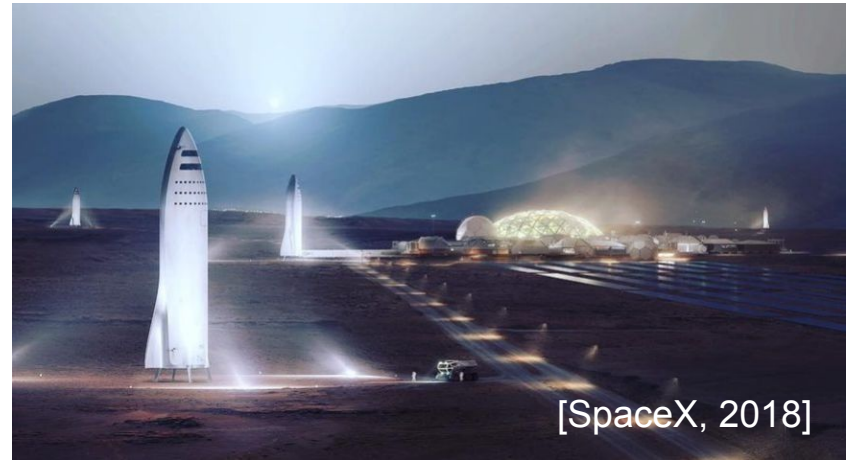
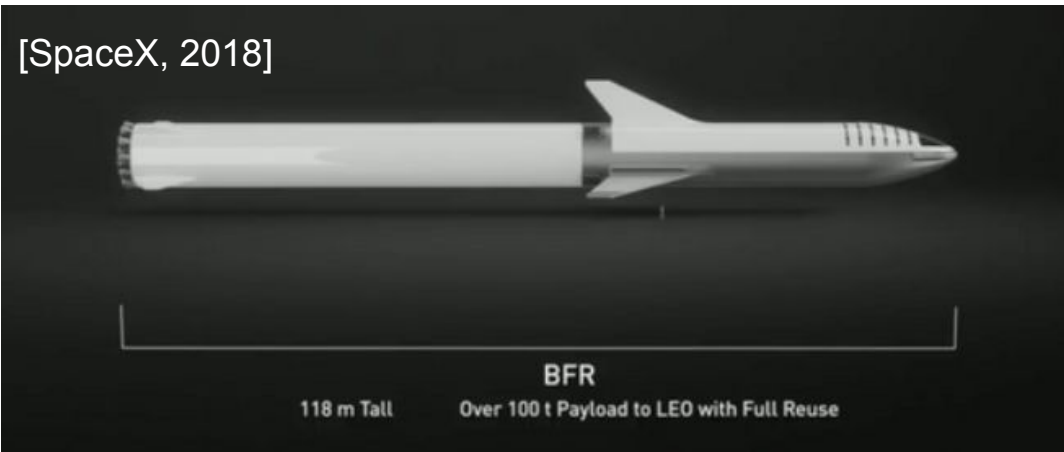
Permian–Triassic extinction event killed 90% to 96% of all species



HIROSHIMA, late 1945 PHOTOGRAPH BY BERNARD HOFFMAN

HOW TO COLONIZE MARS?

**WITH SPACEX'S "BFR" (BIG FALCON ROCKET)
AND THE WILL TO DO IT.**



BFR SYSTEM: INTRODUCES **4 KEYS** TO ENABLE MARS COLONIZATION

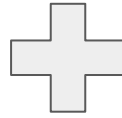
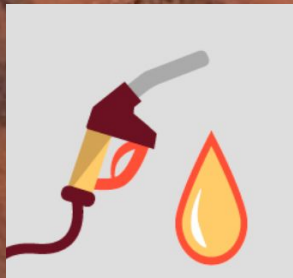
1. In-Situ Resource Utilization (ISRU)
2. Full reusability
3. Refueling in orbit
4. Multiple-purpose rocket



[SpaceX, 2018]

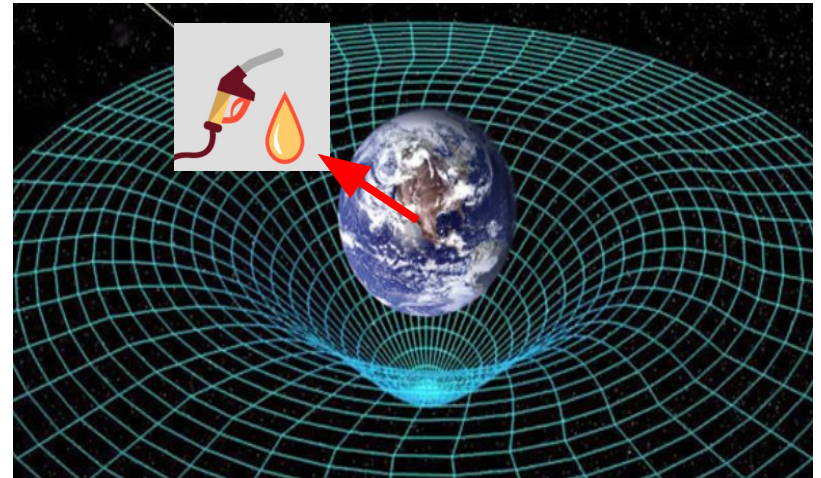
ISRU: **WATER**+**CO2** = **METHANE** (*SABATIER* REACTION)

- 5 MILLION CUBIC KM OF WATER ICE
- 25 TRILLION METRIC TONS OF CO2

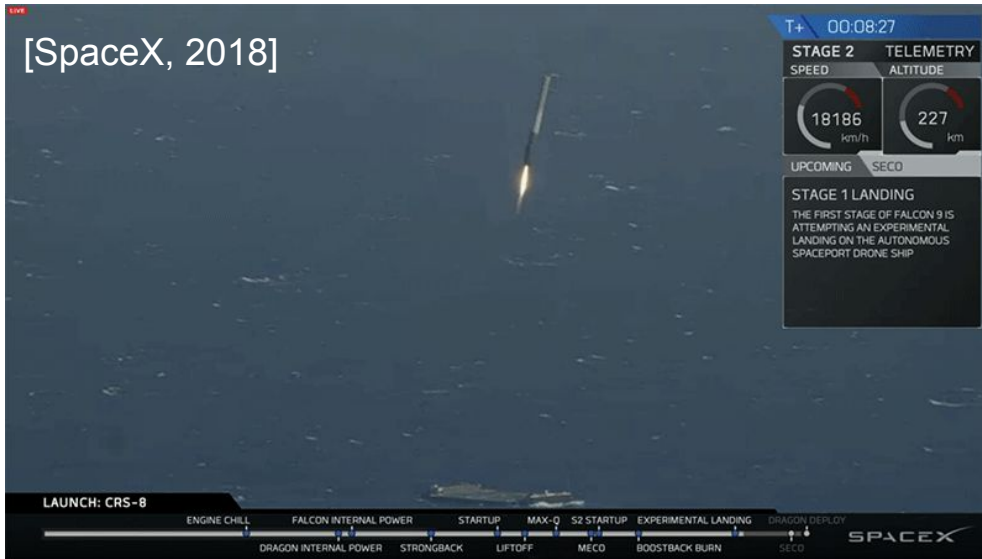


REFUELING AT ORBIT

“LOADING ONCE AT THE TOP OF THE HILL”



REUSABILITY =



RECOVER AND REUSE



VS

EXPENDABLE: LIKE USING A PLANE **ONCE**



MULTI-PURPOSE SHIP.

“FORD PRINCIPLE”

Most long distance trips **less than 30 minutes**

[SpaceX, 2018]



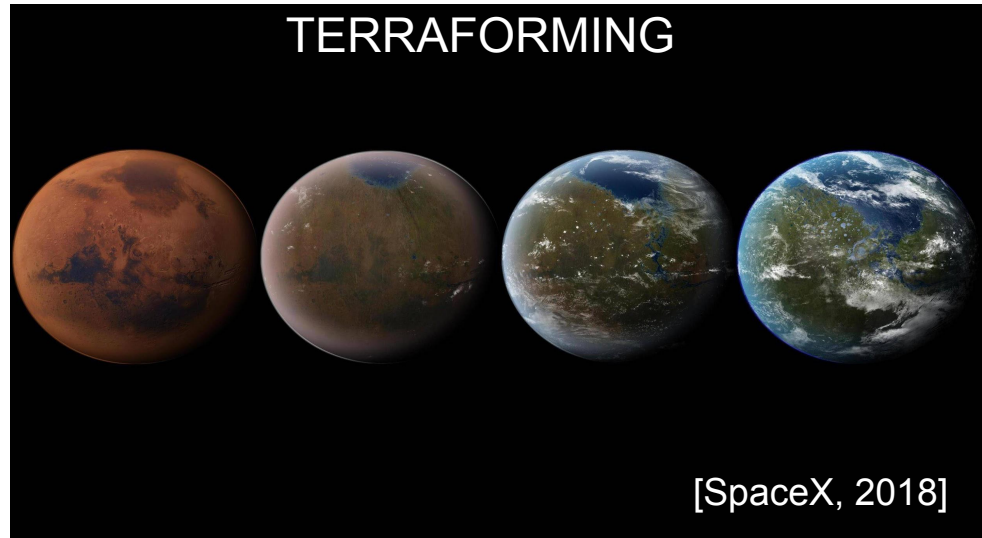
[2001: A Space Odyssey
, 1968]

FAR FUTURE: BECOMING A CIVILIZATION CAPABLE OF INTERSTELLAR TRAVEL



INTERSTELLAR SHIPS

[Interstellar,
2014]



TERRAFORMING

[SpaceX, 2018]

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SUMMIT

OLYMPUS MONS

The solar system's highest peak



PHOBOS & DEIMOS

TAKE A SPACE-AGE CRUISE ABOARD THE MOONS OF MARS

THE END



DISCOVER

VALLES MARINERIS

LAND OF MARTIAN CHASMS AND CRATERS



[SpaceX, 2018]