



TRTR

National Organization of Test,
Research and Training Reactors




Kairos Power

Hermes Demo Reactor Update

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19 JUNE 2023



Kairos Power's mission is to enable the world's transition to clean energy, with the ultimate goal of dramatically improving people's quality of life while protecting the environment.

In order to achieve this mission, we must prioritize our efforts to focus on a clean energy technology that is *affordable* and *safe*.

Overview of Kairos Power

- Nuclear energy engineering, design, and manufacturing company *singularly focused* on the commercialization of the fluoride salt-cooled high-temperature reactor (FHR)
 - Founded in 2016
 - 339 Employees (~90% Engineering Staff)
- Novel approach to nuclear development that includes iterative hardware demonstrations and in-house manufacturing to achieve disruptive cost reduction and provide true cost certainty
- Schedule driven by US demonstration by 2030 (*or earlier*) and rapid deployment ramp in 2030s
- Cost targets set to be competitive with natural gas in the US electricity market

Kairos Power Headquarters



Kairos Power Team



Kairos Power Locations and Infrastructure



HQ / R-Lab / S-Lab
Alameda, CA



T-Facility / Engineering Test Unit
Production Development Facility
Albuquerque, NM



Molten Salt Purification Plant
Elmore, OH

Instrumentation Labs
Rexford, NY

Hermes Reactor
Oak Ridge, TN

Licensing Office
Charlotte, NC

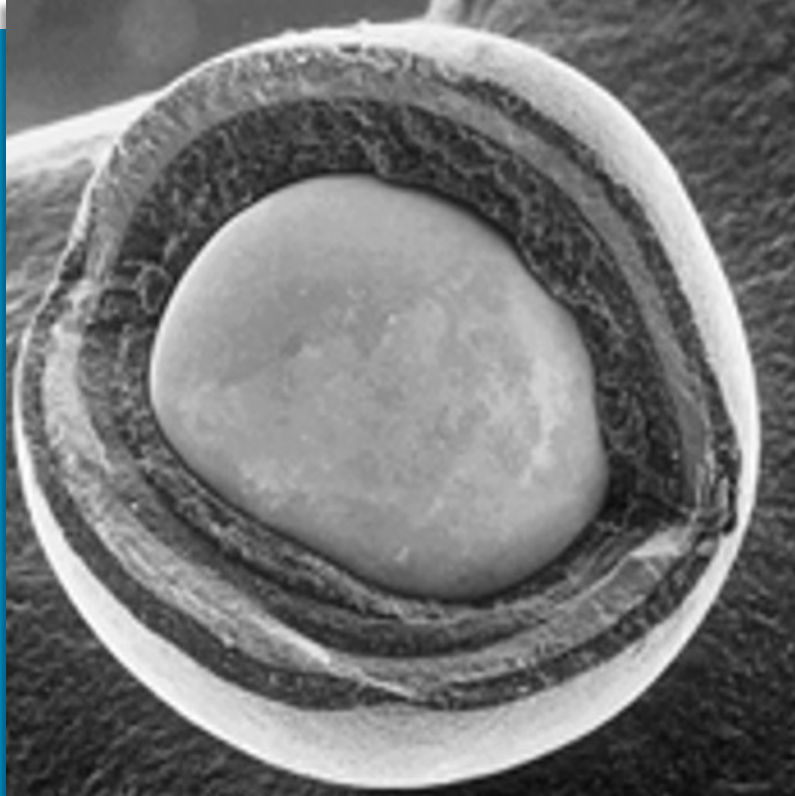


Kairos Power Facilities

- RAPID Lab
- Salt Lab
- Testing Facility

Fluoride Salt-Cooled High Temperature Reactor

Technology Basis



Coated Particle Fuel
TRISO

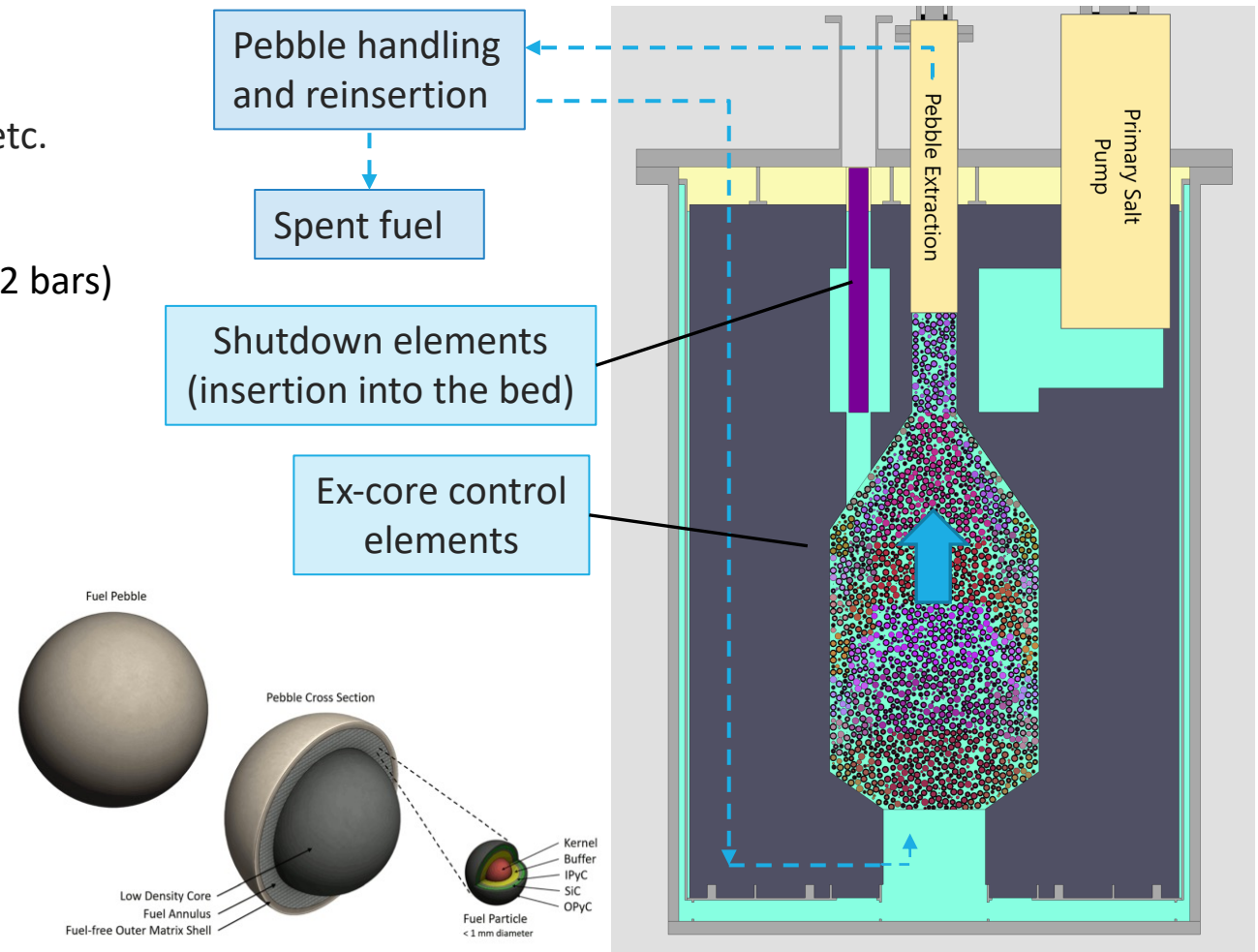


Liquid Fluoride Salt Coolant
Flibe ($2\text{LiF}\cdot\text{BeF}_2$)

Hermes Reactor Description

Licensing following non-power regulations in 10 CFR 50, using guidance in NUREG-1537

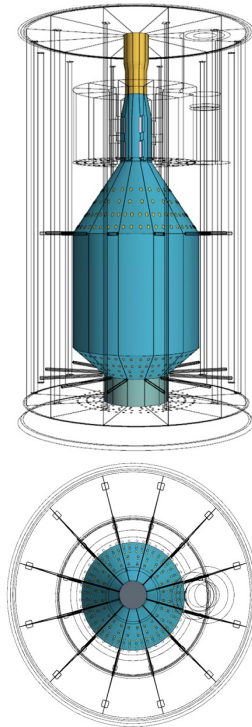
- Graphite reflector
 - Machined graphite blocks
 - Penetrations for flow, control rods, instrumentation, etc.
- Flibe coolant
 - High temperature, low pressure system (550-650°C, <2 bars)
- Pebble bed core:
 - 4-cm diameter graphite pebbles
 - Fuel: ~6 g U in TRISO, ≤ 20% U-235
 - Pebbles move through the core in 30-50 days
 - Reinserted or discharged once design burnup limit is reached
- Core design methodology described in “KP-FHR Core Design and Analysis Methodology” (KP-TR-017)



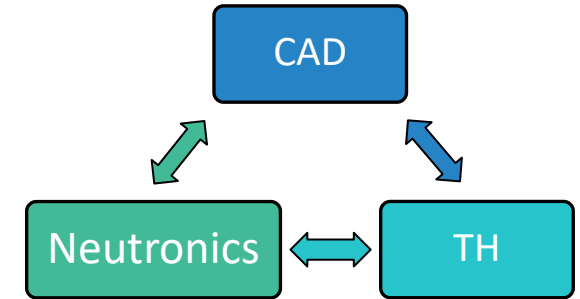
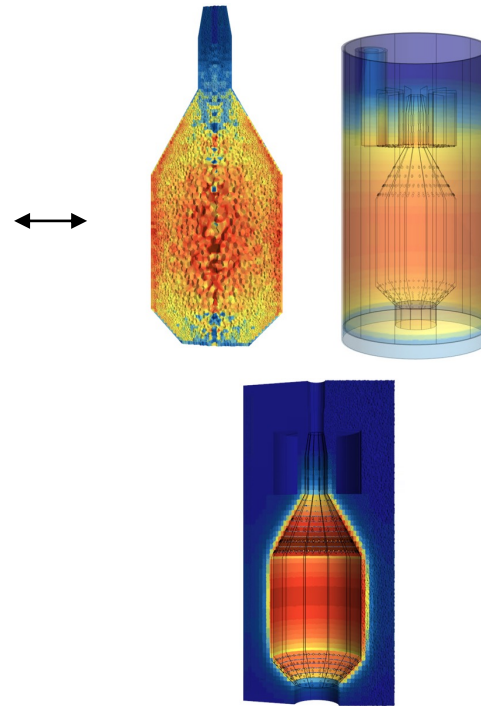
Hermes Nuclear Design

- Iterative Multiphysics Modeling to provide rapid and informed system design updates
- Coupled Methodology tools for safety analysis
 - Reactor kinetics parameters
 - Control rod worth and shutdown margin
 - Reactivity coefficients
 - Power distribution
- Design verification and Method validation through operational testing
 - 1/M approach to criticality via fuel loading and via control rods
 - Zero & Lower power testing
 - Power ascension and system/plant responses

System Design (CAD)



Nuclear Design & Methods (Neutronics, DEM, TH)



Figures of Merit

Neutronics

- Power profile
- Radiation transport

Thermal Hydraulics

- Temperature profiles
- Flow characteristics

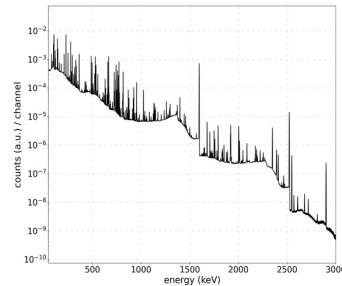
Pebble Dynamics

- Pebble motion
- Packing fraction

Codes and Tools

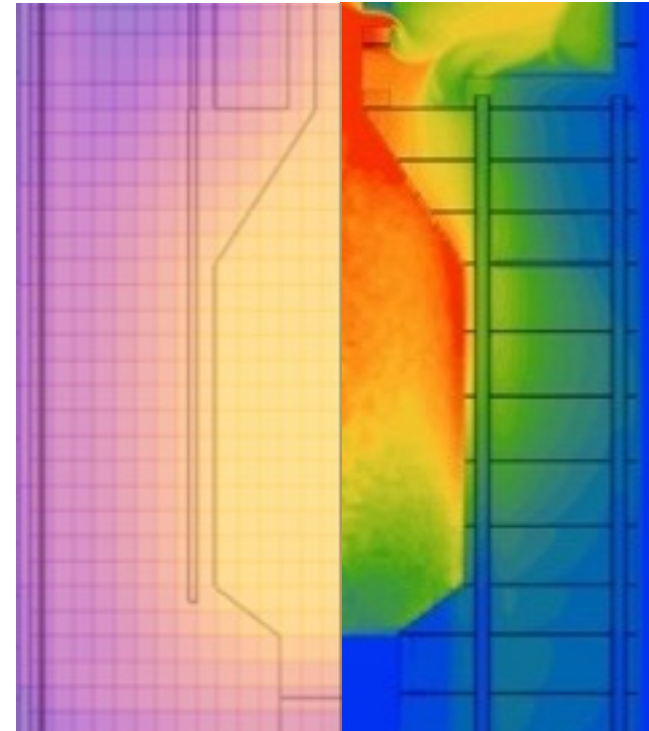
- Serpent 2
- STAR-CCM+
- KP-BISON
- ANSYS
- In-house tools: KPACS, KPATH, KP-SAM
- Code-to-code V&V with MCNP and SCALE

- Fuel depletion
- Source term
- Flibe activation
- Materials qualification
- Criticality safety
- Shielding and dose



- Burnup Measurement

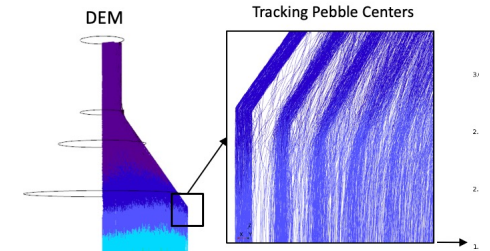
Neutronics and radiation transport



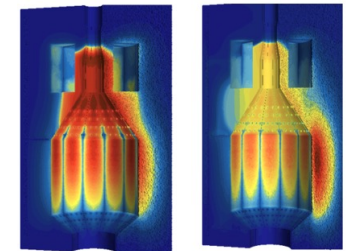
Fast flux

Temperature

Multi-physics modeling



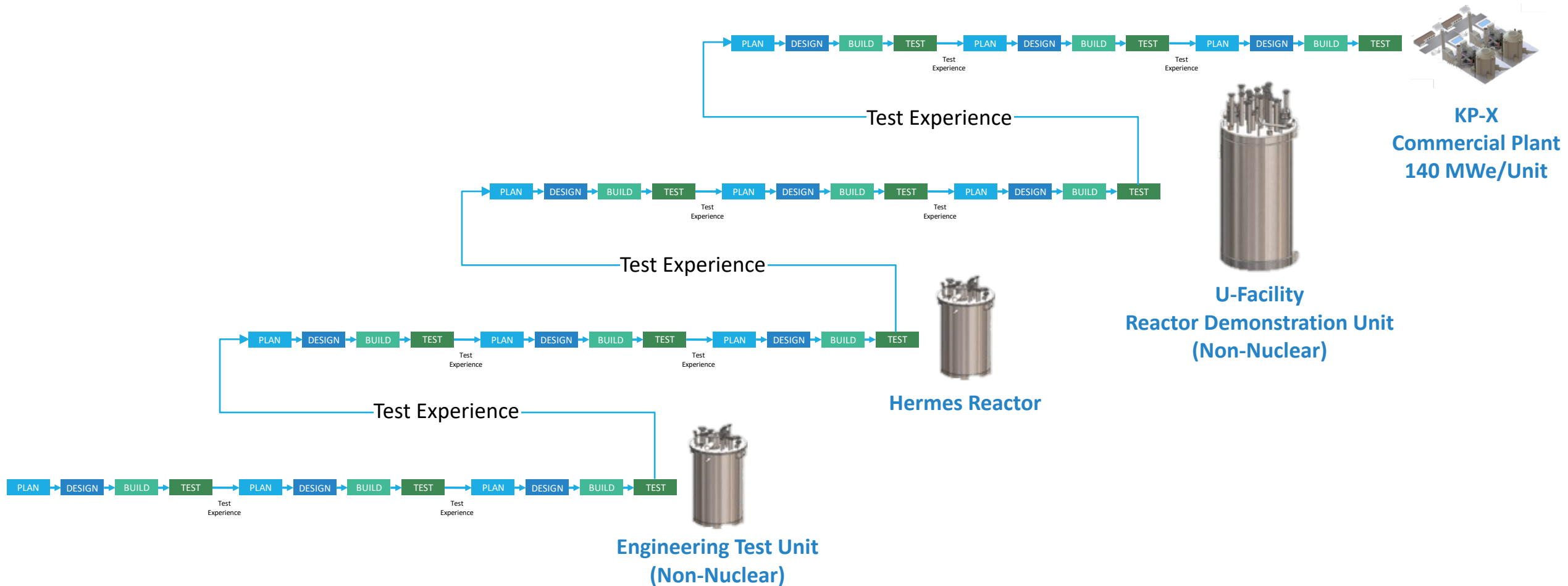
- Discrete elements modeling



- Computational fluid dynamics
- Thermal analysis
- Stress analysis

Kairos Power Path to Commercialization

Successive Large-Scale Integrated Demonstrations



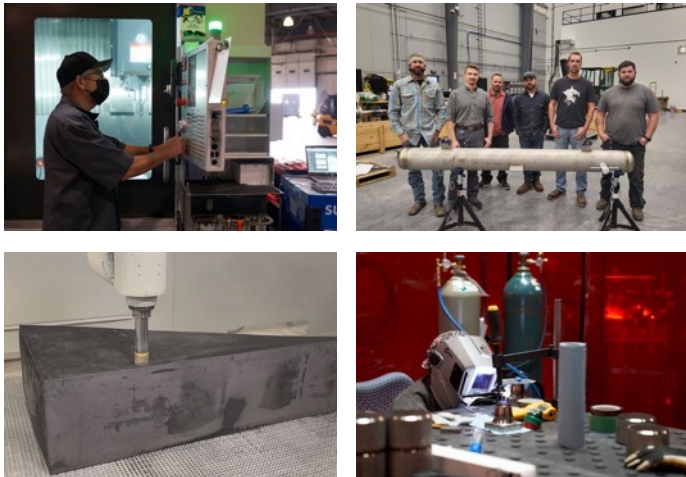
Vertical Integration

Delivering Cost Certainty

Kairos Power has made significant investments in infrastructure to de-risk the supply chain and deliver cost certainty, vertically integrating production or assembly of components and materials that are:

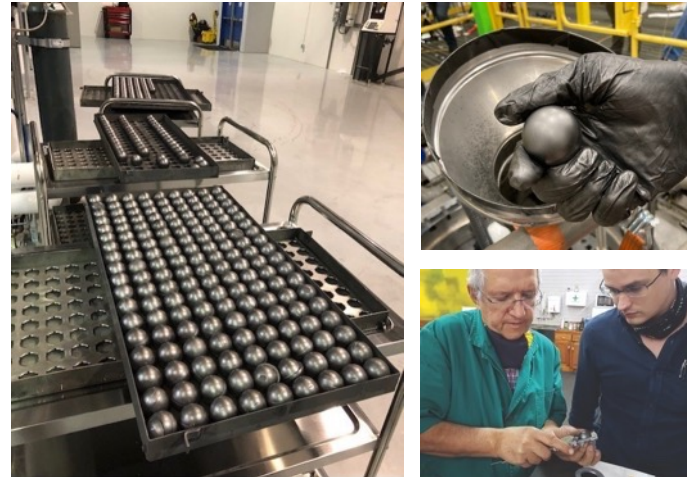
- 1) related to salt
- 2) safety-related
- 3) not available off-the-shelf

KP Southwest Manufacturing Facility



In-house manufacturing of specialized components

Pebble Development Lab & TRISO Development Lab



Fuel development

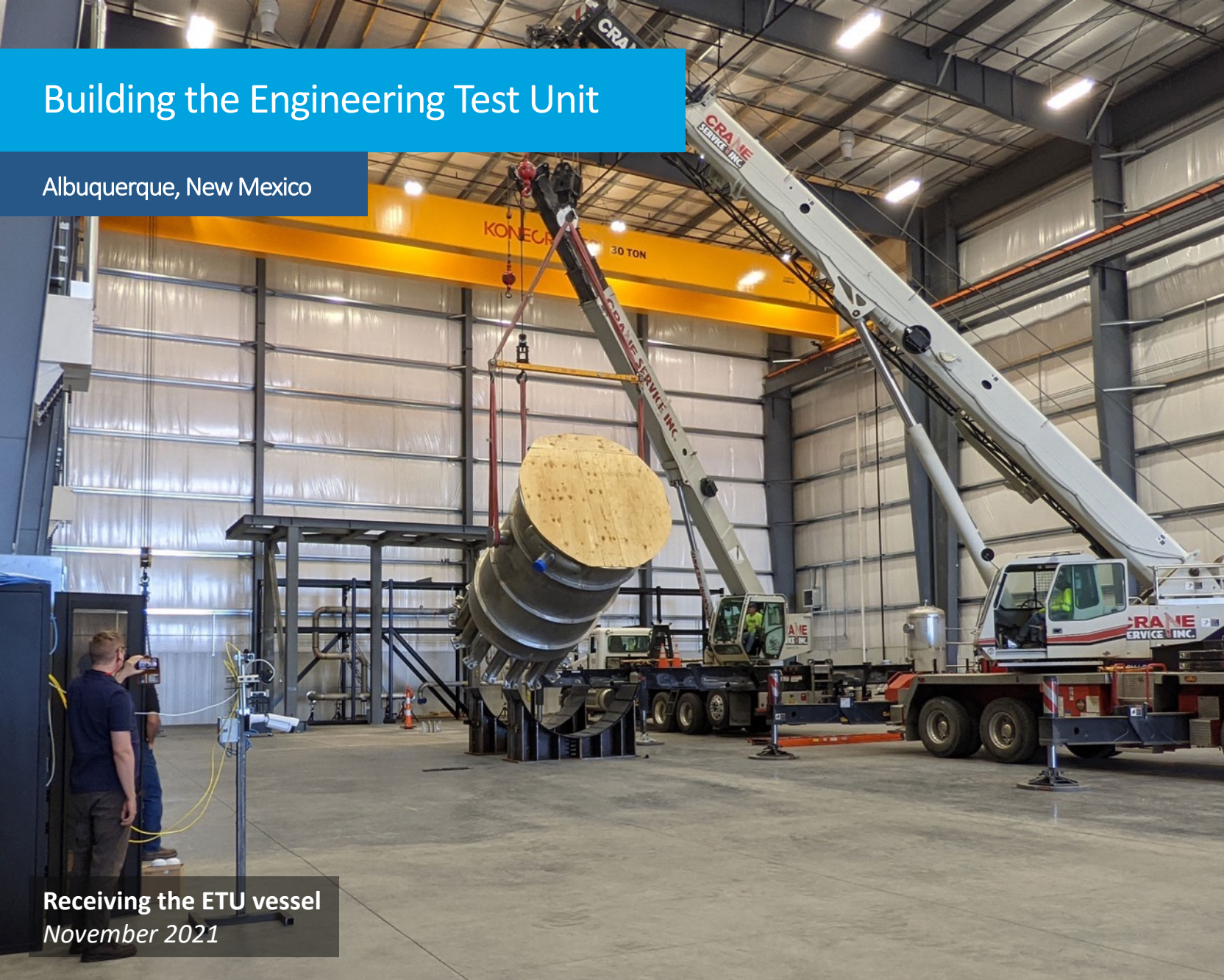
Molten Salt Purification Plant



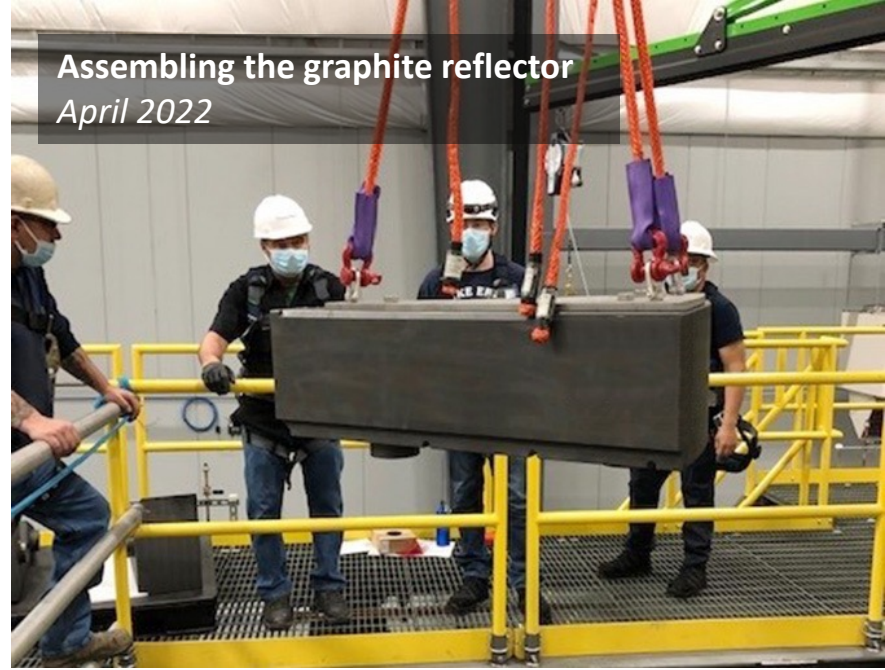
Commercial-scale Flibe production

Building the Engineering Test Unit

Albuquerque, New Mexico



Receiving the ETU vessel
November 2021



Assembling the graphite reflector
April 2022



Adding the 30,000th simulated fuel pebble
May 2022

Receiving the ETU vessel
November 2021



Construction complete / hot commissioning in progress
November 2022



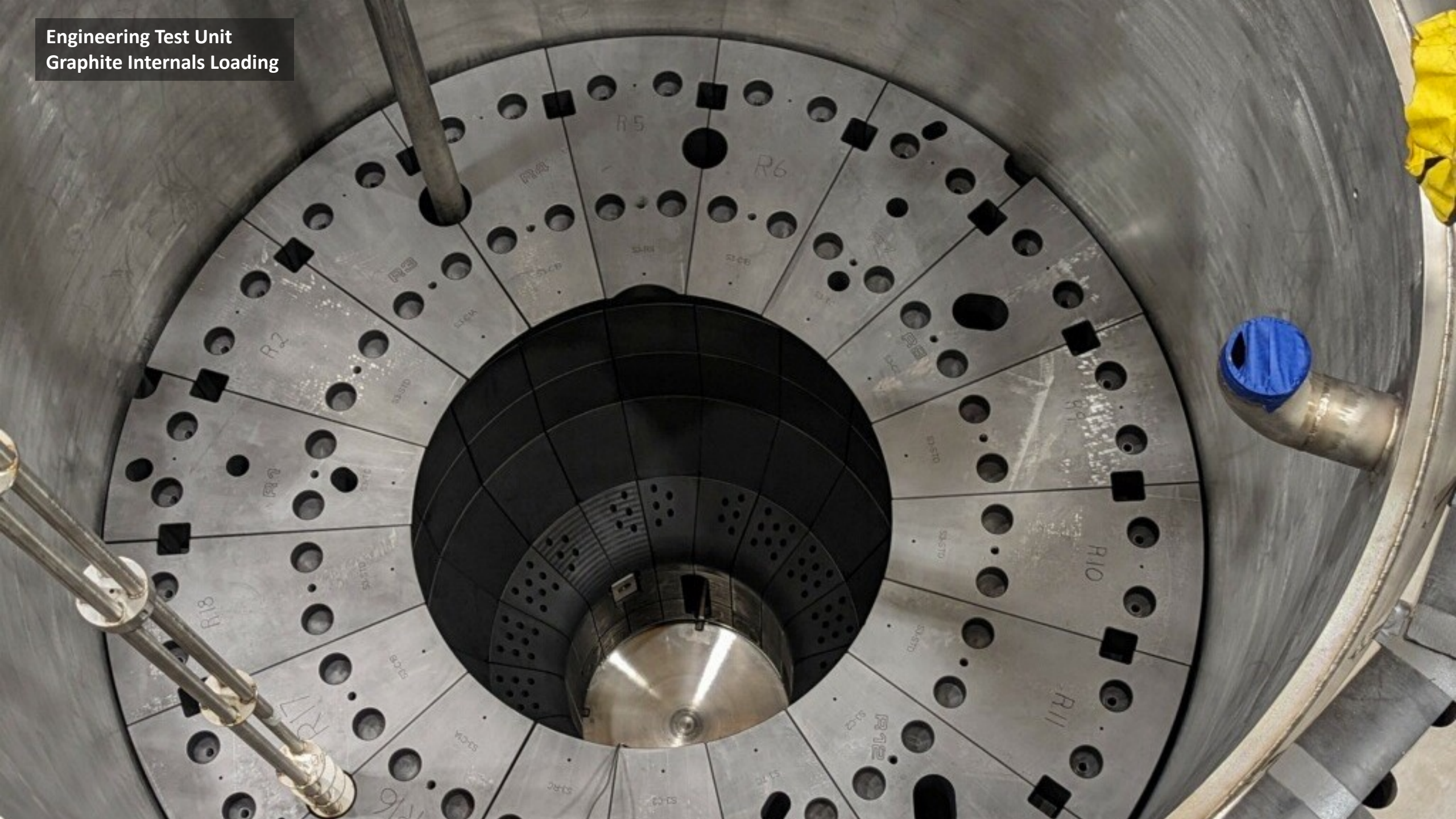
ETU Control Room
Albuquerque, NM



Argos Remote Control Room
Alameda, CA

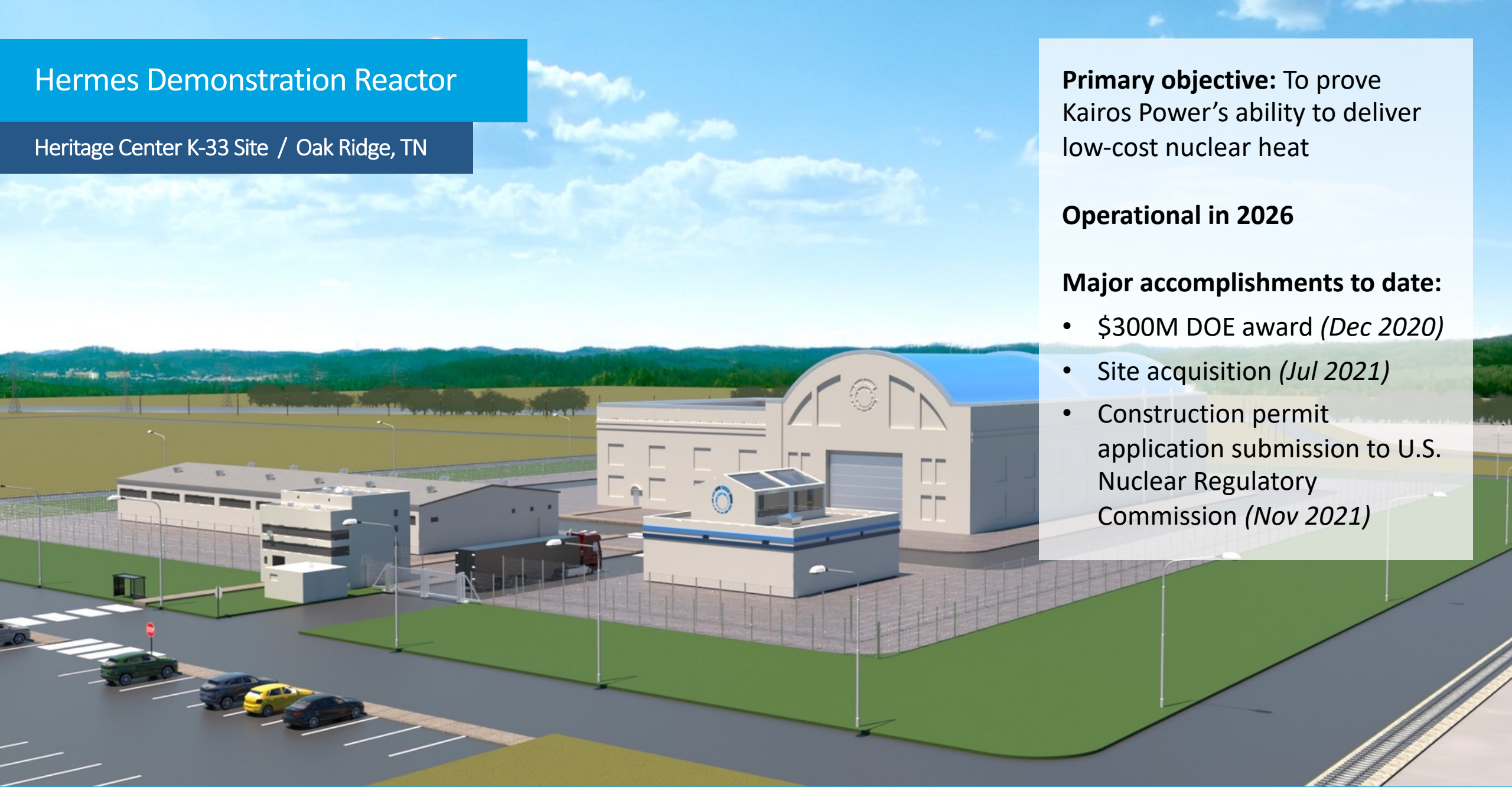


Engineering Test Unit
Graphite Internals Loading



Hermes Demonstration Reactor

Heritage Center K-33 Site / Oak Ridge, TN



Primary objective: To prove Kairos Power's ability to deliver low-cost nuclear heat

Operational in 2026

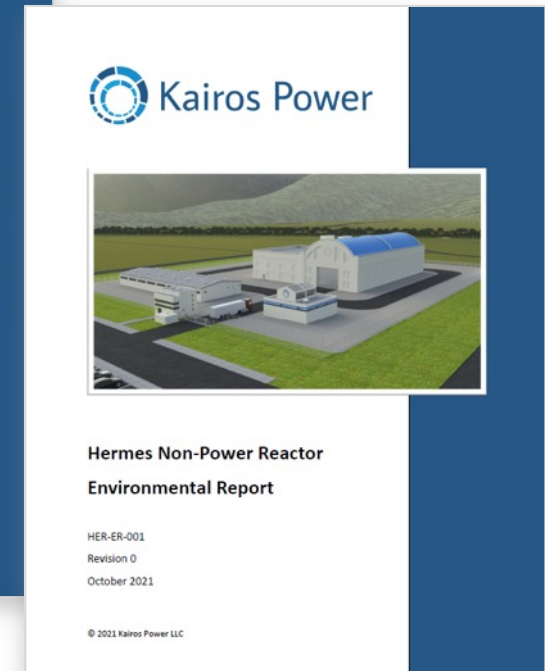
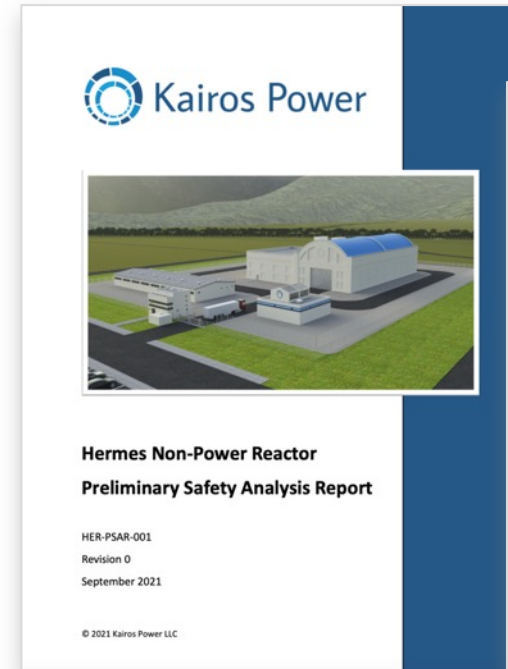
Major accomplishments to date:

- \$300M DOE award (*Dec 2020*)
- Site acquisition (*Jul 2021*)
- Construction permit application submission to U.S. Nuclear Regulatory Commission (*Nov 2021*)

Hermes Construction Permit Application

Leading the Way in Advanced Reactor Licensing

- The U.S. Nuclear Regulatory Commission accepted the Hermes CPA for review in November 2021 following robust pre-application engagement with 11 topical reports and several technical reports supporting the CPA.
- Kairos Power is the first and only developer of a non-light-water reactor to have a firm NRC review schedule for our CPA at a projected 21 months.
- **CPA review progressing ahead of schedule:**
 - ✓ **Safety Evaluation Completed**
 - ✓ **Draft Environmental Impact Statement Finalized**
 - ✓ **ACRS Safety Evaluation Review Completed**
 - ✓ **On track to receive CPA in Fall 2023**



Hermes project status dashboard:
<https://www.nrc.gov/reactors/non-power/hermes-kairos/dashboard.html>

Enabling the world's transition to clean energy

improving people's quality of life and protecting the environment

Our Commitment to Environmental Justice

- Mission driven
- Engaging and supporting local communities
- Diversity, equity and inclusion program
- Priority in building on brownfield sites
- High energy density / low land use



1 fuel pebble = 4 tons of coal



Headquarters
Alameda, CA



KP Southwest
Albuquerque, NM



K-33 Site
Oak Ridge, TN

Join the Kairos Power Team

Working at Kairos Power, you'll find:

- Pride in working on world-changing ideas, projects, and teams
- Security in working on a long-term development project
- Camaraderie in working with an incredibly competent team that has the desire to be exceptional in their field and are driven by the need to make a difference
- Support from a culture that is people-centered

Full-time employees receive great benefits including:

- Competitive Salary
- Medical, Dental, Vision
- Generous Vacation and Sick Time Off
- Paid Holidays
- 401k Benefits
- Short and Long-term Disability Benefits
- Paid New Parent Leave

Apply online at:
kairospower.com/careers



For more information, contact us at recruiting@kairospower.com

KP-OMADA Advanced Nuclear Alliance

The Kairos Power Operations, Manufacturing and Development Alliance brings together leading North American utilities and generating companies to collaborate on the advancement of KP-FHR technology.





Kairos Power

Enabling the world's transition to clean energy
while improving people's quality of life
and protecting the environment