

STEP R&D

Brayton Cycle Development

R&D Capabilities & Progress

STEP R&D Capabilities

Turbomachinery Development Platform

A reconfigurable testing rig featuring 780 kW of heating power, 560 kW of heat rejection capacity, recuperators, and extensive state of the art data acquisition (DAQ) and controls. The system is rated for 538 °C (1000 °F) and 13.8 MPa (2000 psi) operation

Seals Test Rig

The seals test rig has the capability to test seals ranging from 1" to 8" in diameter at 700 °C (1292 °F) and 27.6 MPa (4000 psi)

Bearings Test Rig

The bearings test rig has the capability to test up to 121°C (250 °F) and 11 MPa (1600 psi) to test a variety of bearing types

High Pressure Fatigue / Hydrostatic Test Platform

75 ksi hydrostatic and fatigue test facility to measure the mechanical performance of compact heat exchangers and other equipment

sCO₂ Visualization Loop

Optical test platform to measure flow and density distributions of sCO₂, including Particle Image Velocimetry (PIV)

Turbomachinery Testing



Seals Testing



Bearings Testing

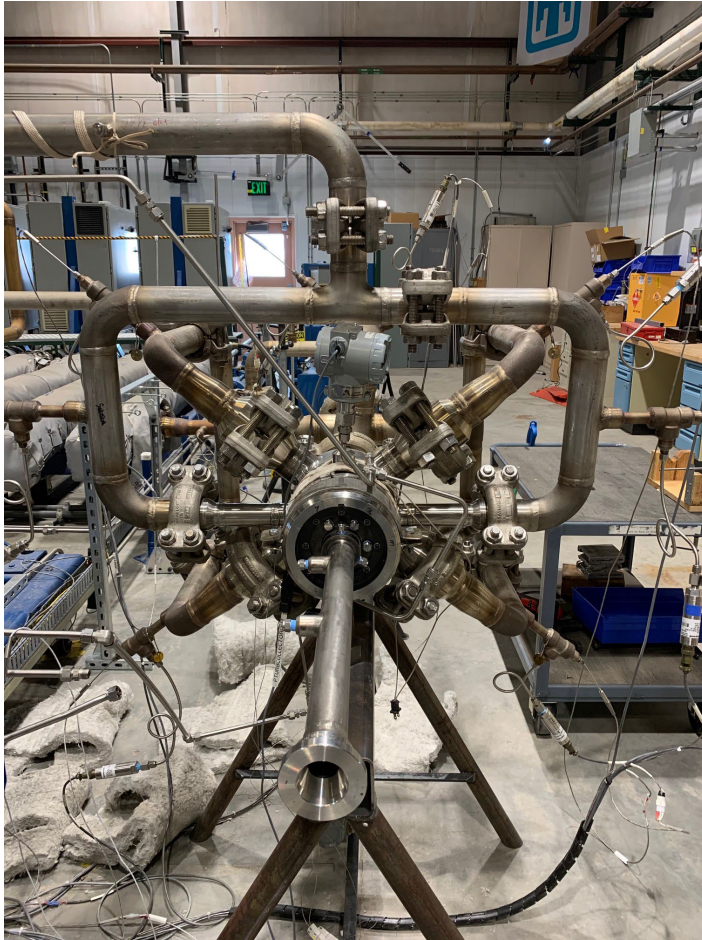


Pressure Fatigue Testing



sCO₂ Brayton Cycle Development

1-10 MWe



Testing of turbocompressor for 1 MWe system:

- Over 450 operating hours achieved
- Demonstration of off-design performance
- Bearing issues currently being resolved



New motor controllers to reject power on the grid using 250 kWe turbine alternator compressors

- “off the shelf” component

2-3-2022

sCO₂ Brayton Cycle Development

>10 MWe

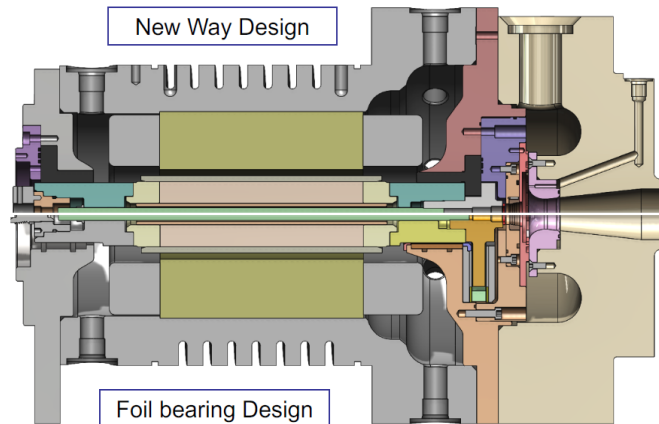


Supercritical CO₂ seals test rig
4,000 psi @700C 40,000 rpm

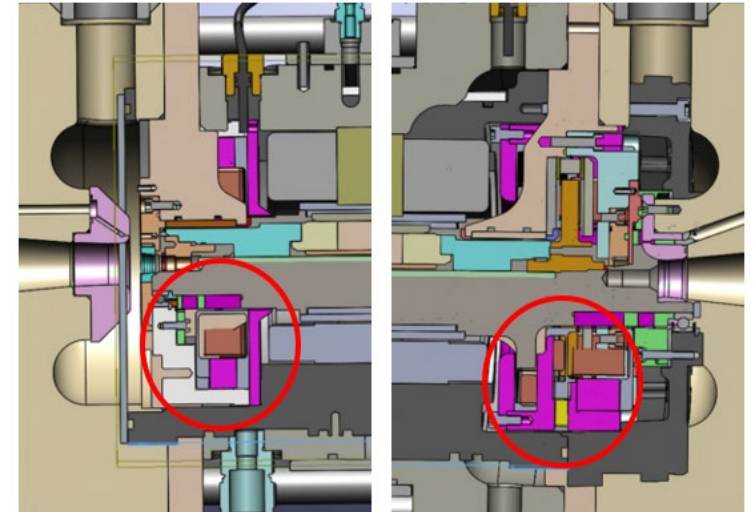
- Shaft size of 10MWe system

Bearing development

- Being tested at kW scale
- Could scale in the future



Re-design of TAC's to use porous media bearings



Re-design of TAC's to use magnetic bearings

Path Forward through Brayton Testing Capabilities

- **New Capability: High Temperature/High Pressure test loop being designed**
 - Max temperature of **750C**
 - Max pressure of **250 bar**
 - **Grid tie** capable of handling ~1MWe
 - To be constructed 2022-2024 depending on funding
- **Turbomachinery**
 - Reconfigure the turbomachinery development platform to test the existing turbine alternator compressor (TAC) coupled to new KEB motor controllers
 - Reconfigure the turbomachinery development platform from simple configuration to RCBC
- **Seals**
 - Test dry gas liftoff seals
 - Commission a new tester barrel for testing of a new seal technology
- **Bearings**
 - Test Porous Media and Magnetic Bearings

2-3-2022

sCO₂ Brayton Systems Community of Practice

DOE and SNL are launching the **Energy Conversion Collaboration Community (EC³)** Community of Practice to clearly articulate the **value proposition** for Brayton.

Join the conversation to discuss:

- Benefits
 - Efficiency
 - Compact Footprint
 - Water Usage/Cost
 - Clean Energy
- Market Opportunities
 - Thermal Storage
 - Waste Heat Recovery
 - Combined Heat and Power
- Value and Impact
- Metrics
 - TRL & MRL
 - LCOE & LACE
 - Cash Flow Analysis



EC³ Contact: Carmen M. Méndez
 National Technical Director, STEP R&D
cmmende@sandia.gov
STEP.sandia.gov
BRAYTON.sandia.gov



