USNC-Tech

Nuclear Technology for Space Settlements and Exploration

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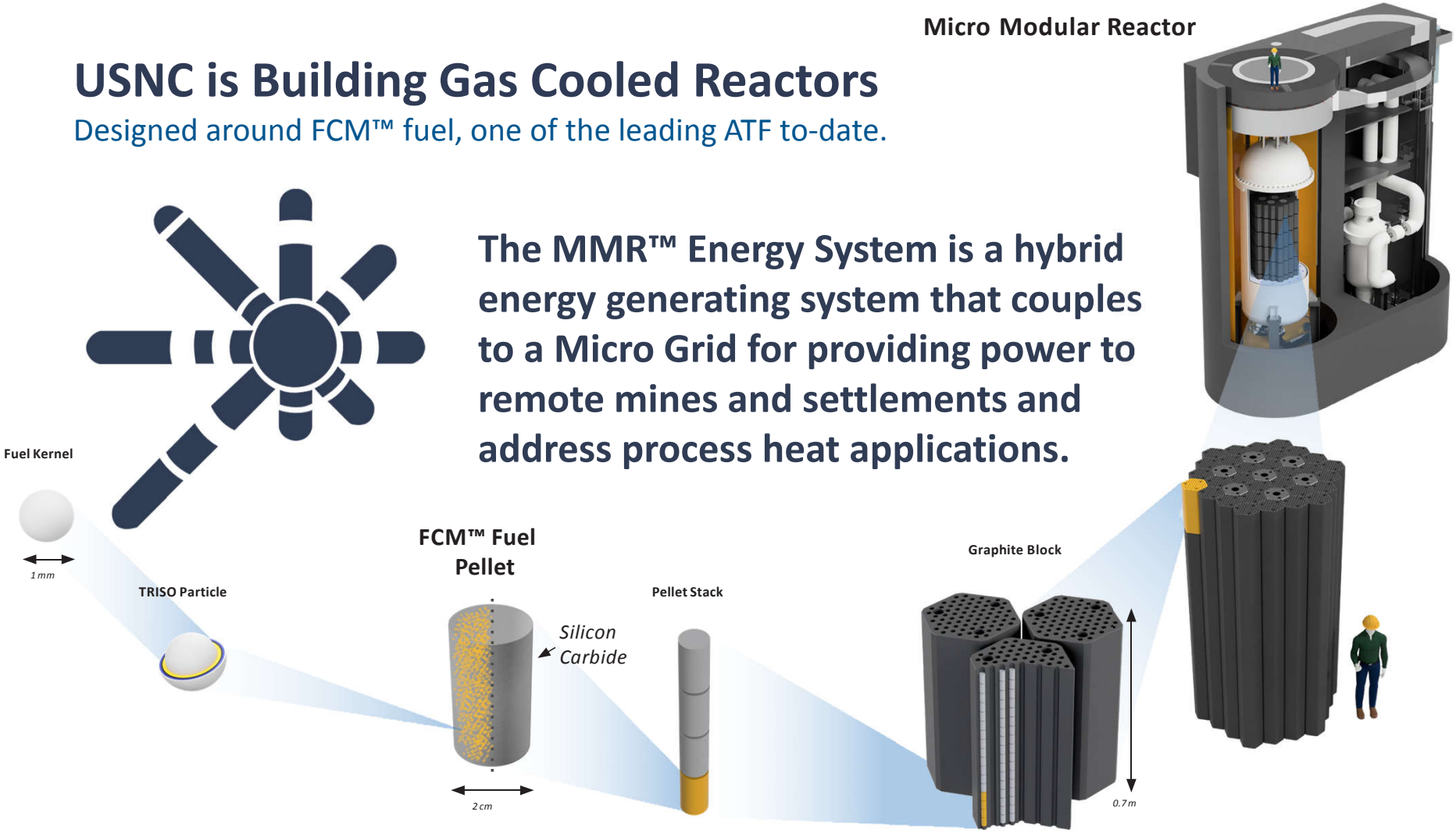
USNC is Building Gas Cooled Reactors

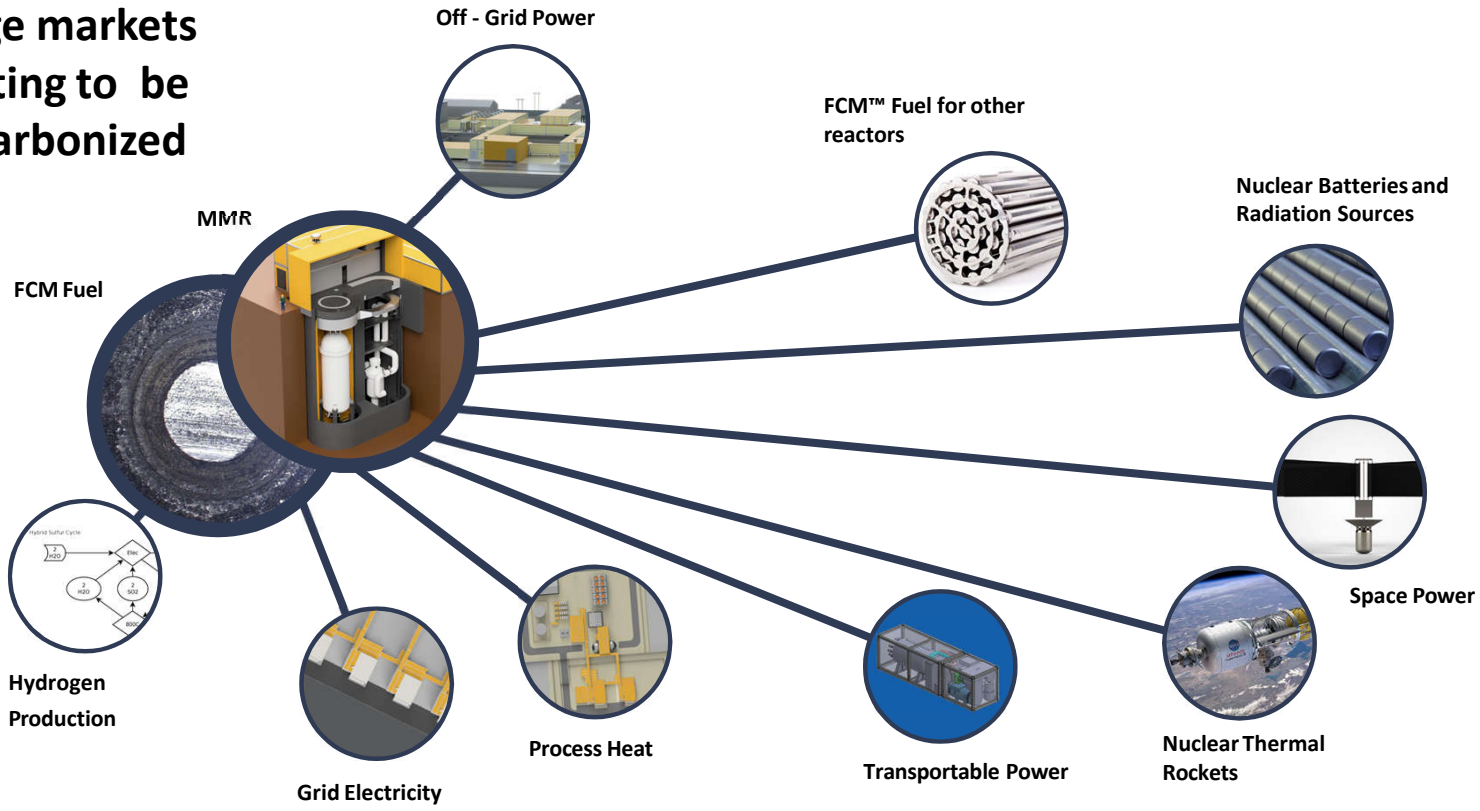
Designed around FCM™ fuel, one of the leading ATF to-date.

The MMR™ Energy System is a hybrid energy generating system that couples to a Micro Grid for providing power to remote mines and settlements and address process heat applications.



USNC-Tech Develops the Next Generation of USNC Systems

Large markets waiting to be decarbonized



Why Go To Space?

Space is Infinite

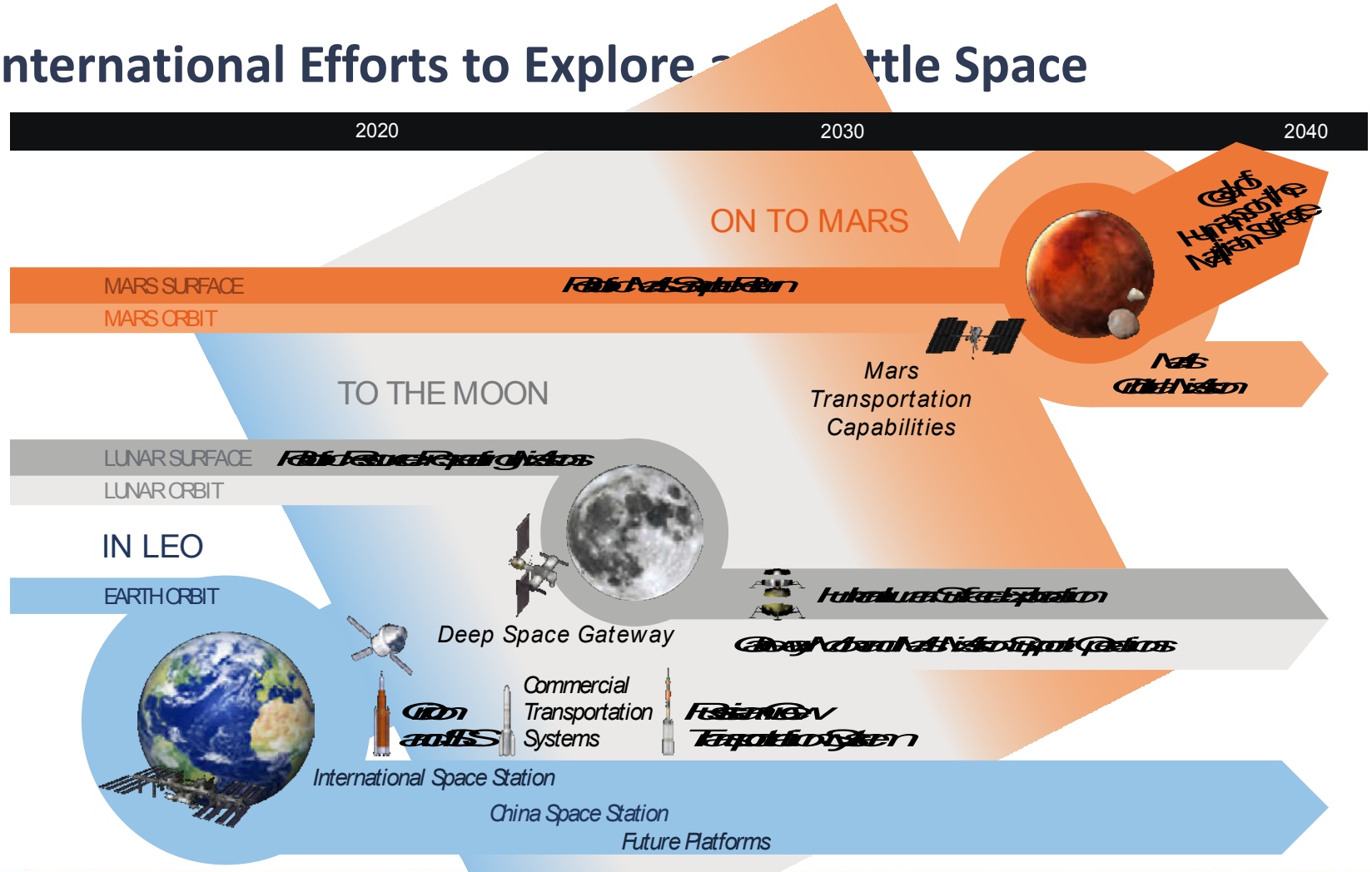
Infinite resources
Infinite room to expand
Infinite problems to study and understand

Why We Explore Space

Fundamental Reasons
- Competition
- Curiosity
- "Cathedral Building"

Quantitative Reasons
- Scientific discovery
- Economic Benefit
- National Security

International Efforts to Explore a ttle Space



What Are We Going to Do in Space?

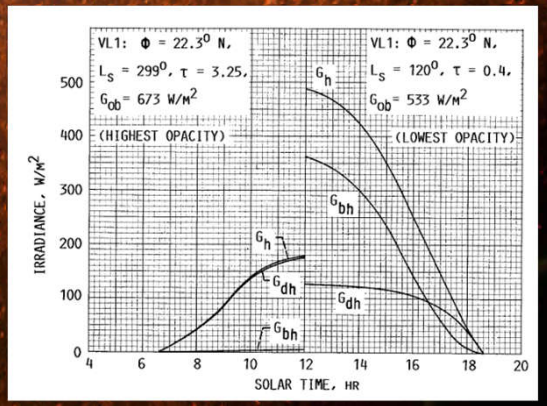

Why Nuclear?
384 Hour Day
400 K
The Moon
Survive the Lunar Night (150 kW_e)
200 ton of
Li-ion Battery or
> 50 tons H_2/O_2 Fuel Cell
vs.
4.5 ton Fission
Reactor System
50 K
384 Hour Night

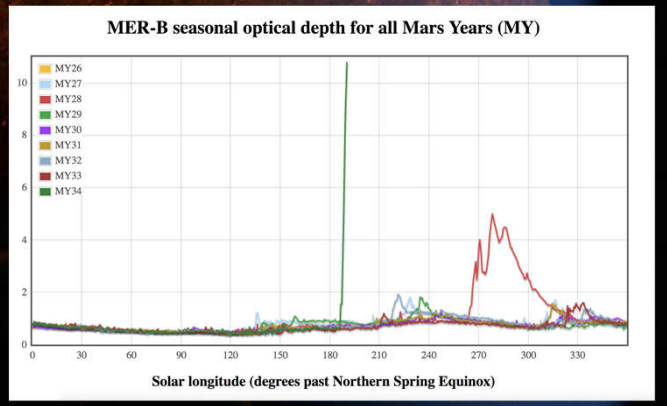
Why Nuclear?

Mars

2018 Global Dust Storm

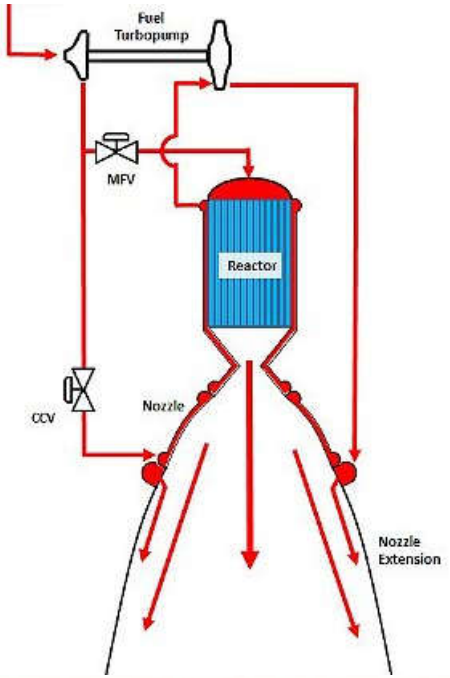
3 Months with the high noon Sun on Mars
as bright as a single full Moon on Earth

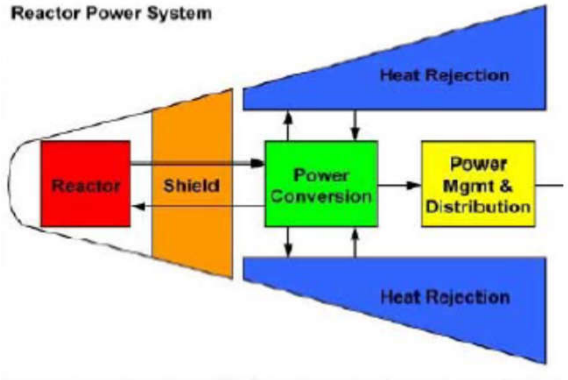


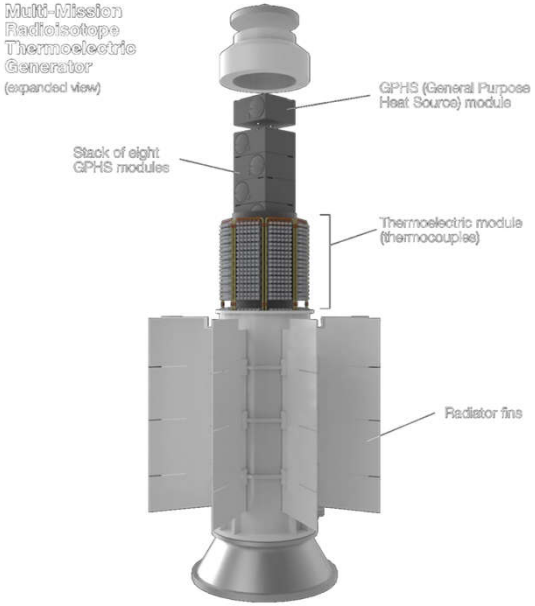


Three Types of Space Nuclear Systems

- Nuclear Thermal Propulsion
  - Nuclear energy for heating a hydrogen propellant.
- Fission Power
  - Nuclear power to generate electricity.
- Radioisotope Power
  - Use decay energy for heat and power.





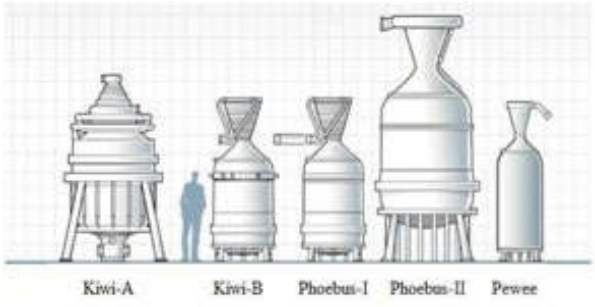


NASA Leading the Way – Kilopower and Nuclear Propulsion

“NASA's Kilopower nuclear reactor would be a space exploration game changer”

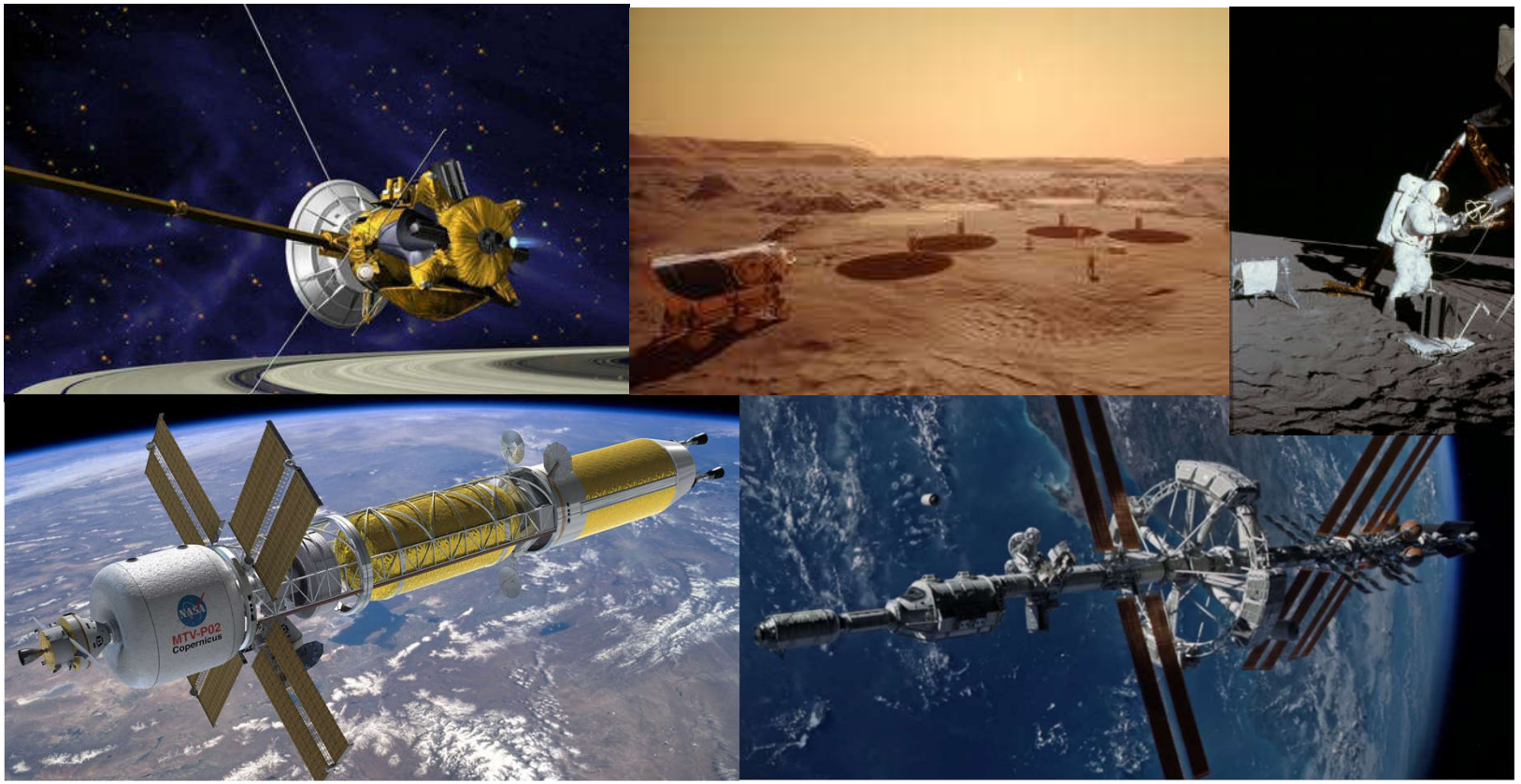
Last year, NASA conducted a successful test of a new nuclear power generator called Kilopower.

“NASA will Flight test a Nuclear Rocket by 2024”



2019 NASA NTP Budget $100 million
2020 NASA NTP Budget $125 million

Find the Nuclear System



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Sampling of USNC-Tech Space Reactor Design

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USNC-Tech Designs, Develops, and Plans to Build Nuclear Reactors

LEU surface fission power reactor for Earth

Permanent power, mobile power, and industrial heat

LEU surface fission power reactor for Space

Power for ISRU, life-support, mining, reprocessing of materials

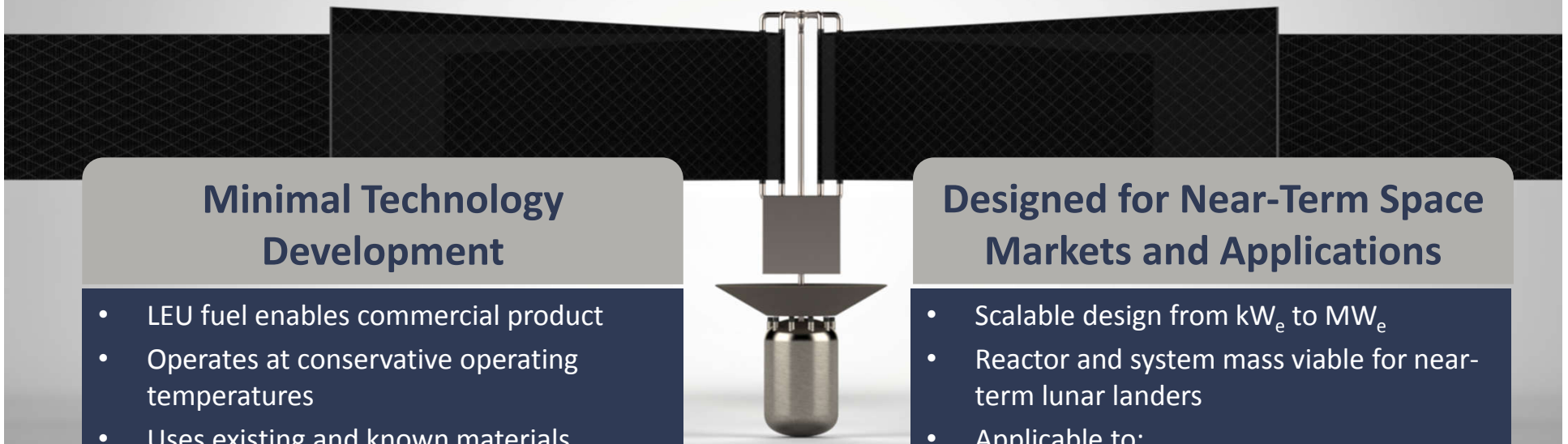
LEU Nuclear Thermal Propulsion (NTP) reactor

Capable of specific impulse (I_{sp}) of 750 s with growth path to > 900 s

LEU Nuclear Electric Propulsion (NEP) reactor

Capable of power density (α) < 20 kg/kW with growth path to < 10 kg/kW

The Pylon: Surface Fission Power for Commercial Space



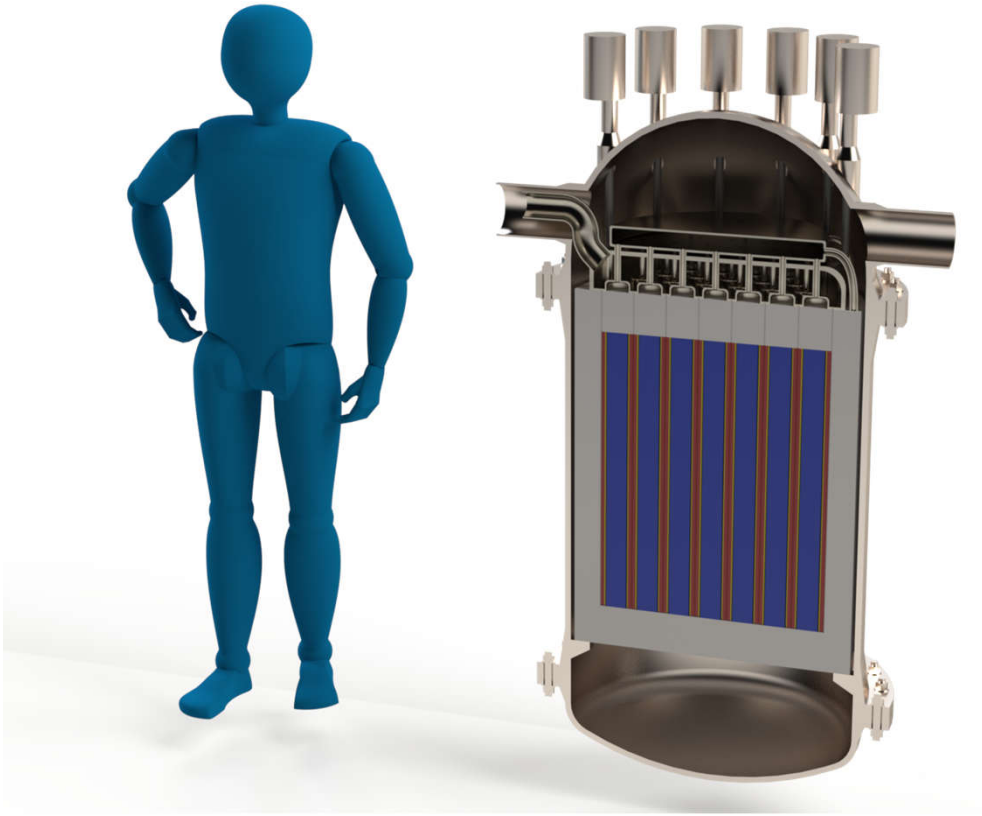
Minimal Technology Development

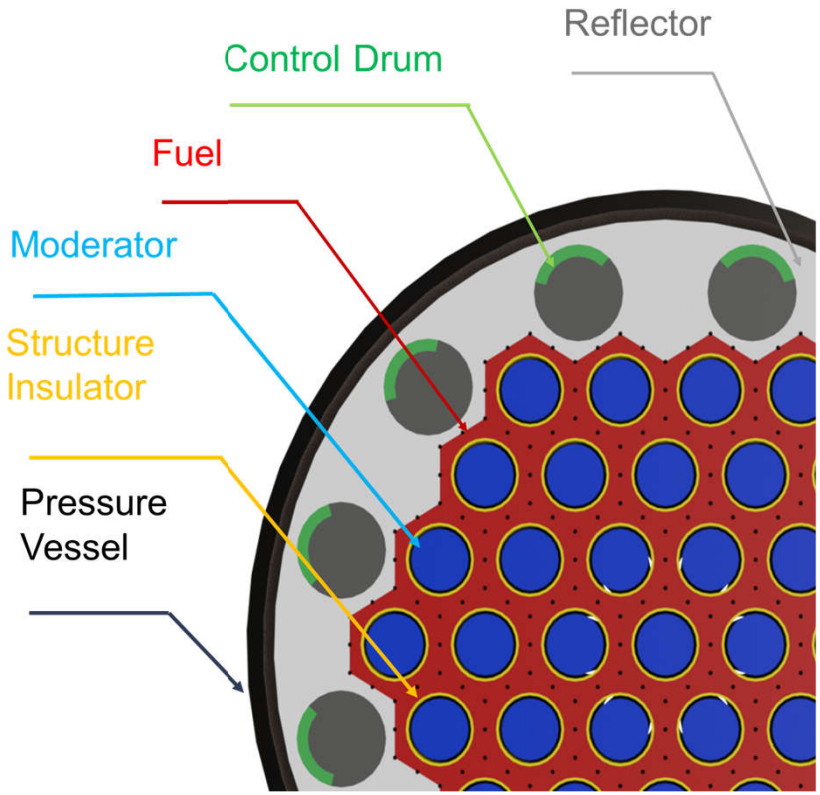
- LEU fuel enables commercial product
- Operates at conservative operating temperatures
- Uses existing and known materials
- Maximizes ability to use modified currently available components

Designed for Near-Term Space Markets and Applications

- Scalable design from kW_e to MW_e
- Reactor and system mass viable for near-term lunar landers
- Applicable to:
  - ECLS
  - ISRU
  - Electrical power
  - Industrial processes

Pylon Reactor





USNC-Tech's Pylon Reactor Concept

Conceptual reactors with conservative performance and scalable power levels

Reactor	Reactor Mass (CBE) (kg)	Power Level (kW_{th})	Power per Reactor Mass (W_{th}/kg)
PYLON-10	950	60	60
PYLON-150	1,500	1000	650
PYLON-1000	3,000	6,000	2,000

Parameter	Value
Reactor Outlet	1,150 K (875°C)
Lifetime	10 years
Uranium Enrichment	19.75 % (LEU)
Fuel Type	FCM™

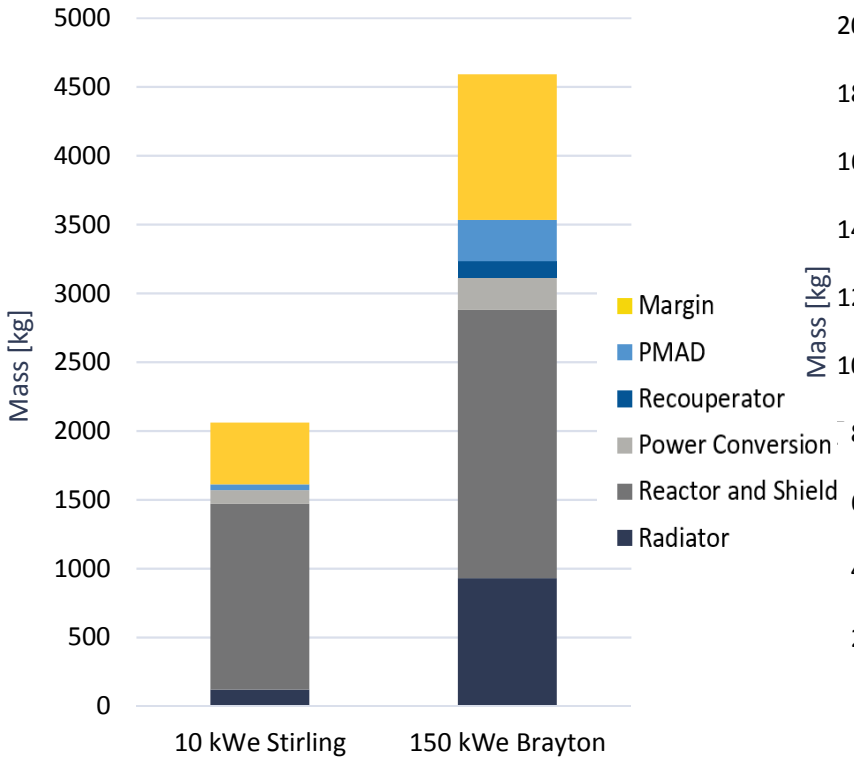
Conceptual model of a 150 kW_e Pylon Reactor

Lunar Pylon System Mass Breakdown

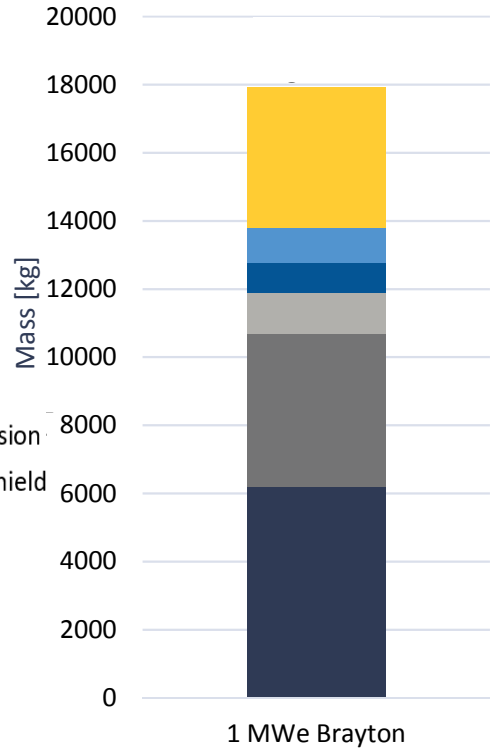
Fits on Lunar Lander Technology

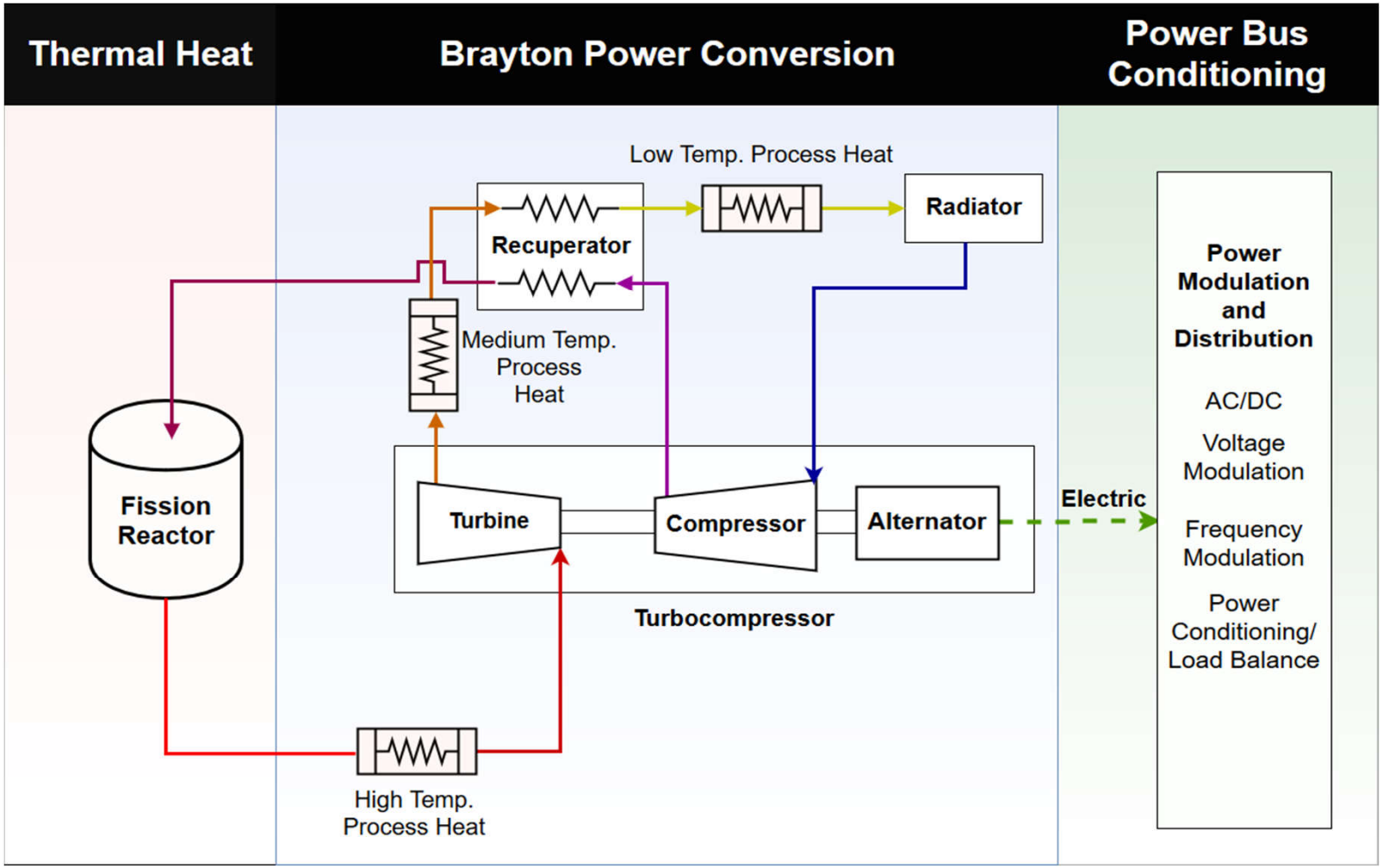
6-ton Blue Moon

3-ton Blue Moon



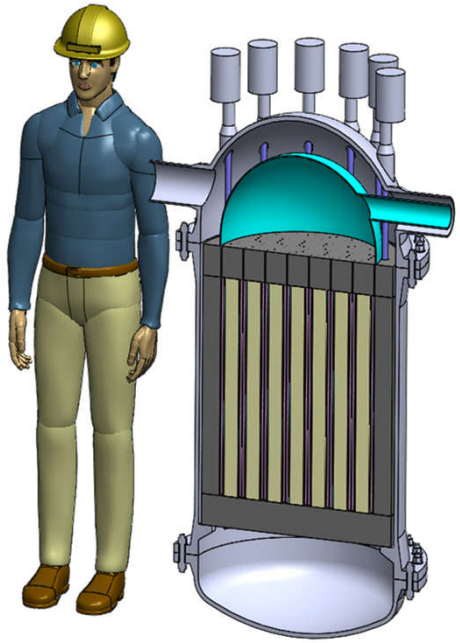
Future Landers





Lunar Pylon

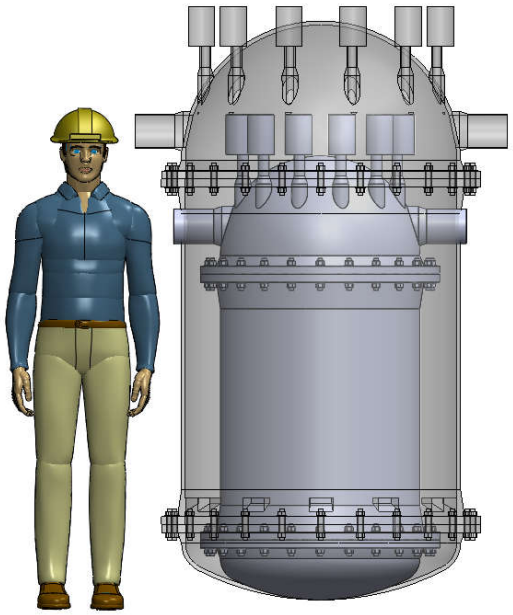
Small commercial fission power system for near term space operations and CLPS class lunar landers such as the Blue Moon. Utilizes a radiator heat rejection system.



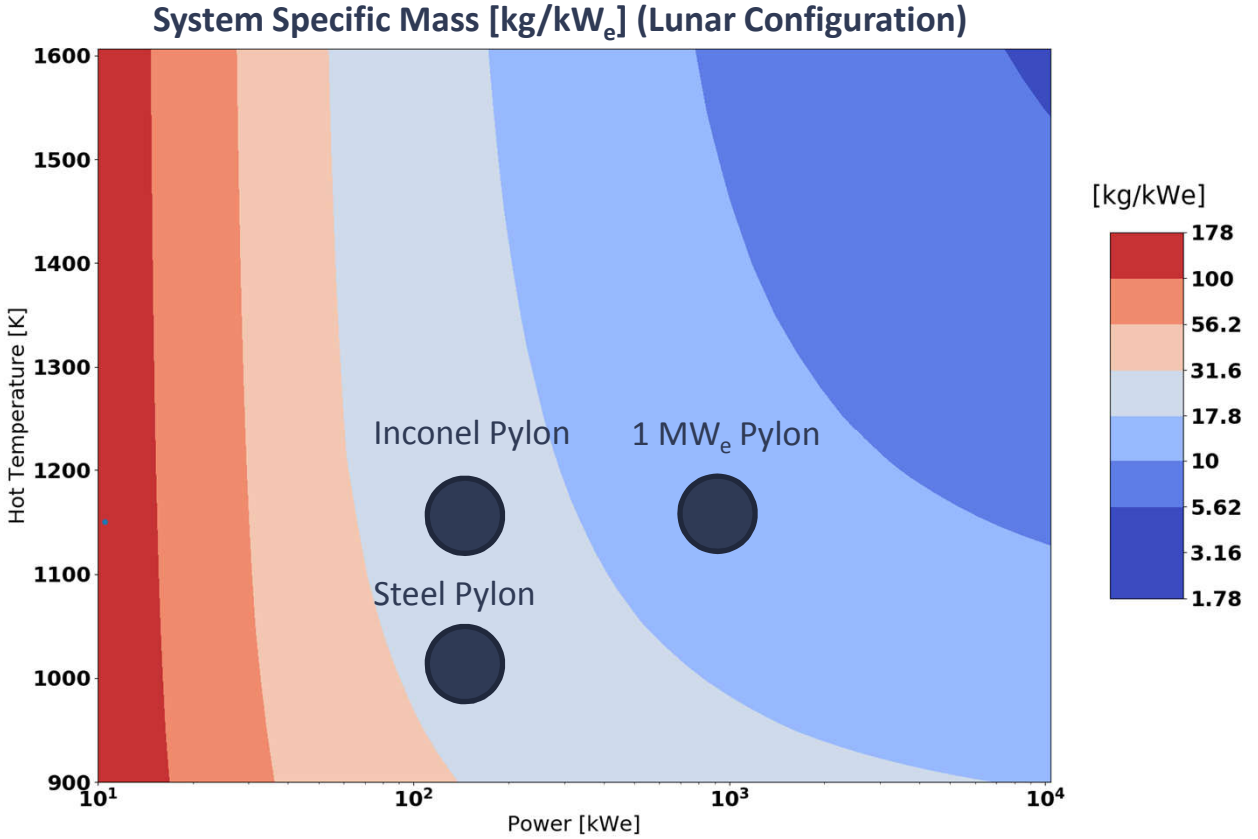
Property	Description
System Power Output	150 kWe
Reactor Mass	1500 kg
System Mass	4500 kg
Turbine Inlet	1150 K (875 °C)
Uranium Enrichment	19.75 % (LEU)
Life time	10 years
Fuel Technology	FCM
Moderator	Hydride
Power Conversion Technology	Direct Brayton Cycle
Efficiency	~ 15%

Nuclear Fission Performance Scales Well to High Power

FCM™ enables specific masses < 10 kg/kWe MWe power levels.



150 kW_e and 1 MW_e Reactor Vessels



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The Finnish Connection with Space Nuclear Technology

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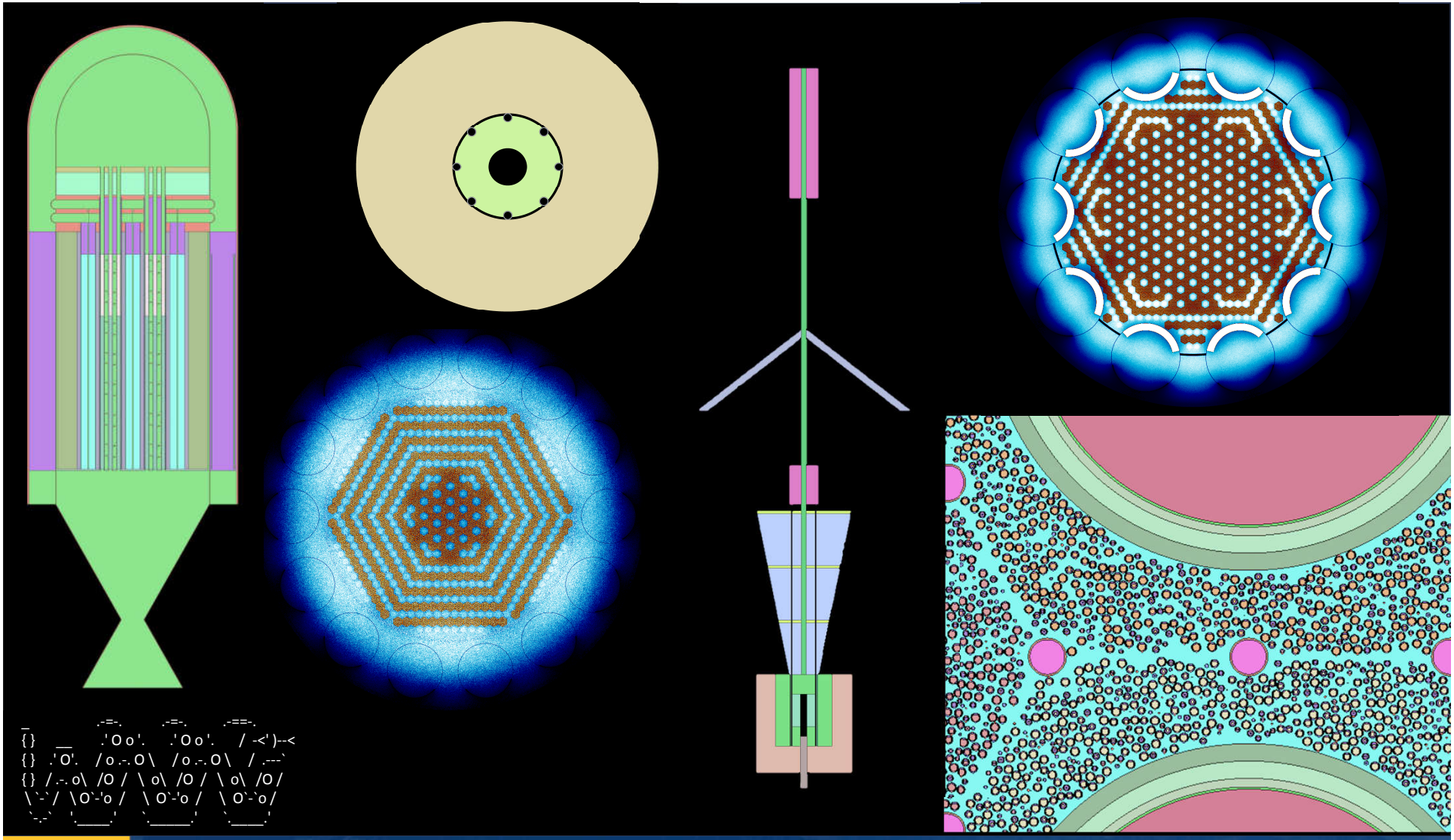

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If you don’t want to go space …

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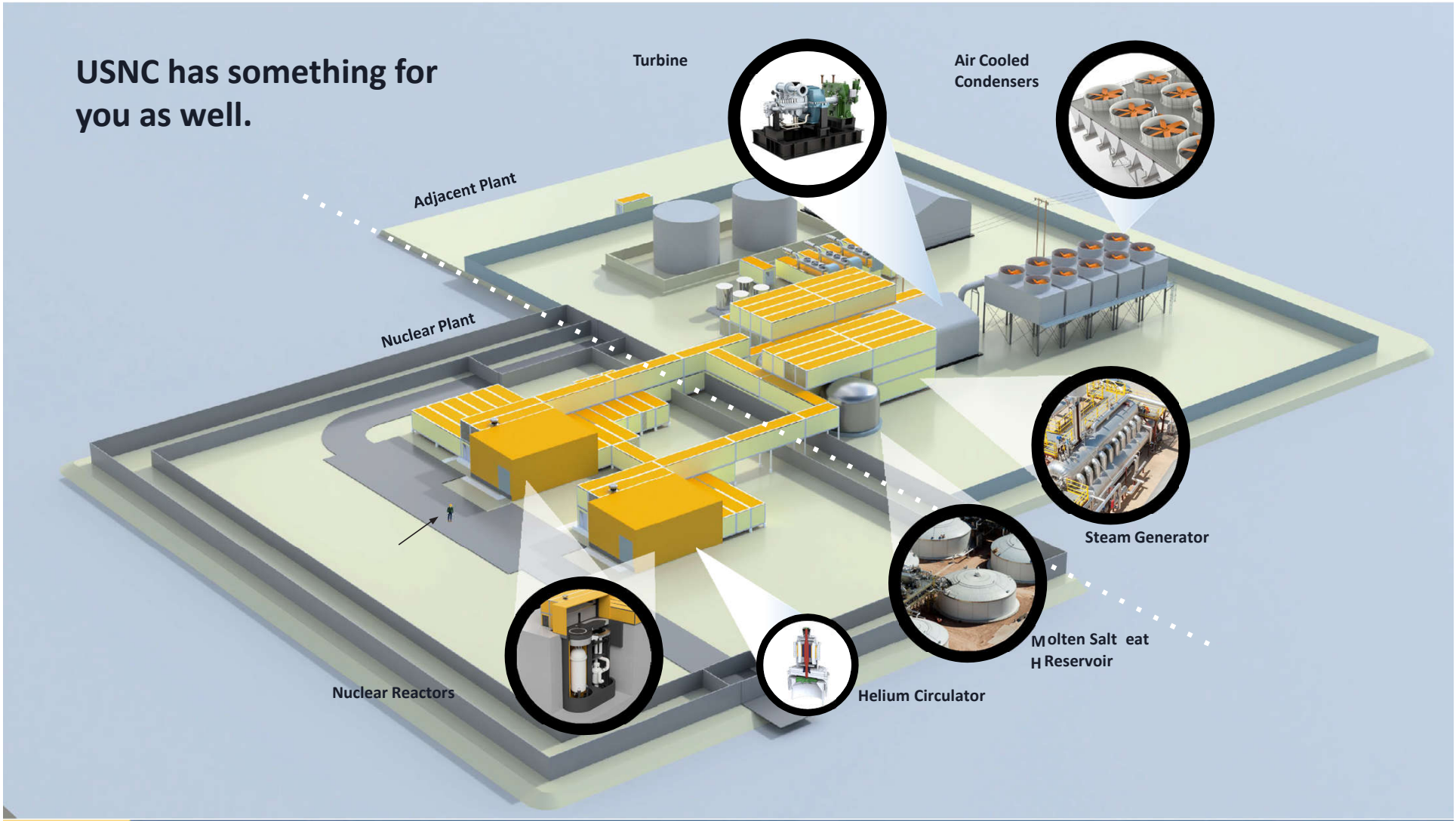
USNC has something for you as well.



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Thank You

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Axiom #1 – Everything must fit in a rocket

Cost to ship 16 metric tons to Mars: $90 million