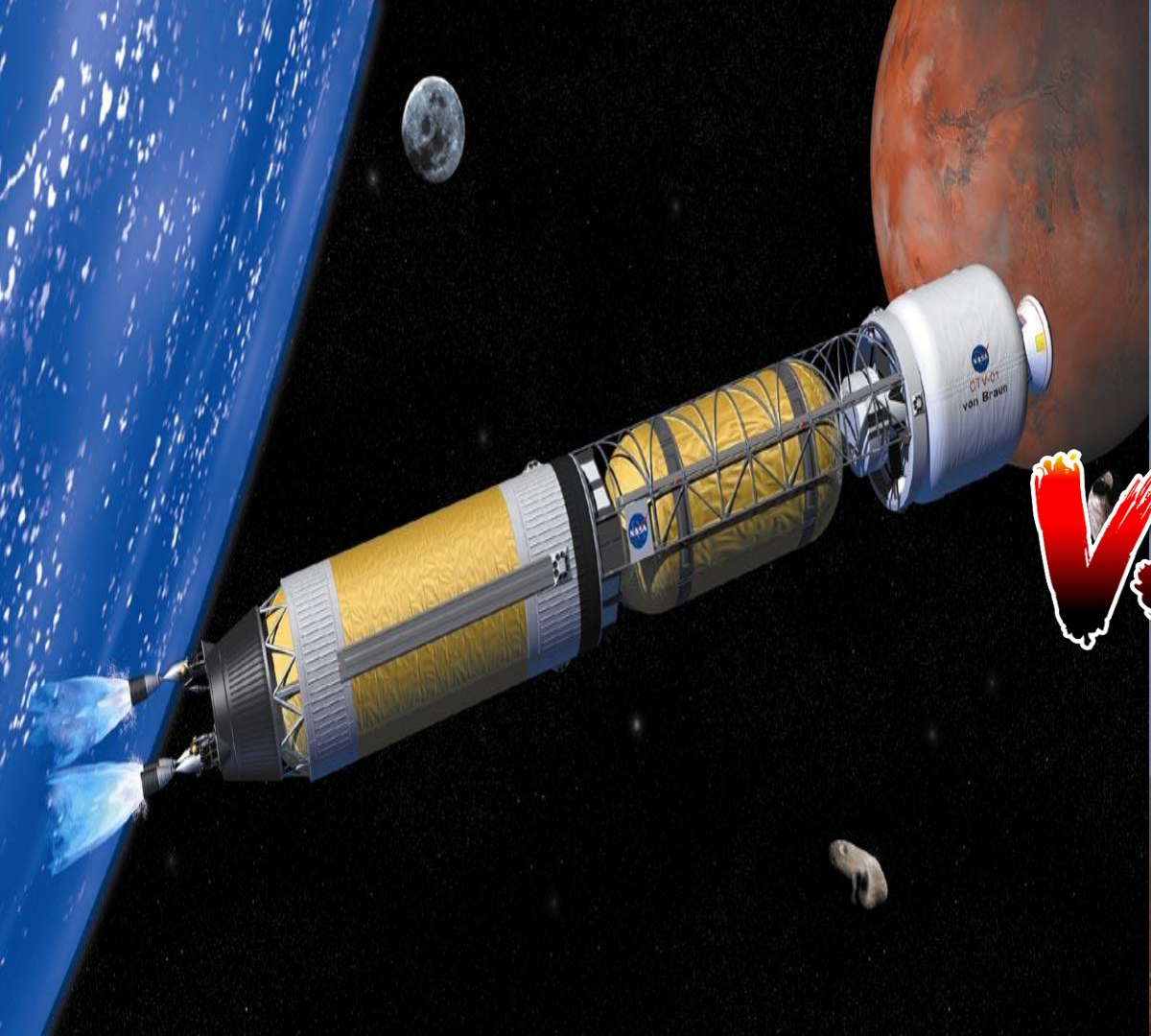


Nuclear Thermal Propulsion Rockets

By - Dhruv Kumar (NIT Agartala)

Overview -

- (a) What are NTP Rockets ?
- (b) Working Of NTP Rockets & Fuel used
- (c) Advantages of NTP Rockets
- (d) Limitations of NTP Rockets
- (e) Risks Associated with NTP Rockets
- (f) Animation for Summary
- (g) How I am going to contribute.



VS



What are NTP Rockets?

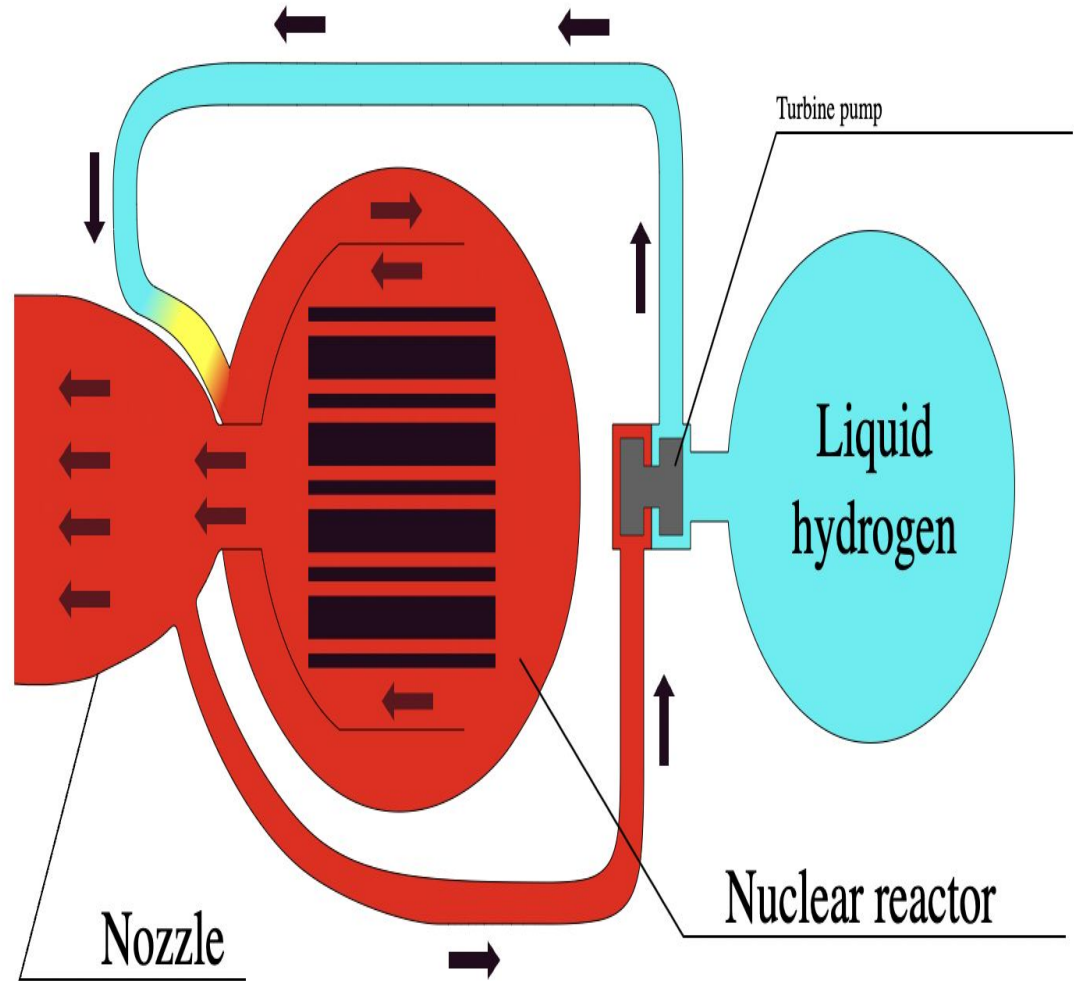
A nuclear thermal rocket (NTR) is a type of thermal rocket where the heat from a nuclear reaction, often nuclear fission, replaces the chemical energy of the propellants in a chemical rocket, usually liquid hydrogen is used as the working fluid.

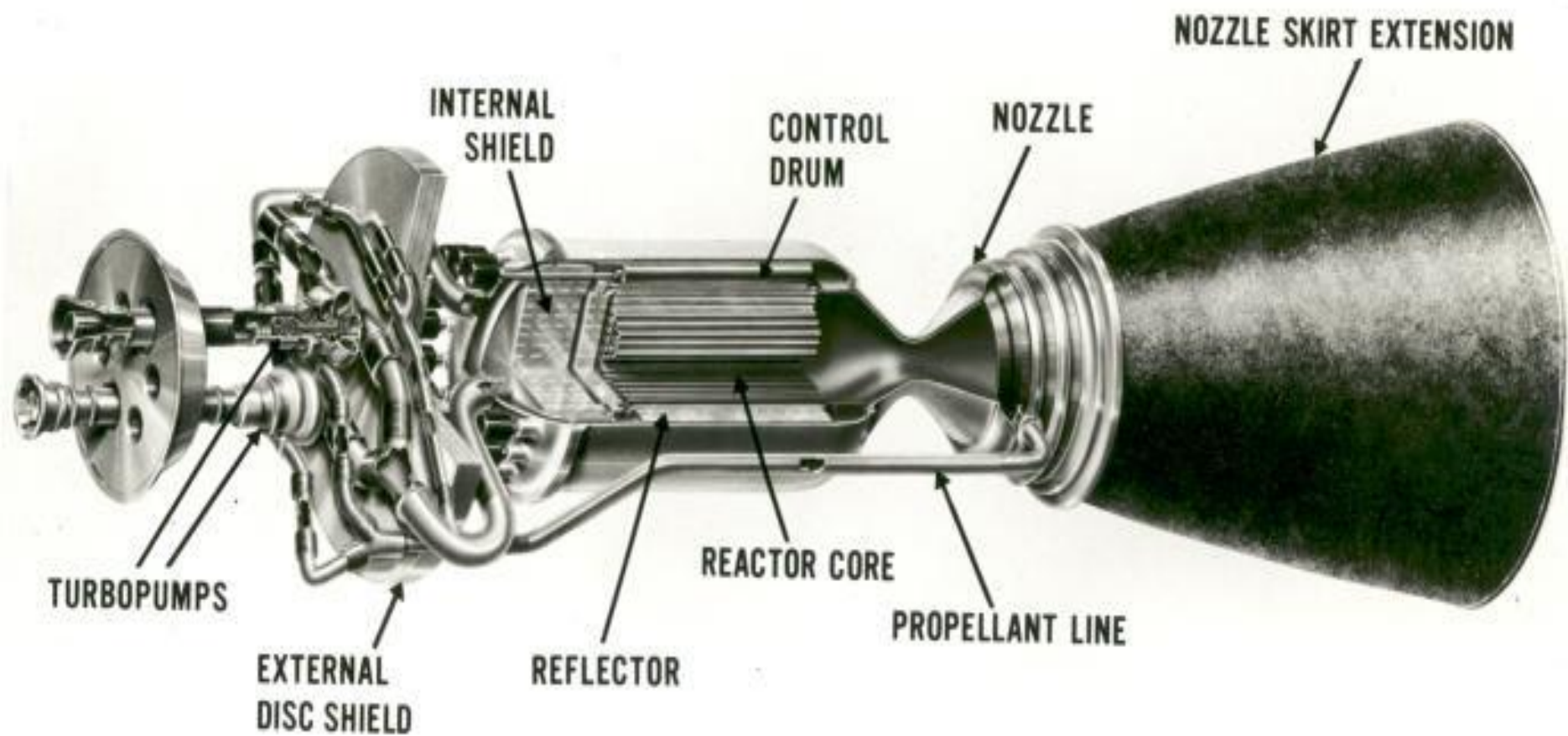
Nuclear thermal propulsion (NTP) systems aren't new, NASA has been working on its development since the early 1960s.

Working -

liquid hydrogen, is heated to a high temperature in a nuclear reactor and then expands through a rocket nozzle to create thrust.

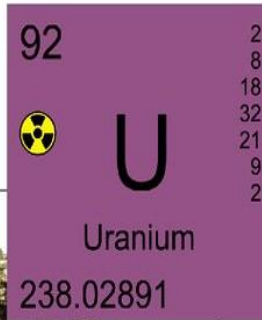
NTR are more efficient as they use low molecular mass propellant.





FUEL

Uranium



A piece of natural uranium ore



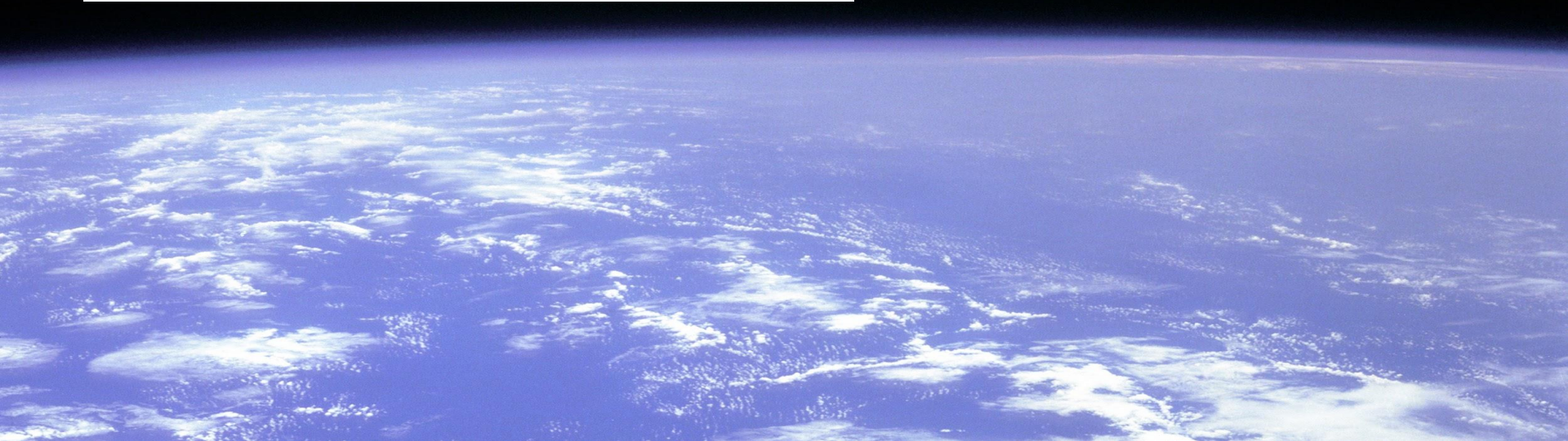
*** NTP Systems Are More Efficient Than Chemical Rockets ***

1} NTP rockets are more energy dense than chemical rockets and twice as efficient.



2} Lighter gases are easier to accelerate. (Low molecular mass)

3} When chemical rockets are burned, they produce water vapor, a much heavier byproduct than the hydrogen that is used in a NTP system. This leads to greater efficiency and allows the rocket to travel farther on less fuel.



4} NTP Systems Will Provide Greater Flexibility -

NTP systems offer greater flexibility for deep space missions. They can reduce travel times to Mars by up to 25% and, more importantly, limit a flight crew's exposure to cosmic radiation. They can also enable broader launch windows that are not dependent on orbital alignments and allow astronauts to abort missions and return to Earth if necessary.

5} NTP Systems Are Focused On Using Low-Enriched Uranium -

DOE is working with NASA to help test, develop and assess the feasibility of using new fuels that require less uranium enrichment for NTP systems. This fuel may be made using new advanced manufacturing techniques and can potentially help reduce security-related costs that come with using highly enriched fuel.

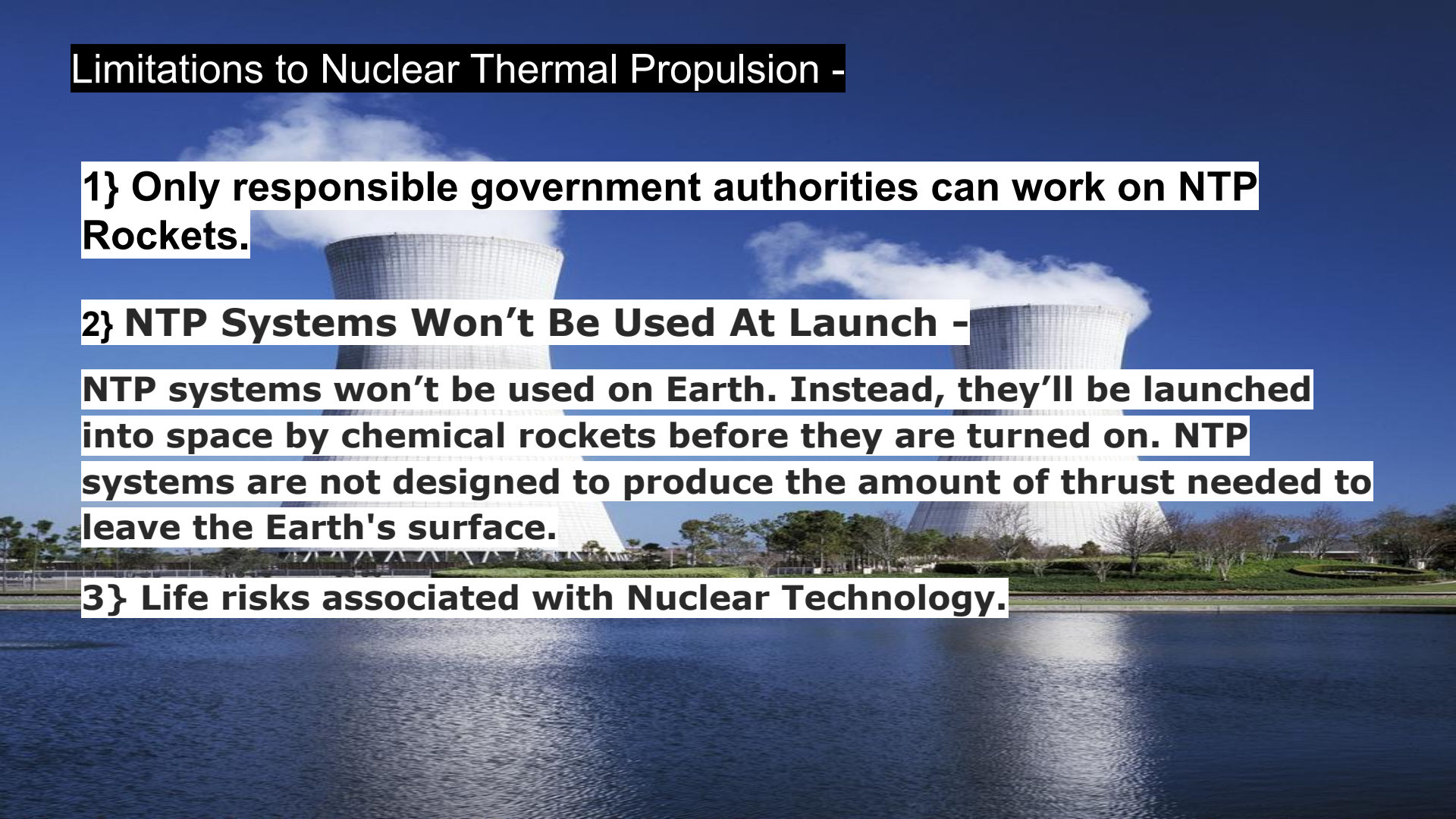
Limitations to Nuclear Thermal Propulsion -

1} Only responsible government authorities can work on NTP Rockets.

2} NTP Systems Won't Be Used At Launch -

NTP systems won't be used on Earth. Instead, they'll be launched into space by chemical rockets before they are turned on. NTP systems are not designed to produce the amount of thrust needed to leave the Earth's surface.

3} Life risks associated with Nuclear Technology.

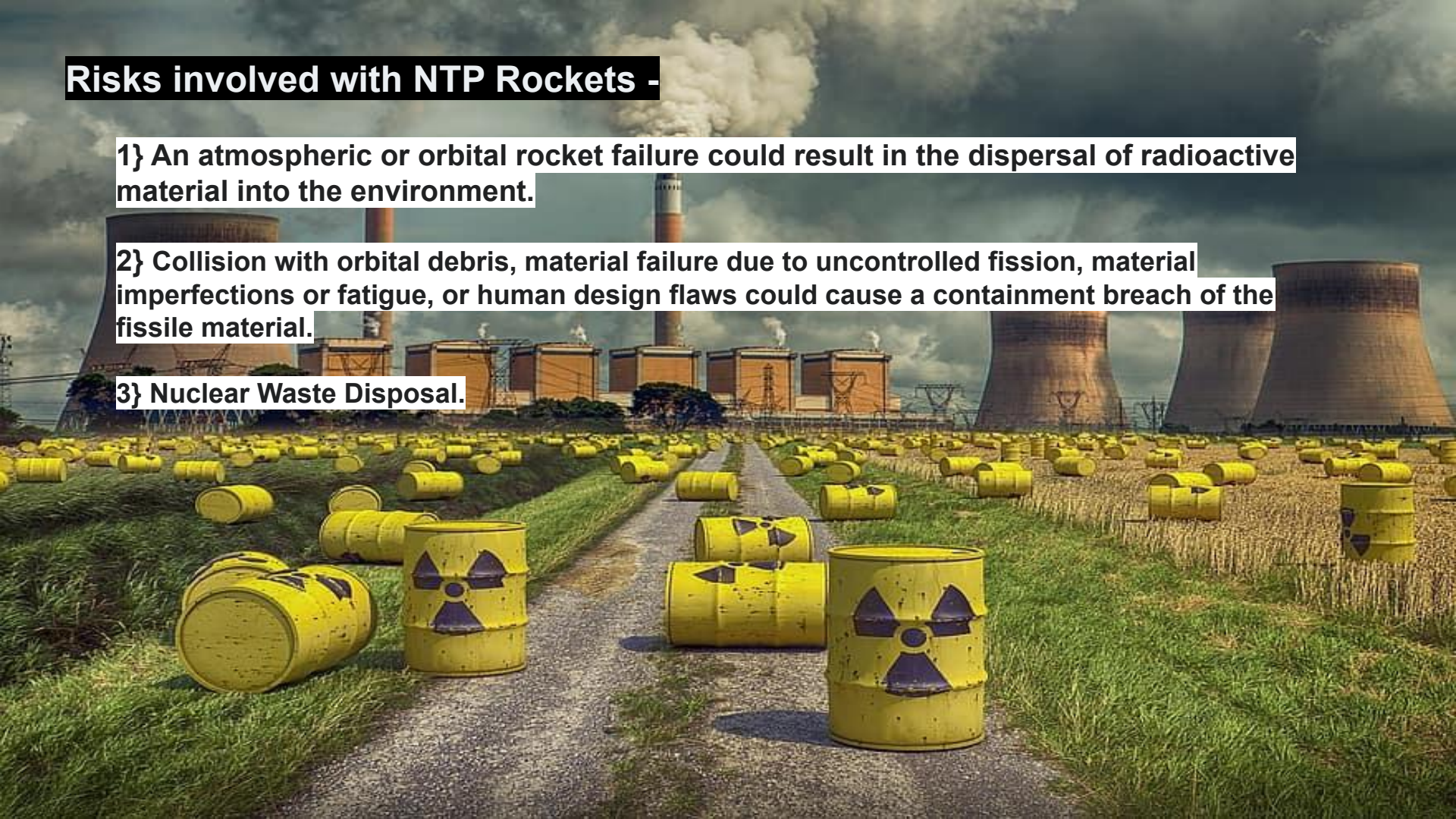


Risks involved with NTP Rockets -

1} An atmospheric or orbital rocket failure could result in the dispersal of radioactive material into the environment.

2} Collision with orbital debris, material failure due to uncontrolled fission, material imperfections or fatigue, or human design flaws could cause a containment breach of the fissile material.

3} Nuclear Waste Disposal.



An aerial photograph of a nuclear power plant facility. A large, intense fire and explosion is occurring in the center, with bright orange and yellow flames rising high into the air. Several large, silver, spherical containment domes are visible in the foreground and to the left of the explosion. The background shows more industrial structures and a road.

Worst Nuclear Accidents in History

“FAILURE IN COOLING SYSTEM”

Fukushima
2011

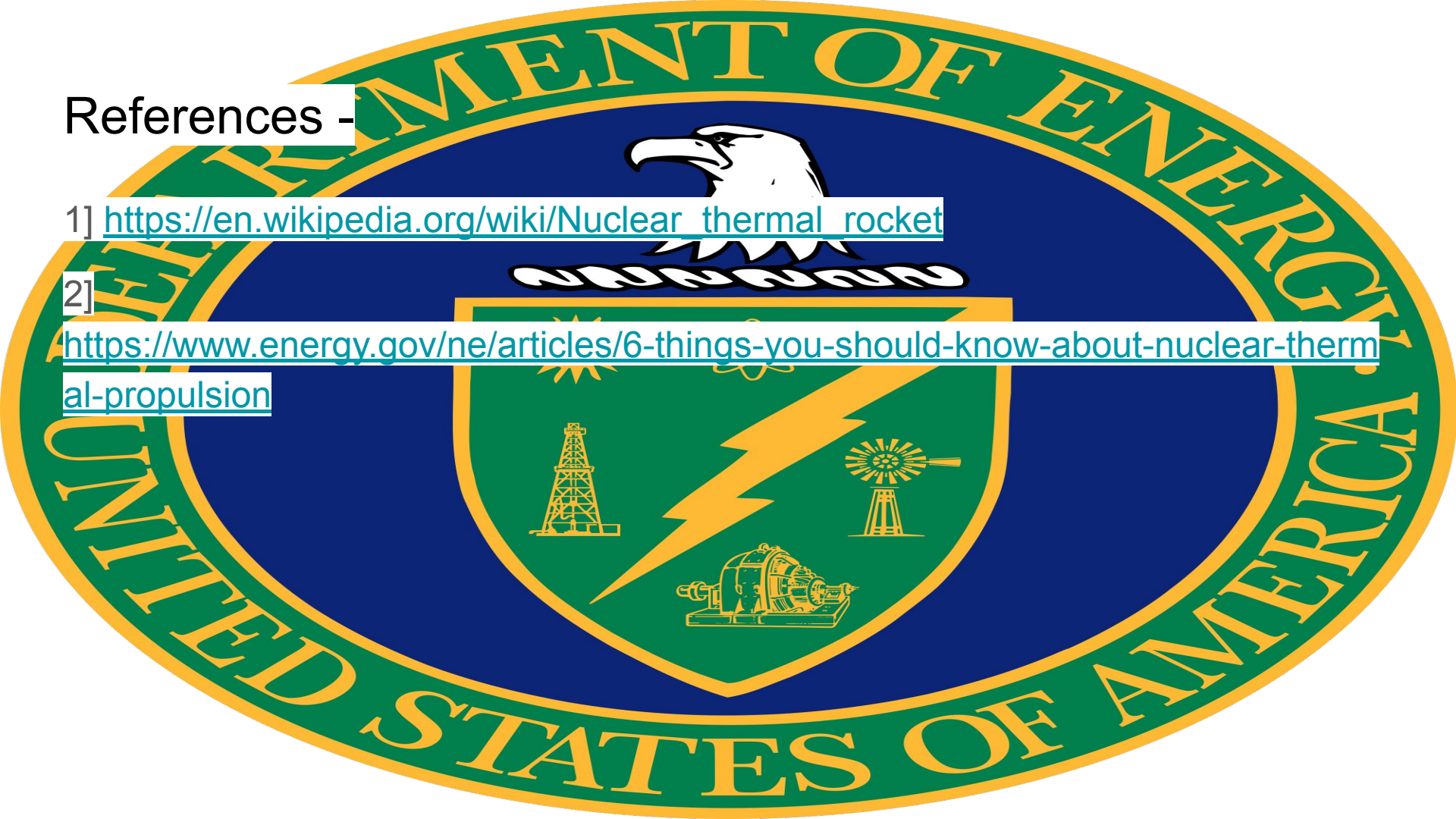
A black and white aerial photograph of the Chernobyl nuclear power plant. The image shows the damaged reactor building with its distinctive containment structure, surrounded by various industrial buildings and infrastructure. A large, arched containment structure is visible in the upper right corner. The overall scene depicts the aftermath of the accident.

Chernobyl
1986

References -

1] https://en.wikipedia.org/wiki/Nuclear_thermal_rocket

2] <https://www.energy.gov/ne/articles/6-things-you-should-know-about-nuclear-thermal-propulsion>



HOW I AM GOING TO CONTRIBUTE ?

I am currently working with **ORBITX INDIA AEROSPACE (p) LTD**

And will continue it as a **Student Project at Space Technology Incubation Centre (ISRO) , National Institute of Technology, Agartala, Tripura**





THANK YOU

A string of eight colorful paper cards is hanging from a thin, light-colored twine. Each card is held in place by a small wooden clothespin. The cards are arranged in a slightly staggered fashion. The first card is red and features a large, dark blue letter 'T'. The next four cards are light blue, yellow, light blue, and yellow, each featuring a large, dark blue letter: 'H', 'A', 'N', and 'K' respectively. The final three cards are light green, yellow, and light green, each featuring a large, dark blue letter: 'Y', 'O', and 'U' respectively. The background is a dark brown, vertically-grained wooden surface.



Q & A