Rolls-Royce Micro-Reactor for Defence Applications

Abi Clayton – Director, Future Programmes

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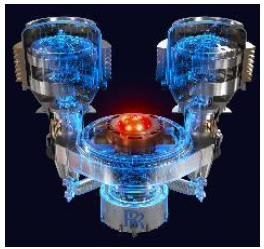
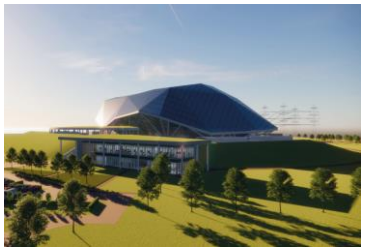
What is a Micro Nuclear reactor?

Micro-Reactor: 1 – 10 MW

Decay Heat	Space	Terrestrial	Submarines	Rolls-Royce SMR
				
1 kW	1 MW	10 MW	10’s MW	0.5 GW

Micro Nuclear is not a new idea

US Army

ML1 Reactor (0.5 MW)

~1965

US Portable Reactor

PM-2A (2 MW)

~1965

US Space Reactor

SNAP-10A (10 kW)

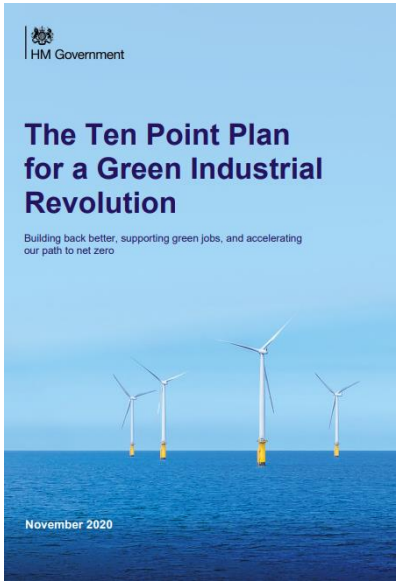
~1965

US Navy Submarine

NR-1 (~5 MW)

1969 - 2008

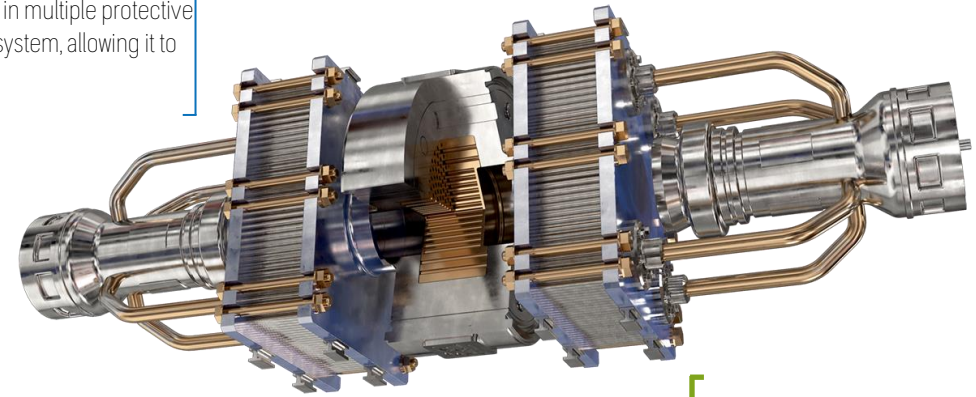
The Need for Change



World Leading Technology

SAFE AND ROBUST
A Rolls-Royce Micro-Reactor is designed to use an inherently safe and extremely robust fuel form. Each uranium particle is encapsulated in multiple protective layers that act as a containment system, allowing it to withstand extreme conditions.

MULTIPLE APPLICATIONS
Providing power for permanent infrastructure, electric propulsion systems, resource extraction and utilisation, including fuel production.



POWER DENSE
Providing the high-power required to reliably support operational demands, independent of environment or conditions to decarbonise the planet.

DEPLOYABLE
Self contained system within the spatial constraints of a shipping container, allowing for transport by road, rail, air, sea and space.

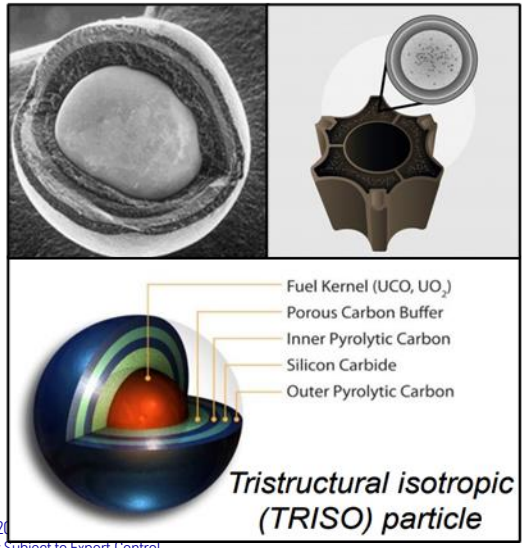
MISSION READY
Designed for rapid deployment and black-start capability, with a lifetime that's tailored to mission duration.

FLEXIBLE POWER
Flexible power and output heat as required, with a design that scales according to specific operational demands.

Generation IV Technology: The Enablers

Coated Particle

Low Enriched Uranium Fuel

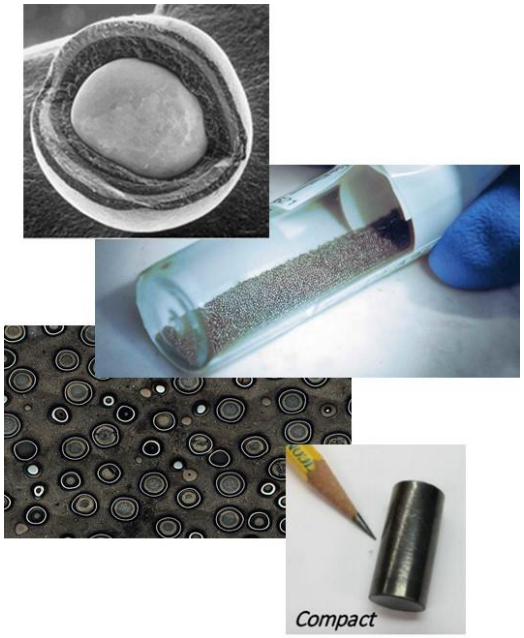


Micro Turbine Generator Design

Heat Pipe Reactor Test

Coated Particle Fuel / Accident Tolerant Fuel

Fuel Kernel	HALEU Uranium Dioxide or Carbide Fuel
Porous Carbon	Absorbs gaseous fission products
Pyrolytic Carbon	Structural protective layer
Silicon Carbide	High temperature protective layer
Pyrolytic Carbon	Secondary structural outer layer
Core	Particles restrained within core matrix



Accident Tolerant Fuel is an essential fuel form for deployable Micro-Reactor safety

Requirements

Product Development

Prototypes
Suitable UK Site

FOAK
UK MOD Site e.g: HMNB Portsmouth, RAF Fylingdales

First Deployment
MOB or FOB, abroad

Multiple Applications

Space

- Permanent Infrastructure
- Human Habitation
- Nuclear Electric Propulsion
- In-Situ Resource Utilisation
- Nuclear Propulsion
- Satellite Power

Maritime

- Floating Power Stations
- Portside Power & Hotel Loads
- Synthetic Fuel & Hydrogen Production
- Vessel Power & Propulsion
- Vessel/Vehicle Charging

Land

- Critical Infrastructure
- Baseload & Transient Power
- Green Industrial Power & High Quality Process Heat
- Remote Power
- Vehicle Charging