MARS TECHNOLOGY INSTITUTE

AN ENGINE OF
INVENTION AND FINANCE
TO ENABLE THE SETTLEMENT OF
THE RED PLANET

THE MARS SOCIETY

MARTIAN CITIES WILL BE INVENTORS COLONIES

All the necessary materials to create new branches of civilization are already on the Red Planet. But we need to create the necessary technologies to transform those materials into resources.

- When Mars is resource rich, people will want to move there.
- Martian colonists will be technologically adept people in a frontier environment that challenges them to innovate.
- They will create breakthrough technologies to survive.
- They will prosper by licensing their inventions for use on Earth.

The Mars Technology Institute will begin that process on Earth **today**!

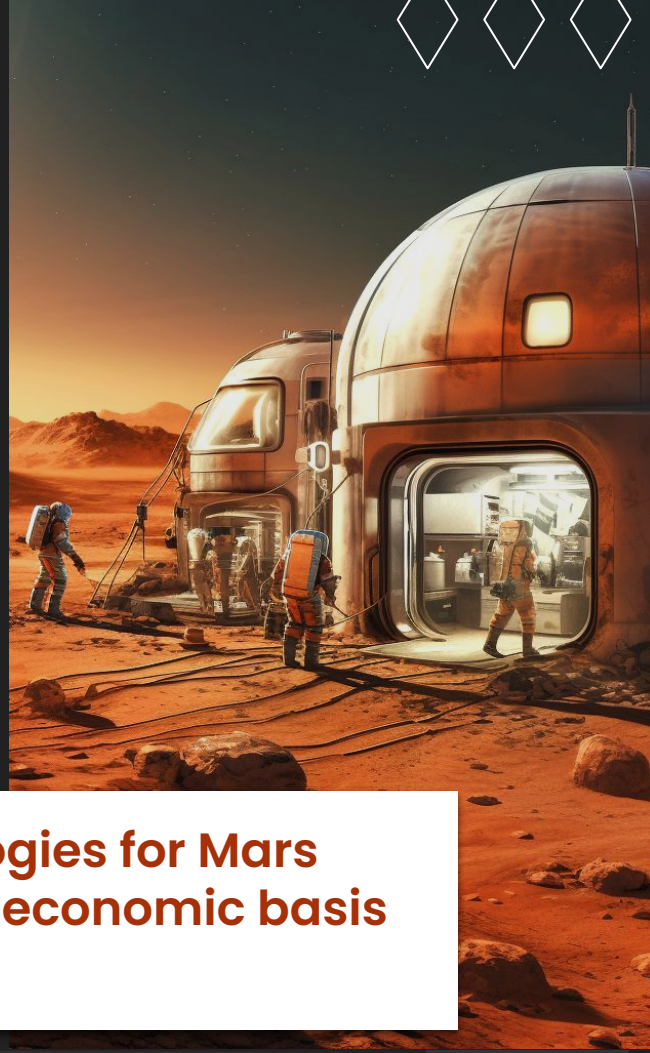
THE BUSINESS CASE FOR MARS

Wealth from Invention!

The Mars Technology Institute presents a compelling opportunity to profit by taking a leading role in the transformation of humanity from a single planet to a multi-planet spacefaring species.

MIT has made a fortune by patenting and licensing the inventions of its scientists.

As a mission-driven international company of inventors, MTI will be able to do so too.



MTI will pioneer first-generation technologies for Mars colonization and prove the viability of a key economic basis for Martian city-states.

MARS' NEEDS

The three critical needs that a Mars colony will face are its severe constraints of labor, agricultural land, and sources of energy.

LABOR SHORTAGE

Mars will have a shortage of labor.

Therefore, Mars will need to innovate in the areas of automation, robotics, and artificial intelligence.

LAND SHORTAGE

Mars will have shortage of cultivable land.

Therefore, it will need to innovate in biotech.

ENERGY SHORTAGE

Mars has no fossil fuels or hydro power options.

Therefore, it will need to innovate in advanced nuclear technologies, including fission and fusion.

BIOTECH *IN FOCUS.*

Priority #1 Food Technology to Enable Mars Settlement

WHY IT MATTERS

- Iowa cornfields, the most productive farms on Earth, produce 12 metric tons corn per hectare/year. With allowance for some fruits and vegetables, that's enough to support 20 people/hectare
- This won't work for Mars settlement! A town of 50,000 people would require 2500 hectares!
- 5 GWe to light with LEDs at 200 W/m2. Chicago-sized power plant needed for small town!
- Problem is sunlight to food energy conversion is 0.2% efficient. If corn fed to cows for beef, 0.02% efficient.

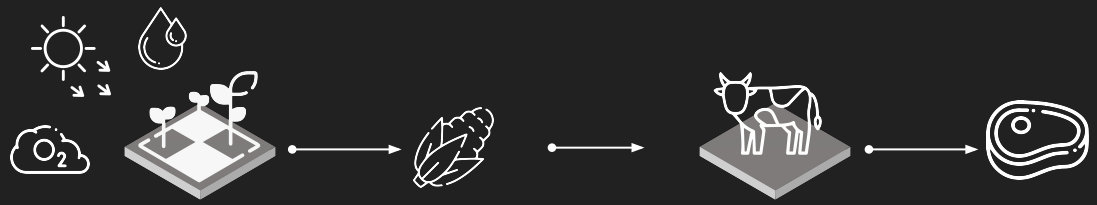
WHAT IT ENABLES

- Sabatier reaction can make methane from CO2 and Water at 60% efficiency.
- Microbes can turn methane to protein at 60% efficiency
- Tissue culture can turn protein to fish or meat at 60% efficiency.
- Net process efficiency is ~ 20%. A hundred times better than growing corn! A thousand times better than raising cows!
- Efficient food production on Mars can help combat hunger on Earth.

FOOD TECH *IN FOCUS.*

Conventional Farming vs. MARS Biotech

CONVENTIONAL FARMING



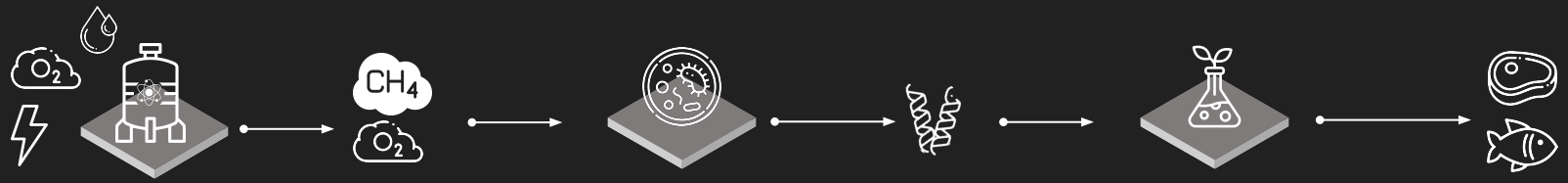
FARM, 0.2% Efficiency

CORN

COW, 10% Efficiency

MEAT, **0.02% Net Efficiency**

MARS BIOTECH



SE REACTOR, 60% Efficiency

METHANE & OXYGEN

MICROBIAL REACTOR, 60% Efficiency

PROTEIN

TISSUE CULTURE, 60% Efficiency

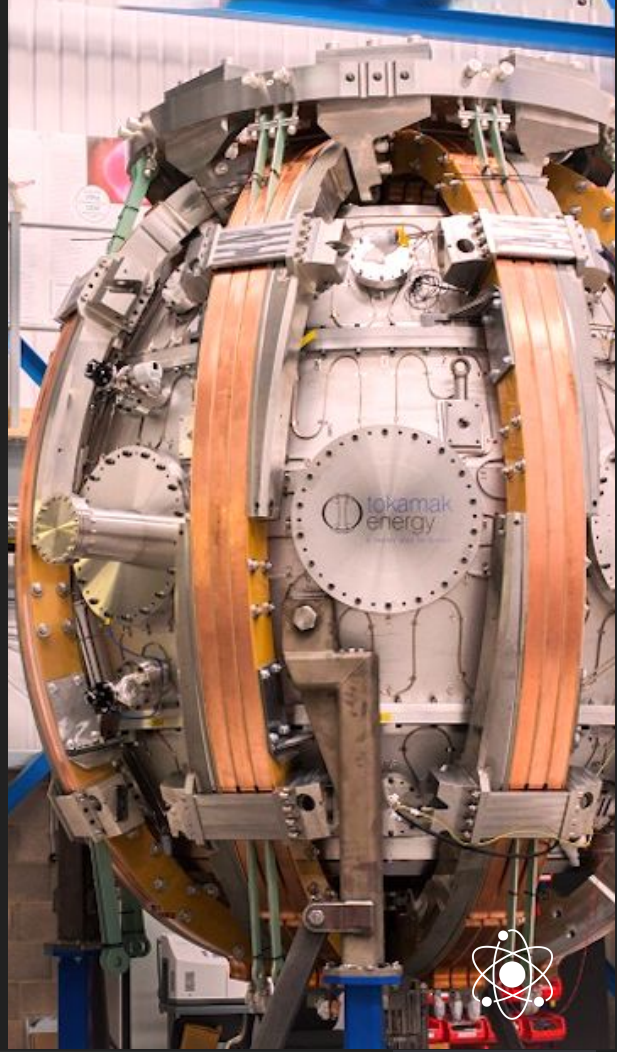
MEAT OR **FISH,** **20% Net Efficiency**

1000X INCREASE IN EFFICIENCY! 1000X DECREASE IN LAND & POWER REQUIREMENTS!

FOCUS AREA 2: ENERGY

- **Advanced Fission systems** incorporating simpler engineering and which can breed fuel from thorium. Example: LFTRs.
- **Fusion.** Deuterium is 5 times as common on Mars as it is on Earth, and a Mars colony will electrolyze large amounts of water every day, making deuterium separation cheap.

Fusion is thus the ideal energy source for Mars.

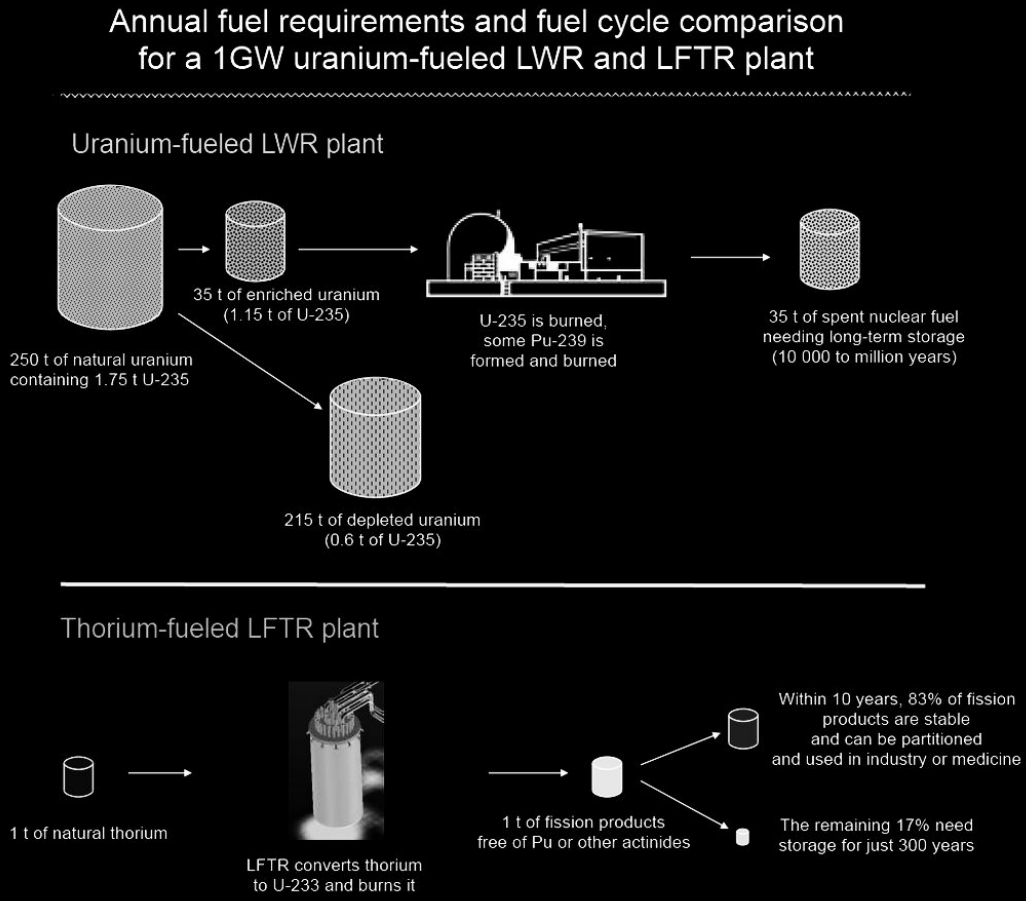


ENERGY *IN FOCUS.*

Lithium Fluoride Thorium Reactors (LFTRs) can breed fissile Uranium-233 from Thorium-232.

- Thorium is 4x as plentiful as Uranium.
- U-233 cannot be used to make bombs.
- Reduces fuel requirements and waste produced by two orders of magnitude
- Simpler internal structure than conventional Light Water Reactors (LWRs).
- Cannot melt down. (Safe)
- On Earth regulatory hurdles have stopped new fission technology while cheapness of uranium (5% of nuclear energy cost) has made breeders non-compelling.

Mars settlers will want better



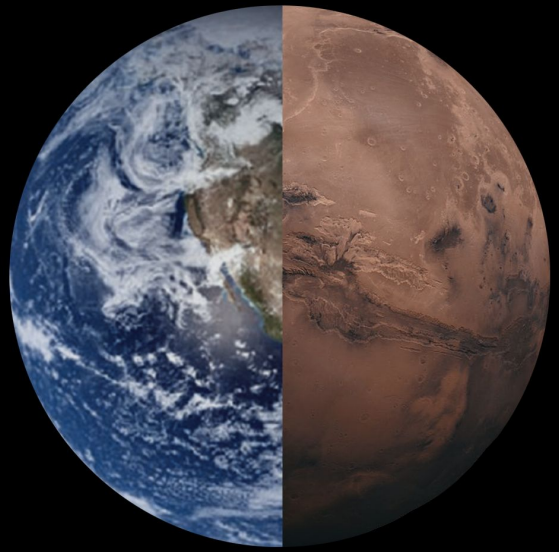
ROBOTICS & AI *IN FOCUS.*

Earth

Robots benefit from the global division of labor for parts.

Robotic automation is used for precision tasks:

- agricultural systems
- scientific research
- health monitoring
- waste management
- energy generation
- power distribution
- 3D printing



Mars

Extreme labor shortage in both number of workers and diversity of skills

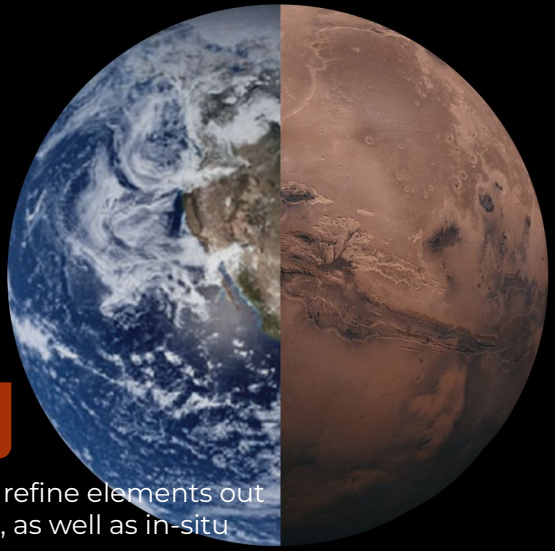
- Need simpler, readily manufacturable robotic assistants applicable to a wide variety tasks.
- Need for AI-augmented Expert System to Unpack all of Earth's Practical Knowledge on Mars
- **Mars Needs AI Technology to Enable Almost Anyone to Do Almost Anything**

- Simpler robotic assistants and AI-driven human skill multipliers developed for use on Mars would open way to revolutionary applications on Earth.

ORE REFINING *KEY TECHNOLOGY APPLICATION.*

Earth

Materials manufacturers benefit from global transport providing access to high grade ores



Mars

Global transport of ores will not be practical for some time

No one site is likely to access high grade ores for all necessary elements.

Martian economy could be boosted by supporting asteroid mining, as asteroids are much easier to access from Mars than from Earth.

Asteroid mining will require in-situ refining of ore prior to transport.

THEREFORE:

- Mars development will require technologies to refine elements out of ores inferior to terrestrial commercial grades, as well as in-situ refining of asteroidal ores.
- Both biotech and physical-chemical methods offer potential.
- Development of such technology for Mars will open the Asteroid Belt to mining and expand availability of useful ore everywhere.

STRUCTURE OF MTI

The structure of the MTI will be a non-profit, and it will seek funding based on tax-deductible donations.

MTI will draw on the Mars Society's worldwide scientific network to coordinate global research to develop technologies to the point where they are ready for spin off as product companies. MTI will assign the relevant IP, develop the business plans, and assemble leadership teams for such companies, and find investors to fund them.

MTI donors will receive pro rata preferences to buy stock in such companies.

Dividends from such activities will be paid to MTI, spin off company leadership, and spin off company investors according to their stock ownership.

There will thus be six sources of cash for MTI/MTL:

- Donations
- Investments
- IP licensing income
- Dividends from spin-off companies
- Stock sales of spin off companies after IPOs
- Government and private corporation R&D contracts.

MARS TECHNOLOGY LAB

We will also set up a C-Corp, the Mars Technology Lab, which will be initially 100% owned by the MTI. This will allow MTI to obtain additional support by bidding SBIRs and other contracts only open to bid by for profit companies.

MTI'S VOLUNTEER ARMY

THE MARS SOCIETY

Leads a global network that includes thousands of people committed to the goal of exploring and settling Mars.

DISTRIBUTED RESEARCH

MTI will also seek to greatly amplify the amount of research it can do with available funds by not only fully funding professional researchers at its own central facility and some distributed locations, but providing limited funds for materials to volunteers who propose credible distributed research projects and are willing to do the work without salary.

- This continues the tradition we have established with our analog research stations and rover competitions, whose productivity per unit cash spent has exceeded commercial standards by several orders of magnitude.
- Such volunteer projects, in many cases supervised by teachers making use of their school's lab facilities, could have great educational value for the student volunteer researcher recruits.
- The IP generated by all such distributed projects would be owned by MTI, but student volunteers could have their names on papers and patents, which would greatly advance their career prospects.
- The MTI could thus serve as the flagship of a broadly based international STEM program.

LEADERSHIP

DR. ROBERT ZUBRIN

President & Founder of the Mars Society

He holds Masters and Ph.D. degrees in Aerospace and Nuclear Engineering – University of Washington

Robert Zubrin will serve as President of the Mars Technology Institute. After serving seven years as a Senior Engineer at Lockheed Martin, Dr. Zubrin founded Pioneer Astronautics, an aerospace R&D company which he led as President for 27 years until selling it in 2023. He served as Principal Investigator on over 50 NASA research and development programs, with a primary focus on developing technologies that would allow materials on Mars, the moon, and asteroids to be transformed into useful resources enabling the exploration and development of space.

In 1998, Dr. Zubrin founded the Mars Society, and has led many highly successful Mars Society projects, including the establishment of simulated human Mars exploration stations in the American desert and on Devon island, 900 miles from the North Pole.

BOARD OF ADVISORS

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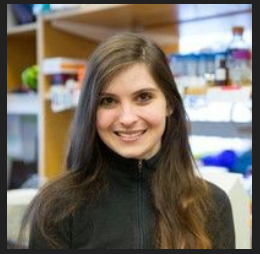

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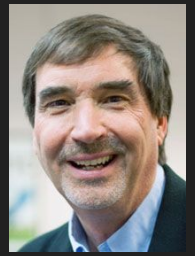

William J Clancey
FL Institute for Human & Machine Cognition

EXPERT KEY
- BUSINESS
- BIOTECH
- AI/ROBOTICS
- SPACE
- NUCLEAR

Mars Technology Institute 11.20.2023

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Dick Clark
CEO & President, Clark Leadership Consulting

Cécile Renaud
Biologist

The Mars Society is currently in the process of recruiting a distinguished Board of Advisors for the MTI.

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VISION

The MTI will establish an empire of spin-off companies each devoted to commercializing one or more of its inventions.

This will allow MTI to become not only the engine of invention, but also the engine of finance to enable the human exploration and settlement of Mars.

To quote Frederick Douglas, *“Who would be free, themselves must strike the blow.”* Rather than rely on NASA to establish humanity on Mars, we can, must, and will take up the challenge ourselves.

MARS TECHNOLOGY INSTITUTE

CONTACT:
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ROBERT ZUBRIN

THE MARS SOCIETY