The ACU Molten Salt Research Reactor

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NEXT Lab Director, Abilene Christian University

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ABILENE CHRISTIAN UNIVERSITY

Abilene Christian University

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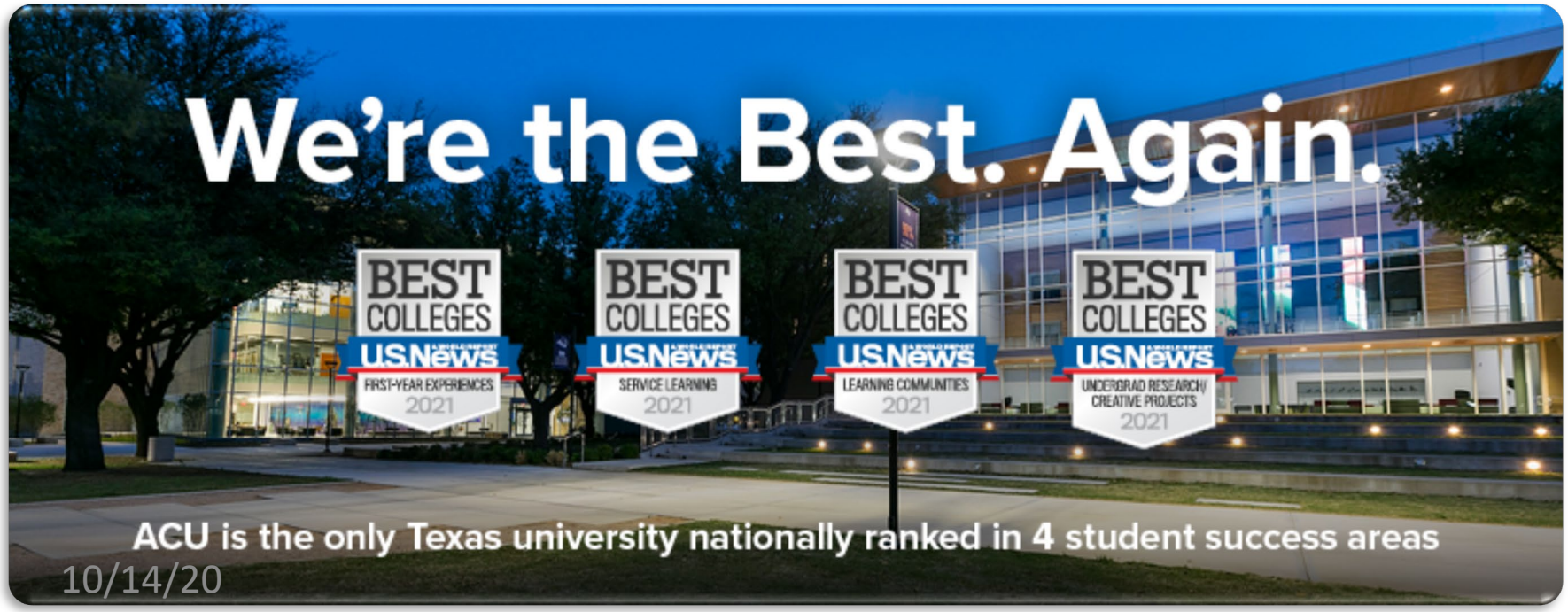
- Main Campus in Abilene, Texas population 123,000
- Fall 2020 marks the third consecutive year for a record number of students enrolling at ACU: 5,293 students.
  - Main campus is in Abilene Texas. 3,675
  - ACU Dallas: 1,618



ACU Commitment to Research

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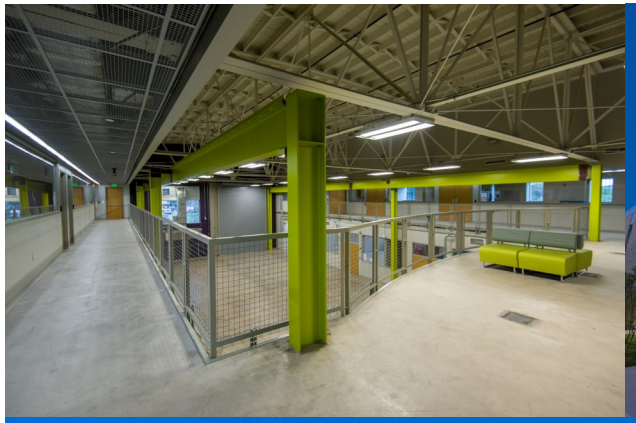
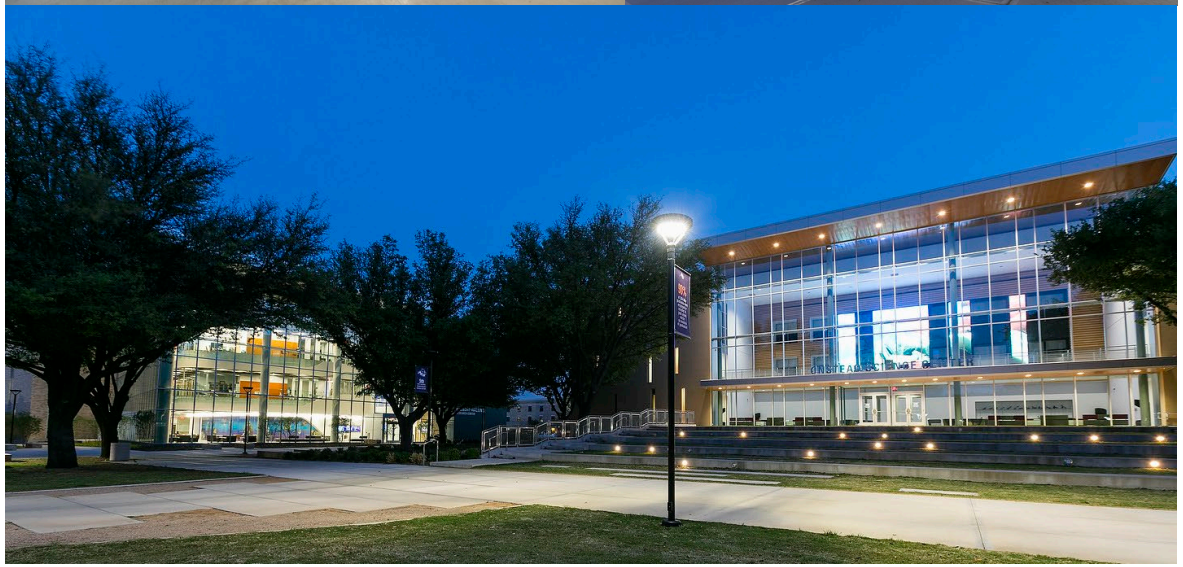
- Physics program started in 1969 focused on research
- ABET accredited engineering program started in 2012
  - 19 faculty, 174 undergraduate students
- $50M + invested in science and engineering infrastructure
- Hired Vice President of Research to increase research and technology invention and corporate engagement activities.
- Planning a new $15M Science and Engineering Research facility
- Administrative and financial support of NEXT Lab





ACU History of Research

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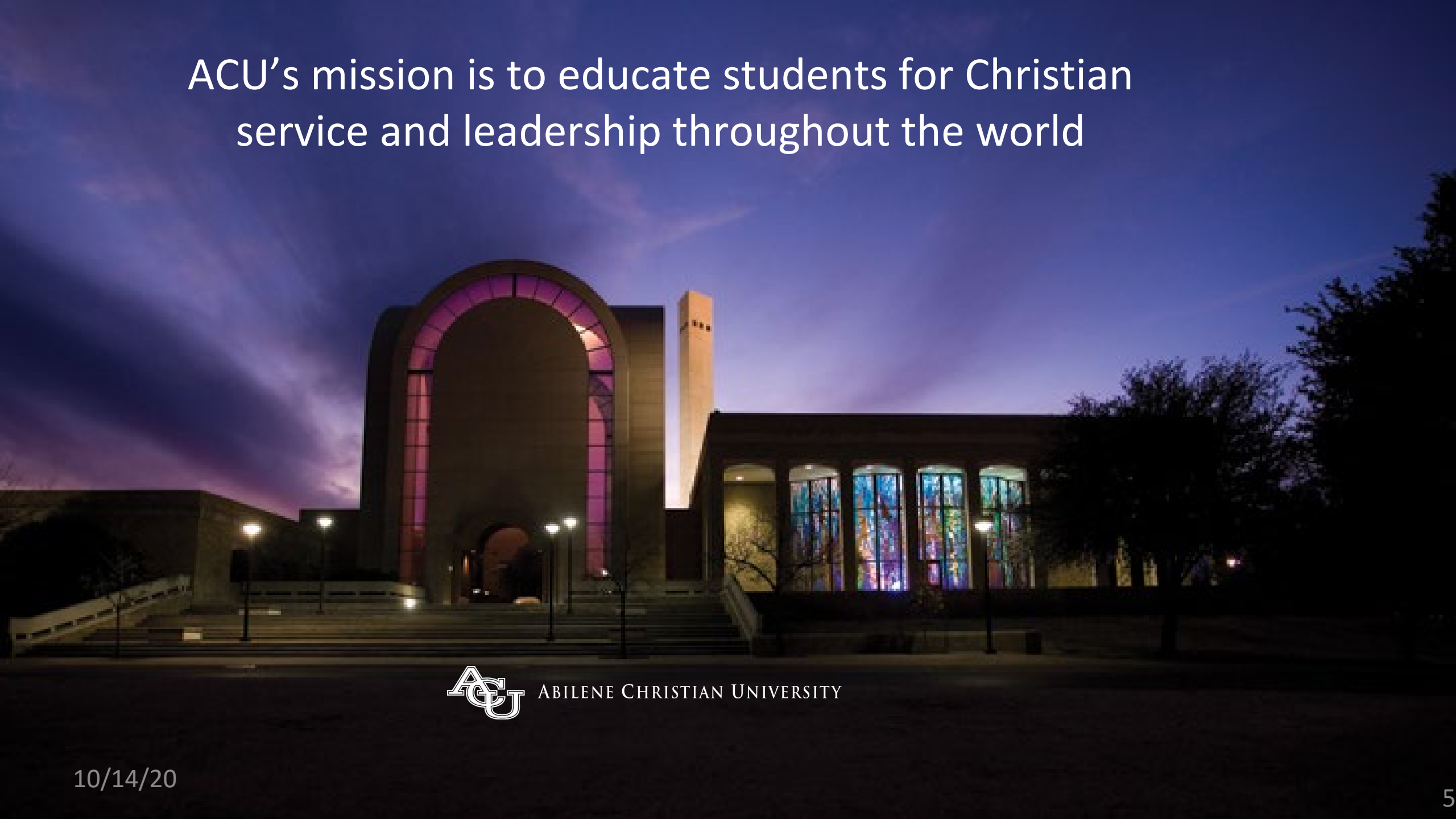
- 60 years of funded research through the Robert A. Welch Foundation, NIH, the Petroleum Research Fund, and others.
- 40 years of continuous DOE funded nuclear research
- ACU research successes
  - Old Model
    Take students to world-class facilities
  - New model
    Bring world-class facilities to ACU
    Bring the world to ACU

ACU's mission is to educate students for Christian service and leadership throughout the world



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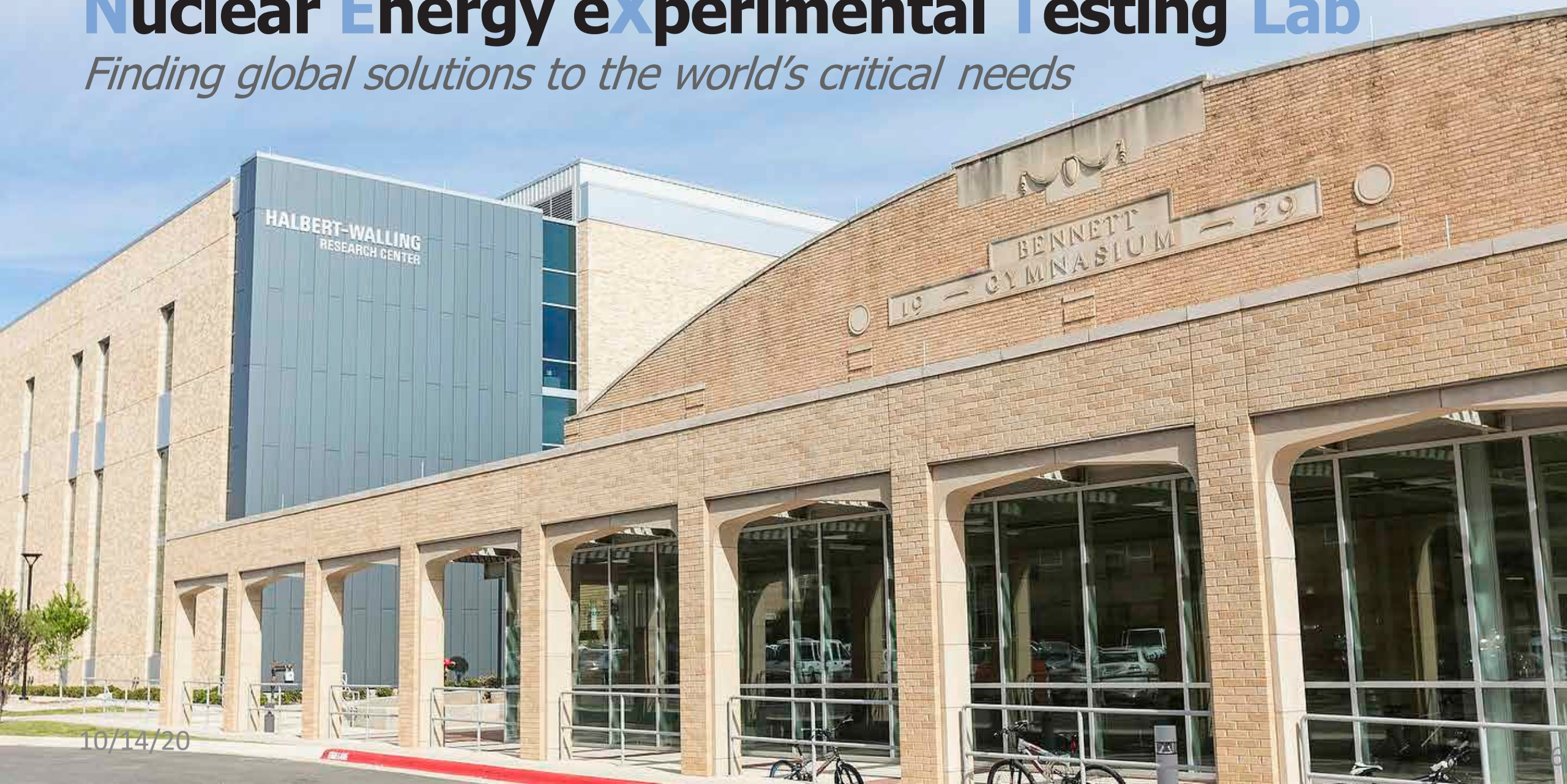
Nuclear Energy eXperimental Testing Lab

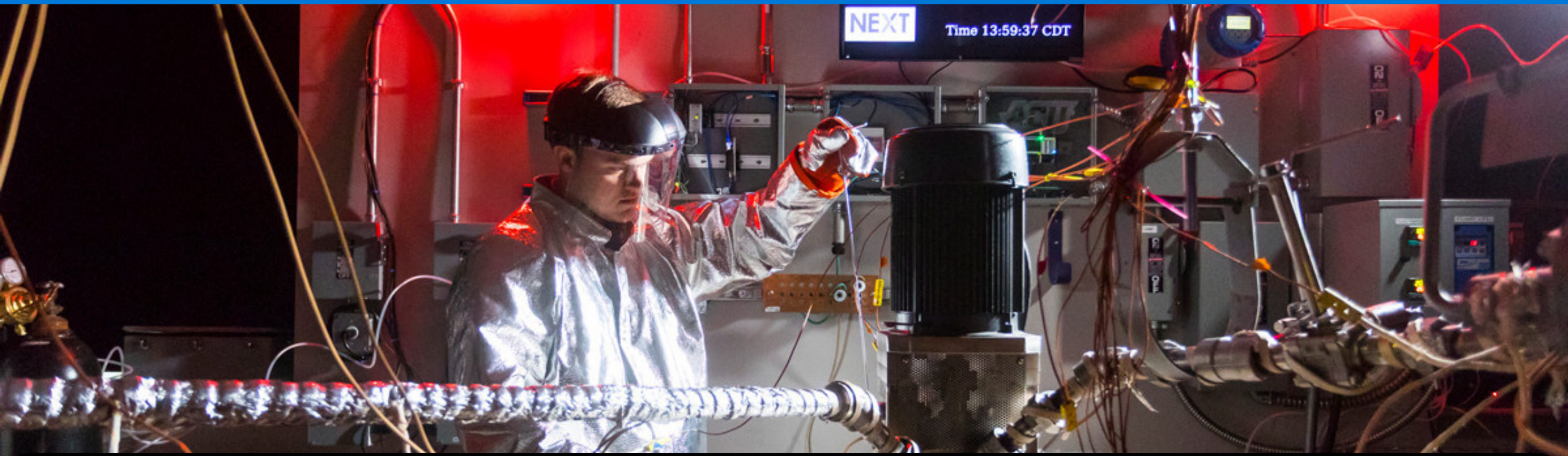
Finding global solutions to the world's critical needs



The NEXT Lab mission is to provide global solutions to the world's need for:

- energy that is less expensive and safer
- water that is pure and abundant
- medical isotopes to diagnose and treat cancer

while educating the next generation of leaders in nuclear science and engineering.



Abilene Christian University (ACU) intends to design, license, construct and commission a Molten Salt Research Reactor (MSRR).


ACU NEXT Lab Summer 2020

NEXT Lab Research Projects

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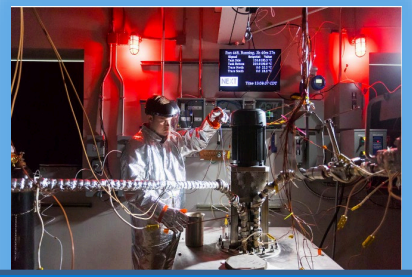
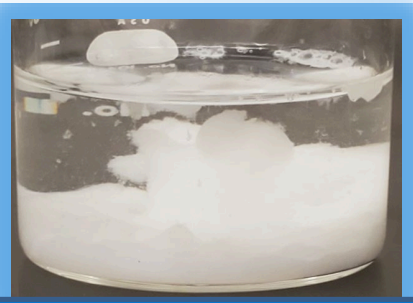
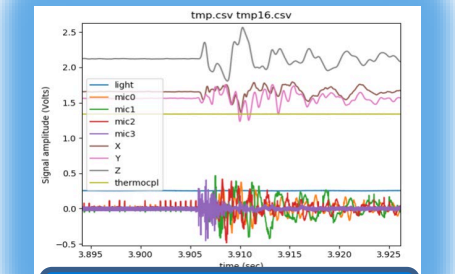


Molten Salt Test Loop

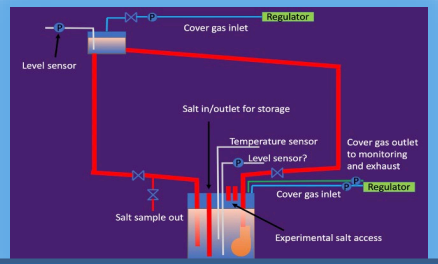


Fission Fragment Removal



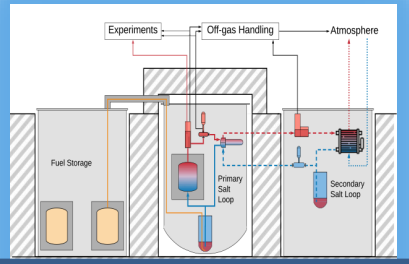
Instrumentation

Data Acquisition



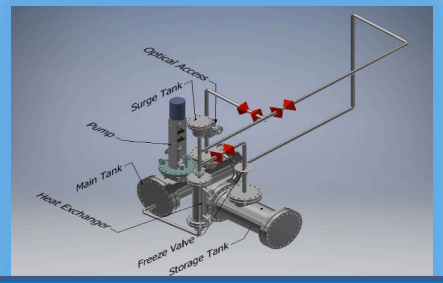
Fluoride Molten Salt Test Loop

Salt Purification System

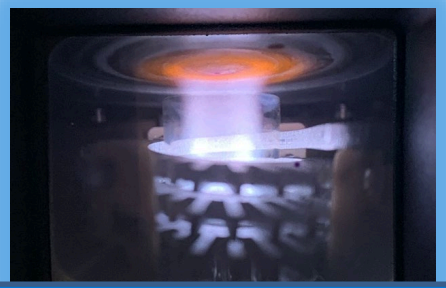


Molten Salt Research Reactor

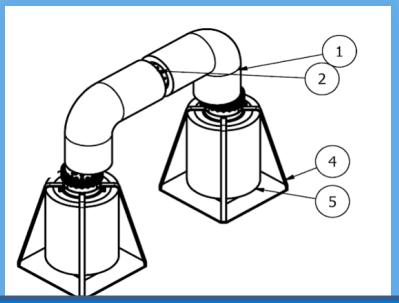
Component Test System



Molten Salt Test System



Chemical Analysis System



Molten Salt Filters

NEXT Research Alliance

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Georgia Tech

TEXAS A&M UNIVERSITY

ABILENE CHRISTIAN UNIVERSITY

TEXAS
The University of Texas at Austin

University of Texas, Austin

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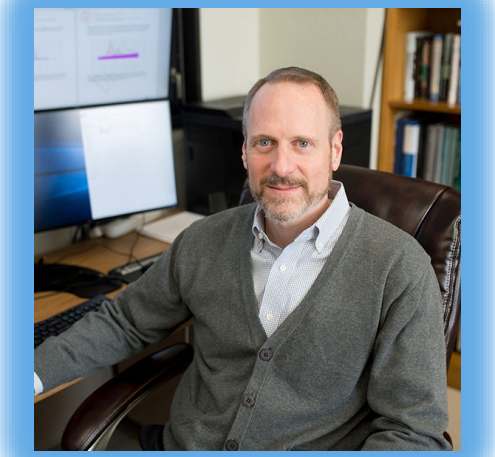
Dr. Derek Haas, Assistant Professor in the Nuclear and Radiation Engineering (NRE) program of the Mechanical Engineering Department of the University of Texas at Austin and experimental researcher focused on non-proliferation with eight years experience at Pacific Northwest National Laboratory, who is the lead for the MSRR Reactor Research Bay Interface design team.



Dr. William (Bill) Charlton, Director of the UT Nuclear Engineering Teaching Laboratory, which includes the 1 MW TRIGA reactor, is the John J. McKetta Energy Professor in the Nuclear and Radiation Engineering Program and a primary contributor in reactor operations and experimental planning.

Dr. Kevin Clarno, former lead of the Reactor Physics Group at Oak Ridge National Laboratory, which develops the SCALE nuclear analysis code suite, and lead of CASL (Consortium for the Advanced Simulation of LWRs), is an Associate Professor in the Nuclear and Radiation Engineering program of the Mechanical Engineering Department, Chair of the UT Reactor Oversight Committee and a primary contributor in the reactor design.

Texas A&M University

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Dr. Pavel Tsvetkov is an Associate Professor in the Texas A&M University Nuclear Engineering Department and leads the MSRR Fuel Handling Subsystem design team. He joined A&M in 2005 focusing on design and instrumentation and control for novel systems. Dr. Tsvetkov's focus is providing key contributions and evaluations in design decisions that guide and inform licensing and deployment.

Dr. Mark Kimber is an Assistant Professor in the Department of Nuclear Engineering at Texas A&M University and leads the MSRR Thermal Management Subsystem design team.

Dr. Sean M. McDeavitt joined the faculty of Texas A&M University in the Fall of 2006 and has multidisciplinary experience in nuclear, materials, and chemical engineering and is the Director of Nuclear Engineering & Science Center and the Nuclear Power Institute for workforce development. Sean leads the Chemistry group for the NEXTRA.

Georgia Institute of Technology NEXT

Nuclear Energy eXperimental Testing

Dr. Steven Biegalski is the Chair of Nuclear and Radiological Engineering and Medical Physics Program at Georgia Institute of Technology and was a faculty member at The University of Texas at Austin for 15 years and held the position of Reactor Director for The University of Texas at Austin TRIGA reactor for over a decade.

Dr. Bojan Petrovic is a Professor of Nuclear and Radiological Engineering at Georgia Institute of Technology whose expertise is in the areas of advanced reactors design and numerical simulations of nuclear systems.

Dr. Preet Singh focuses on corrosion and materials engineering within the context of molten salt reactors. His work includes understanding the basic mechanisms involved in material degradation and using that knowledge to develop a mitigation strategy against environment-induced failures.

MSRR Licensing Plan

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- ACU is seeking a license under AEA Section 104c pursuant to 10 CFR 50.21(c) for a **University Research Reactor** facility with a maximum licensed power level of 1 MW_{th}.
- Two-Step licensing process (10 CFR Part 50) submittal will be separate Construction Permit (CP) and Operating License (OL) applications.
- First public meeting with NRC was September 29, 2020.
- Regulatory Engagement Plan was submitted.
- NRC Docket Number: 99902088

Site Location

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Multiple sites are under consideration

- Environmental/radiological aspects of site selection are considered
- Goal is to build on or near the ACU campus in Abilene, TX.

MSRR is Simplified MSRE

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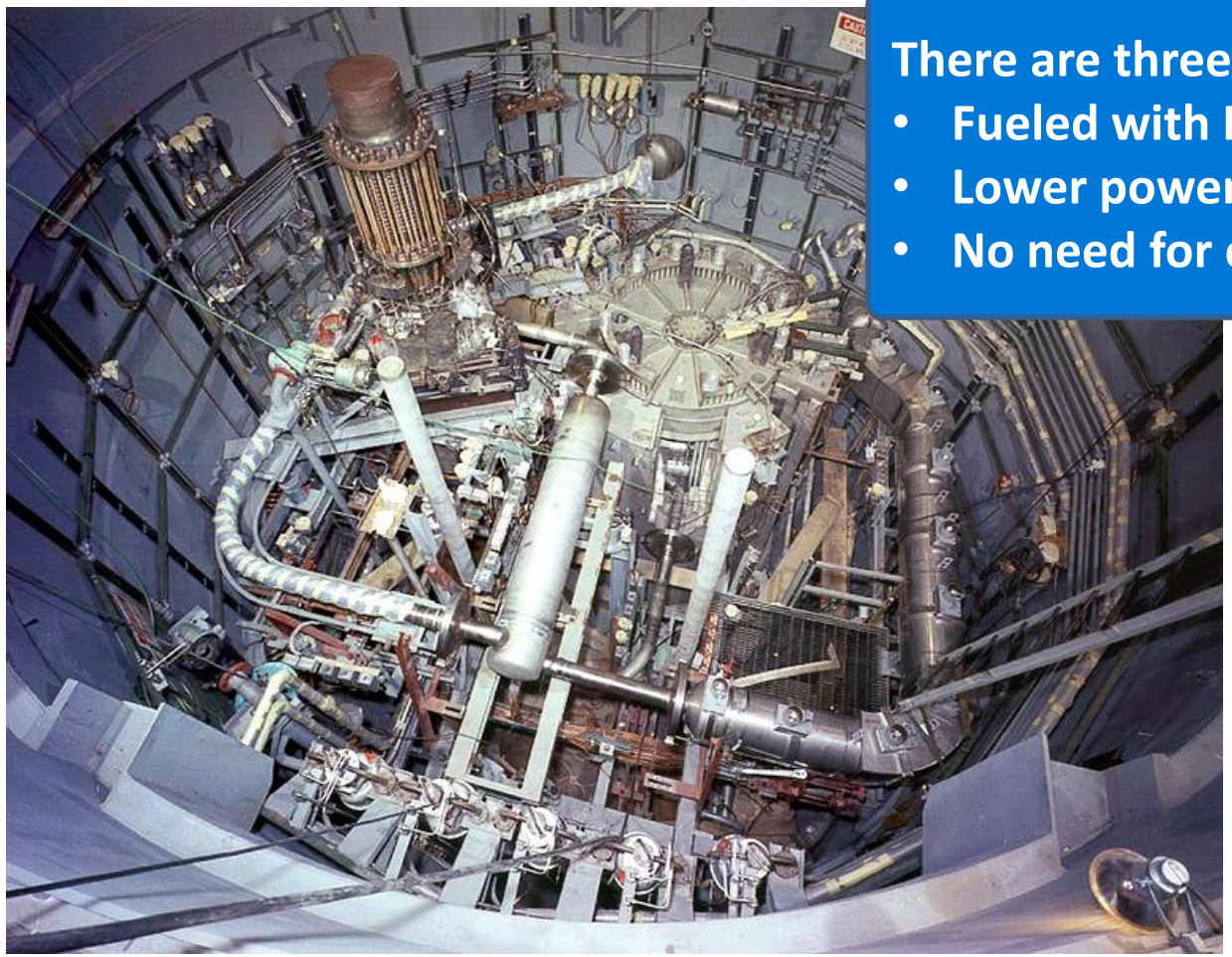
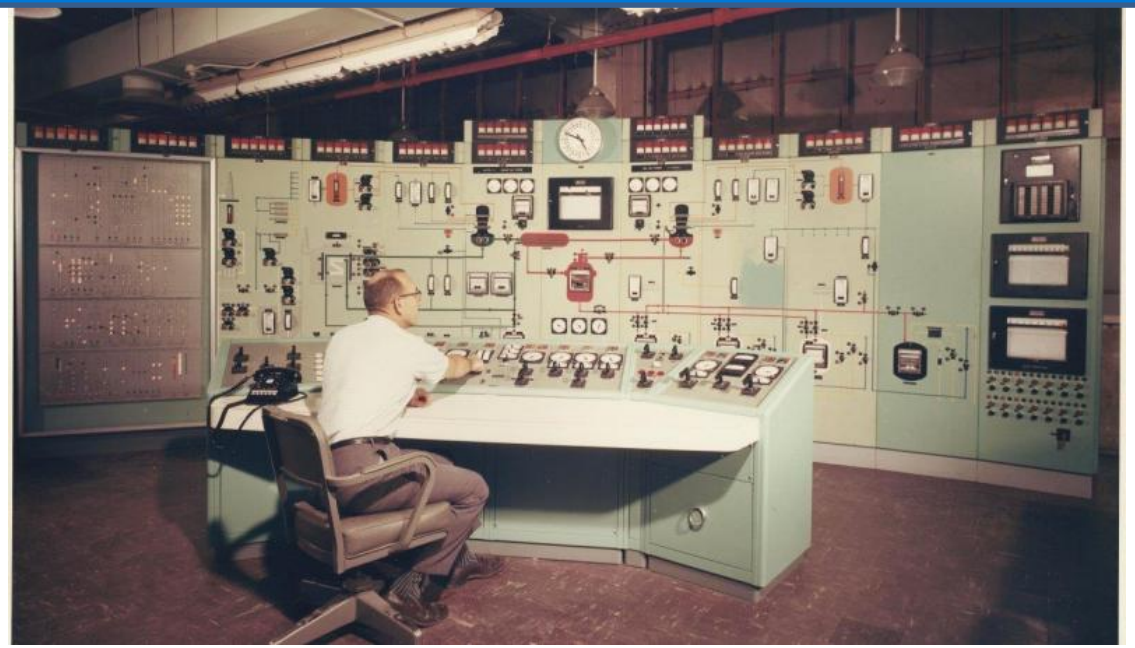
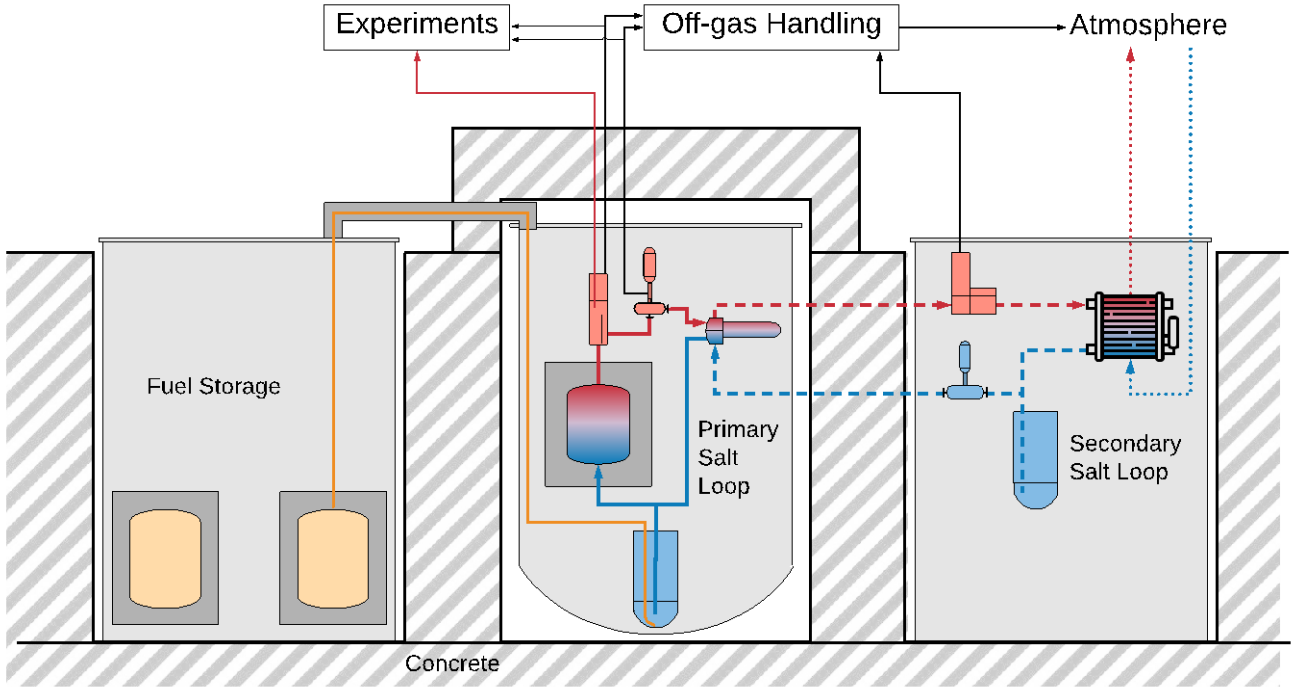


There are three major differences between the MSRE and the MSRR

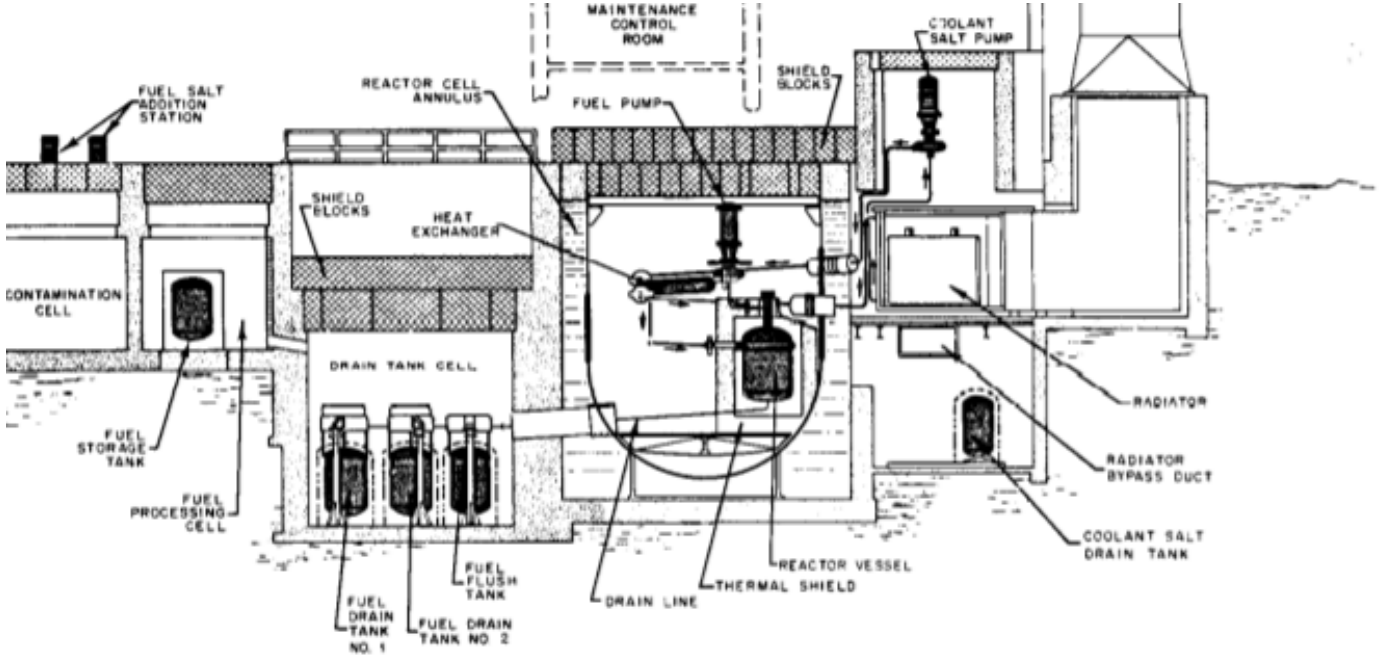
- Fueled with HALEU instead of HEU
- Lower power and power density
- No need for cooling water within containment



MSRR


Experiments
Off-gas Handling
Atmosphere
Fuel Storage
Primary
Salt
Loop
Secondary
Salt Loop
Concrete

MSRE


MAINTENANCE CONTROL ROOM
FUEL SALT ADDITION STATION
REACTOR CELL ANNULUS
FUEL PUMP
SHIELD BLOCKS
COOLANT SALT PUMP
HEAT EXCHANGER
CONTAMINATION CELL
DRAIN TANK CELL
RADIATOR
RADIATOR BYPASS DUCT
FUEL STORAGE TANK
FUEL PROCESSING CELL
COOLANT SALT DRAIN TANK
REACTOR VESSEL
THERMAL SHIELD
DRAIN LINE
FUEL FLUSH TANK
FUEL DRAIN TANK NO. 1
FUEL DRAIN TANK NO. 2

Overview of Conceptual Design

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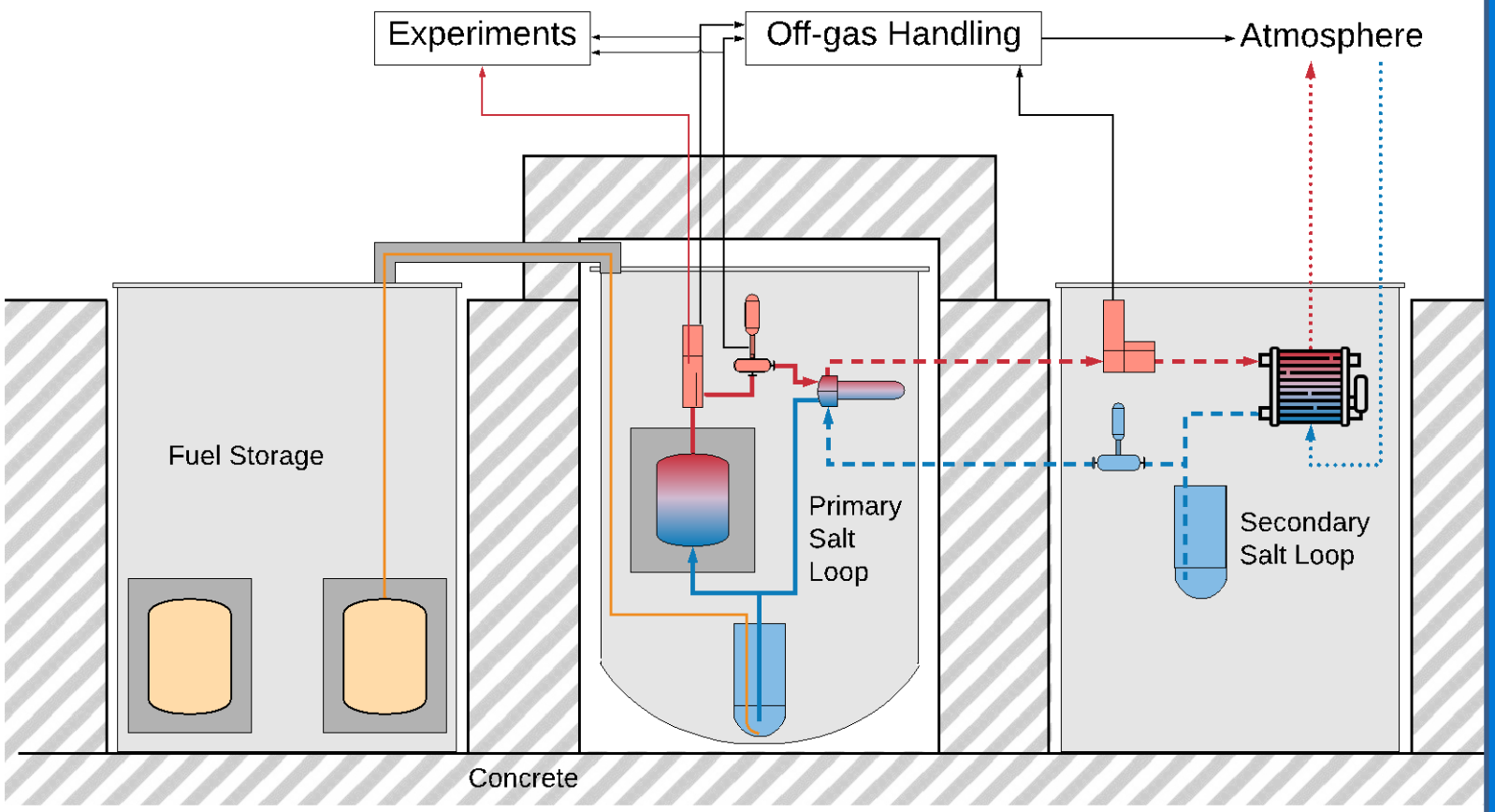
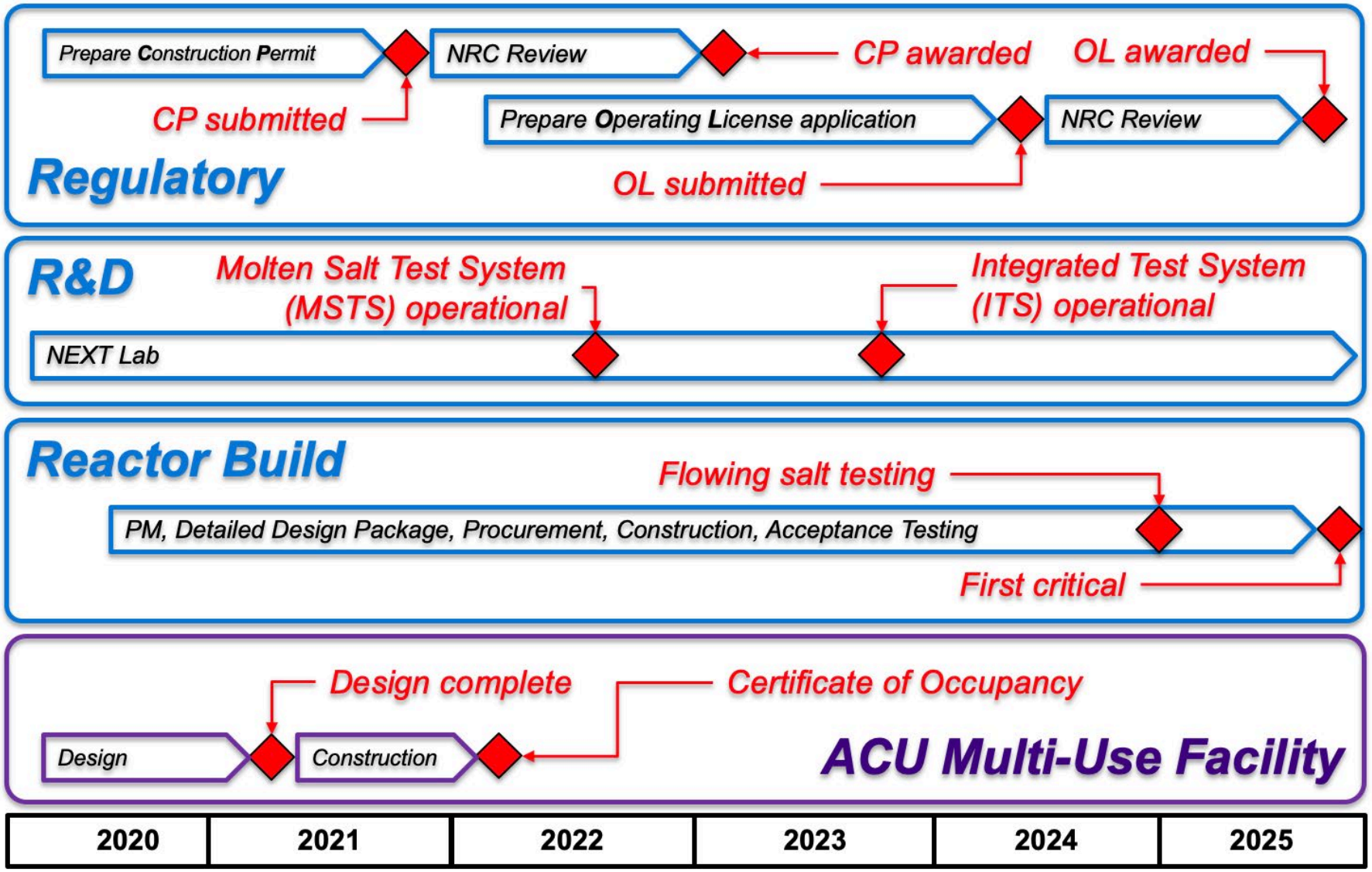


The MSRR has:

- graphite moderator
- fluoride salt
- Maximum thermal power of 1 MW_{th}.
- reactor vessel that is 6 feet tall and 4.5 feet in diameter

Schedule


Prepare Construction Permit
NRC Review
CP awarded
OL awarded
CP submitted
Prepare Operating License application
NRC Review
OL submitted
Regulatory
R&D
Molten Salt Test System (MSTS) operational
Integrated Test System (ITS) operational
NEXT Lab
Reactor Build
Flowing salt testing
PM, Detailed Design Package, Procurement, Construction, Acceptance Testing
First critical
Design complete
Certificate of Occupancy
Design
Construction
ACU Multi-Use Facility
2020
2021
2022
2023
2024
2025

THANK YOU

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