



NRIC overview OECD ZPR Workshop 2023

July 2023

Changing the World's Energy Future

Bradley John Tomer



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NRIC

National
Reactor
Innovation
Center



National Reactor Innovation Center Overview OECD NEA Zero Power Reactors (ZPR) Workshop

June 22, 2023

Brad Tomer, Acting Director, Chief Operating Officer

nric.inl.gov

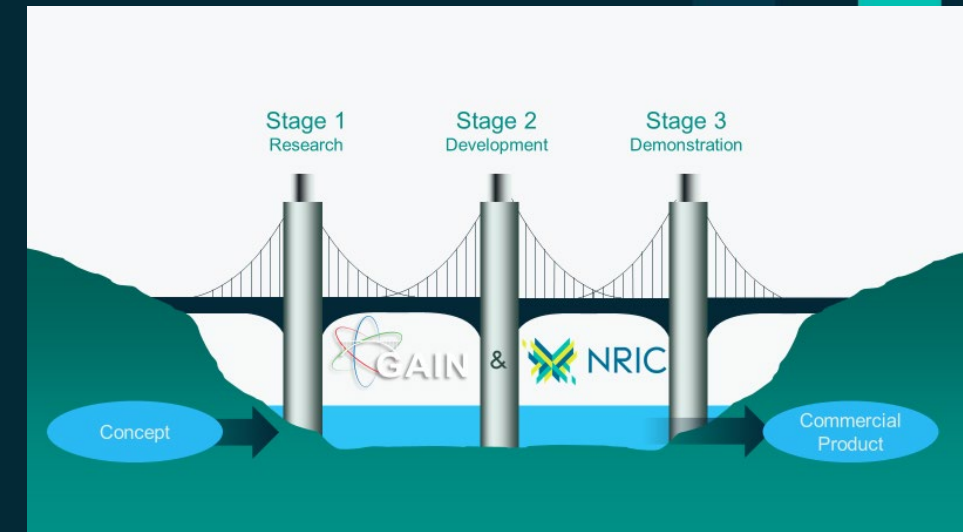


NRIC is a new DOE program, launched in FY'2020



NRIC Enables Nuclear Reactor Tests & Demonstrations

- Authorized by the Nuclear Energy Innovation Capabilities Act (NEICA)
 - DOE-Office of Nuclear Energy; INL Nuclear Science & Tech
- Partner with industry to bridge the gap between research and commercial deployment
- Leverage national lab expertise and infrastructure
- Manage demonstrations to success



Vision: Enable commercial nuclear by 2030

Collaborative Approach

NRIC is
partnering
regionally and
nationally to
support
demonstrations

LANL

INL MFC, NS&T, ATR, ESH&Q, F&SS, S&S

Local, Regional, National Public Stakeholders

IES, NSUF, ART, ARDP

Demo Sites

ANL & ORNL

End Users

DOD; NASA; others

Investors

Polymakers

DOE NE-3/4/5 and ID

NRC

PNNL

GAIN, NEAMS, ARDP

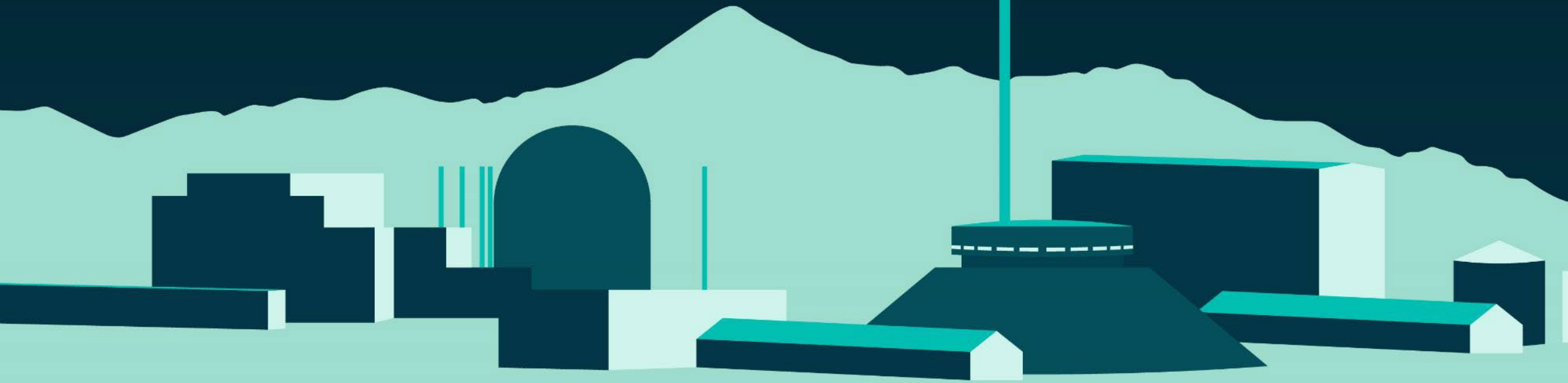
Complementary Tech Fields

International Partners & Resources

Advanced Reactor Developers

NNSS

Priority: Empowering Innovators



- Advanced Reactor Test Beds
- Experimental Facilities
- Virtual Test Bed
- Addressing Costs and Markets

- Planning Tools

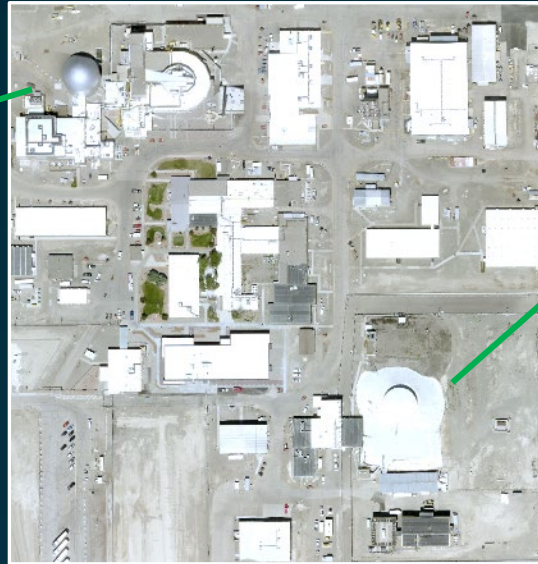
- NRIC Resource Team
- Demonstration Resource Network (<https://nricmapping.inl.gov/>)
- Siting Tool for Advanced Nuclear Development

NRIC Testbed Strategy

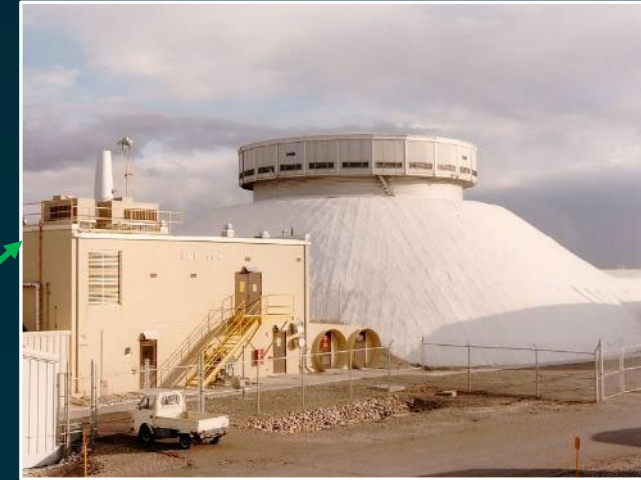
NRIC-DOME Testbed



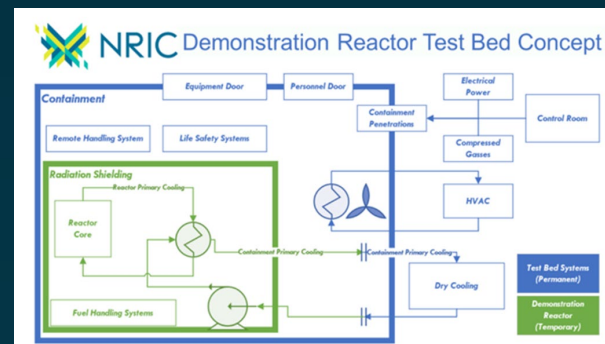
Materials & Fuels Complex at INL



NRIC-LOTUS Testbed



- ZPPR Operated from 1969 to 1990
 - Used for transuranic and enriched-uranium material inspection/repackaging and experiments
- Establish ZPPR as NRIC-LOTUS Testbed
 - $<500\text{KW}_{\text{th}}$ $>20\%$ enriched fuels
 - Conceptual design phase complete
 - Preliminary/Final Design Initiated
 - First user expected 2026

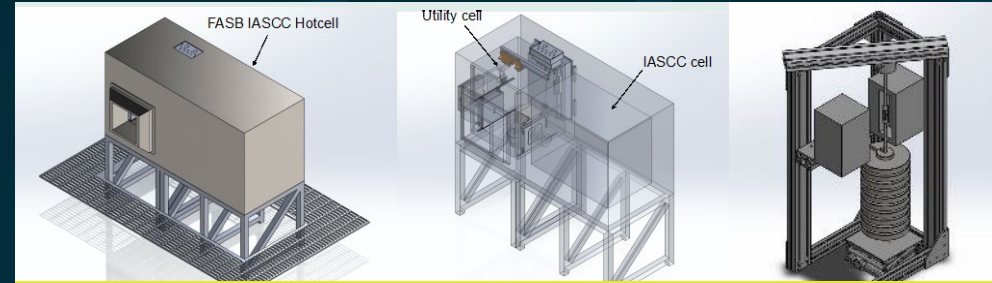
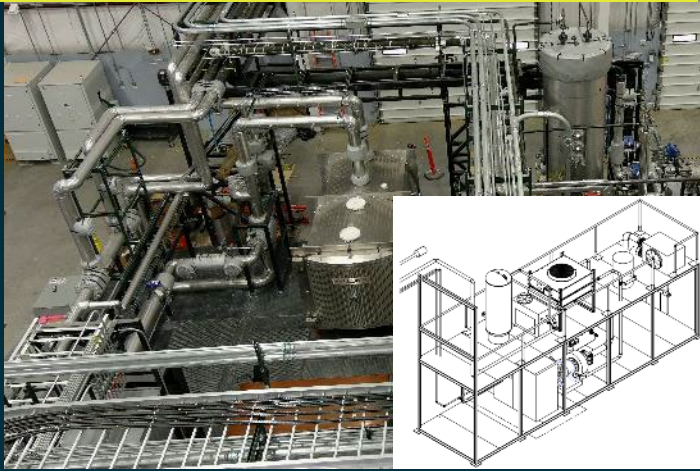


Zero/Low Power Testing

- First reactor experiment in LOTUS testbed planned zero power test
 - Provides data on several safety basis parameters
 - Decay heat curve, power distribution, control elements & safety rod reactivity worth, reactor kinetics, detector performance, initial critical configuration, pump/circulator performance
 - Ideal first test for low Technical Readiness Level (TRL) reactors
- Most tests in DOME are planned higher power tests
 - Provides data on several additional safety basis parameters
 - Demonstrate fuel performance and characterized transport of radiological material under normal operations, test reactor components under operating condition, heat balance
 - Most appropriate for higher TRL reactors

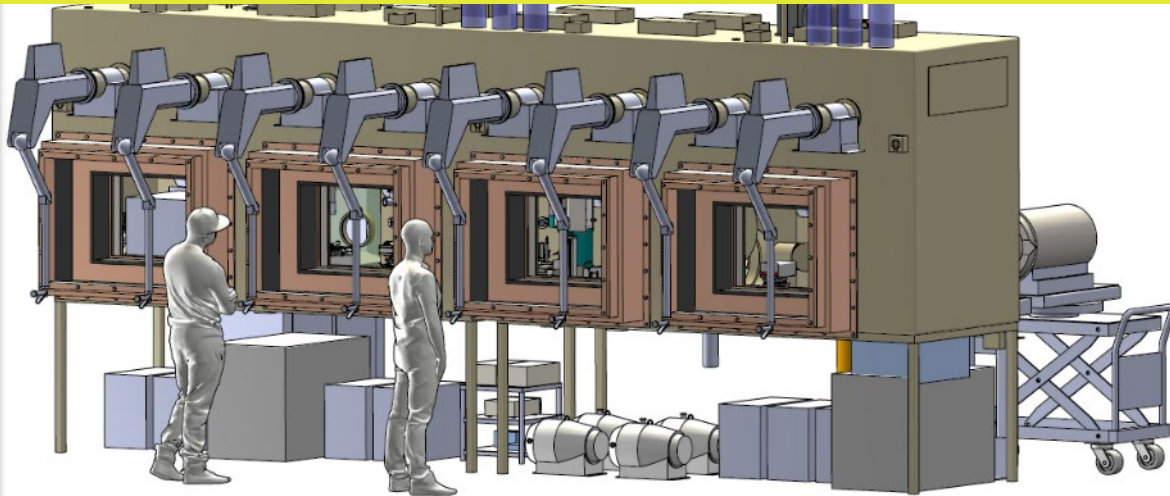
NRIC Experimental Infrastructure

**Helium Component Test Facility
[2022]**

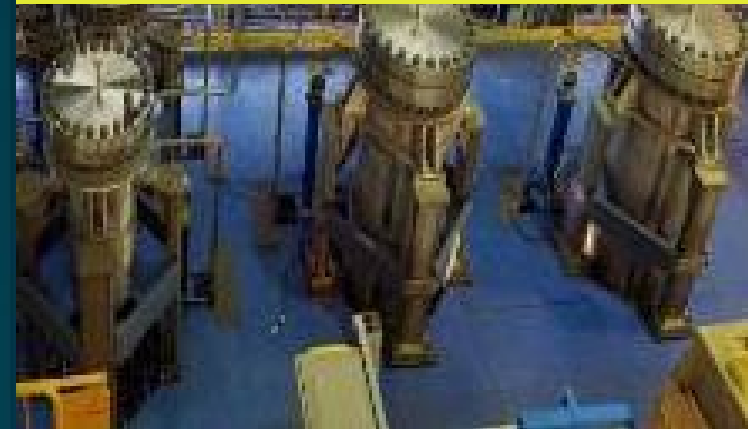


In-HotCell Thermal Creep Frame [2023]

**Molten Salt Thermophysical Examination Capabilities
(MSTEC) [2024]**

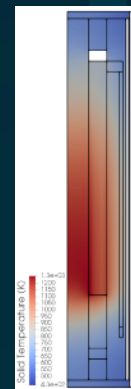
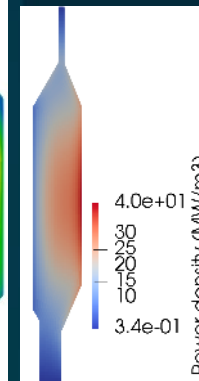
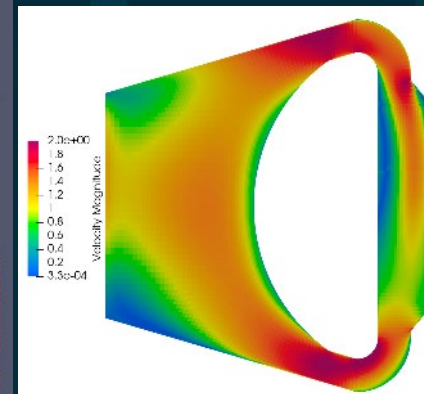
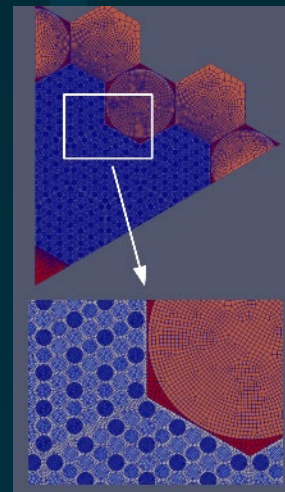


**Mechanisms Engineering Test Lab
(METL) [Operating]**



NRIC - Virtual Test Bed

- Central location for reactor developers/stakeholders to access/leverage state-of-the-art ModSim reactor models to evaluate performance and safety of their advanced reactors
- Cross-laboratory collaboration between NRIC and Nuclear Energy Advanced Modeling and Simulation (NEAMS) programs
- Repository/Library of NEAMS models of advanced reactors: sodium, microreactors, gas, molten salt, fluoride high-temperature reactors
- Currently hosting 30+ distinct advanced reactor models, with 7 NEAMS codes showcased... More coming soon!
- 200+ users since we started tracking in April 2023 (NRC/Industry/Academia)



Example models and results in the VTB repo



Announcement of Tech Talk on VTB

VTB Link: https://mooseframework.inl.gov/virtual_test_bed

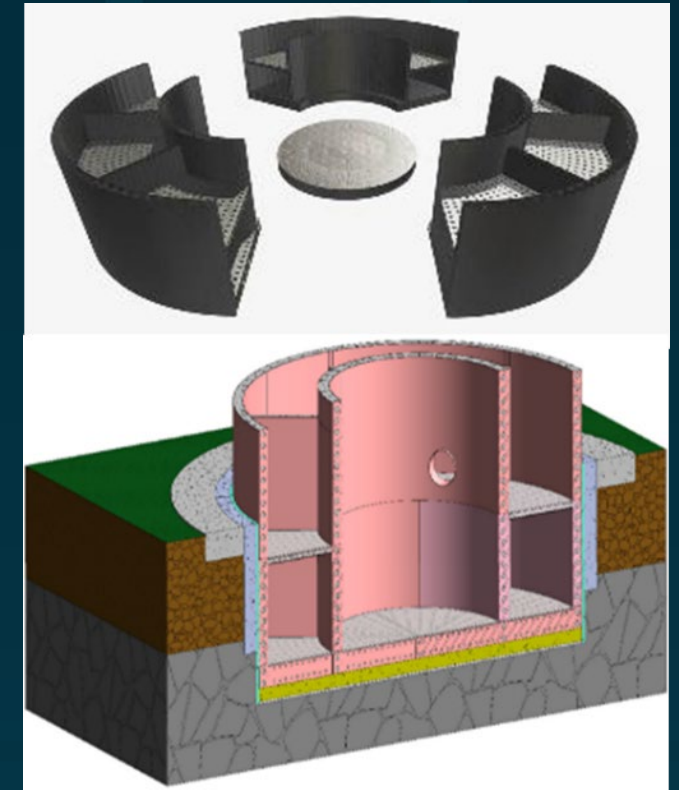
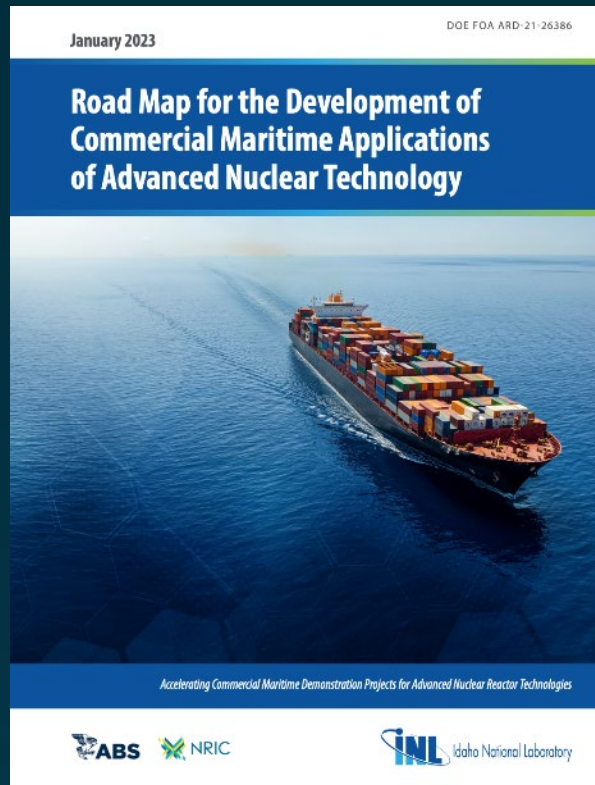
ANS Special Session Link:

<https://www.ans.org/meetings/wm2021/session/view-874/>

NRIC Tech Talk Link: https://nric.inl.gov/nric-tech-talks-modeling_simulation/

Addressing Cost and Markets

- Advanced Construction Technologies – Project kicked off Jan 2022
- Digital Engineering & Knowledge Sharing/Lessons Learned
- Demonstration/Deployment Opportunities (Maritime)



Benefits of Testing & Demonstration

- Bridge the gap between development and commercialization
 - Providing funding to mature technology readiness and reduce risks to participants for first of a kind build
 - Facilitate partnership between technology developers, end users, national labs, universities, regulators, industrial participants
- Learn by doing reduces risks associated with first commercial build
 - Identify materials standardly available
 - Optimize design
 - Establish procedures
 - Sequencing of operations
- Builds confidence with regulators
- Develop supply chain

Thank you!

Questions?

