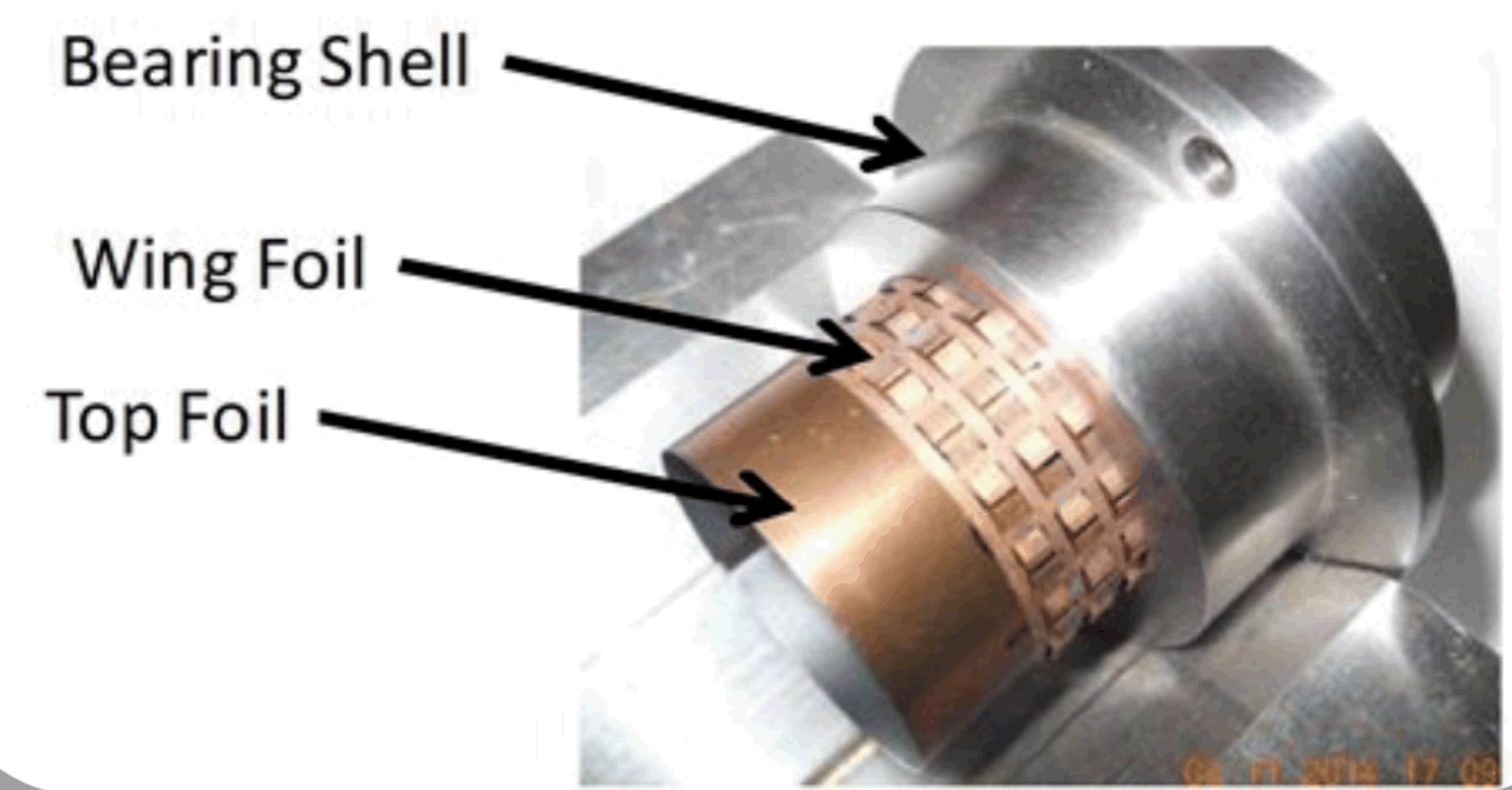
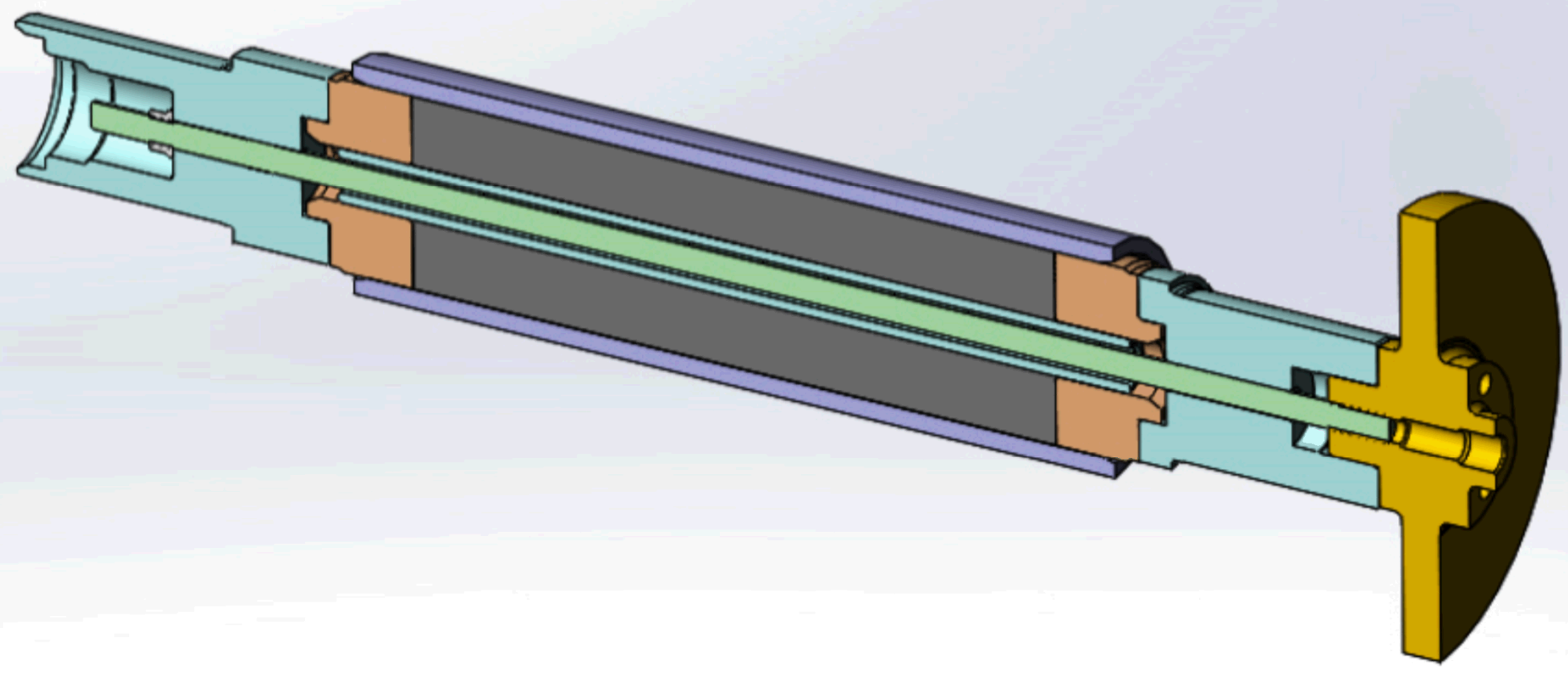


BEARING TEST PLATFORM



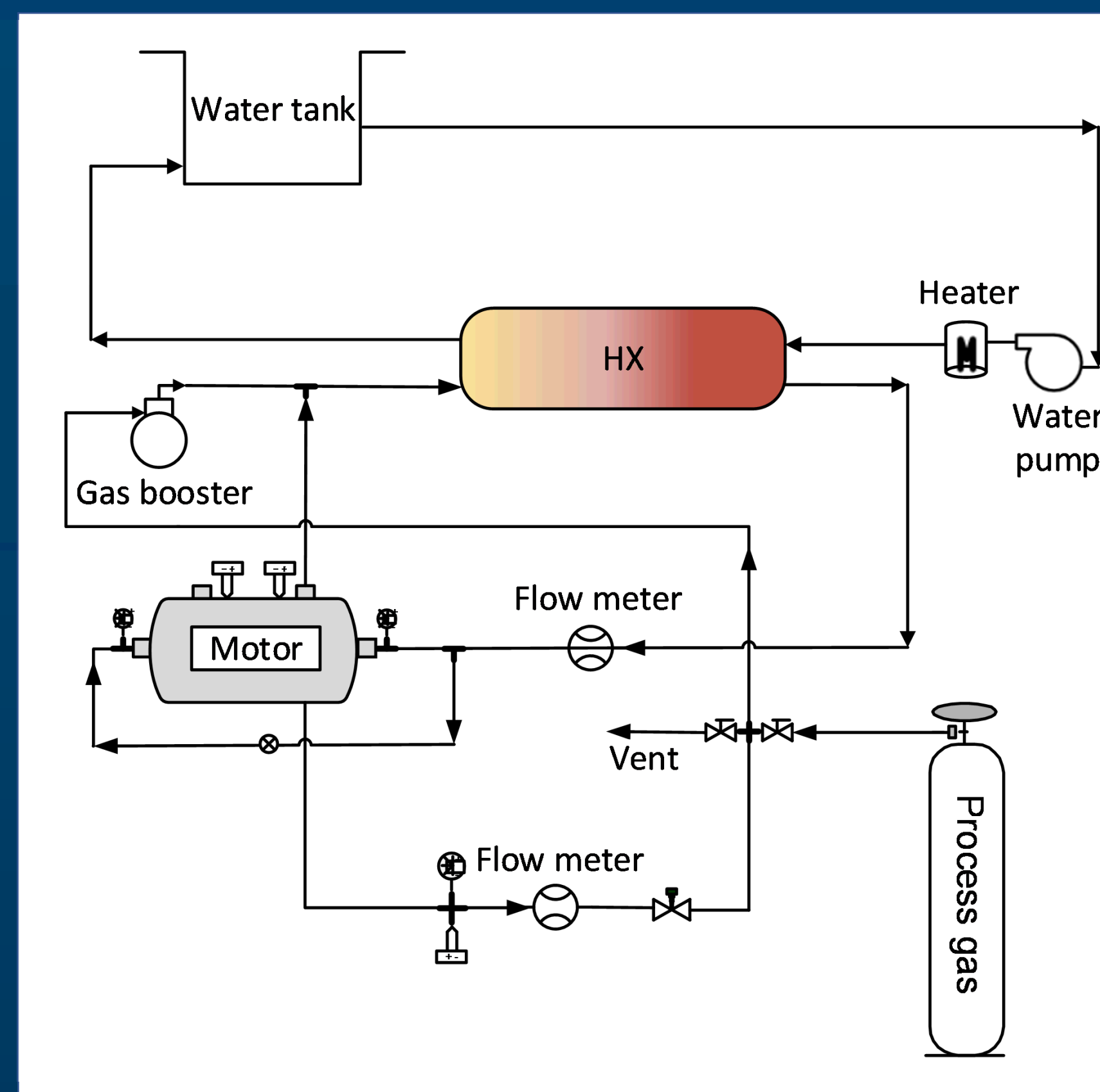
sCO₂ Brayton Capability at NESL

As one of Sandia's component test capabilities, the bearing test platform allows us to evaluate a variety of prototype designs under sCO₂ Brayton power cycle conditions.

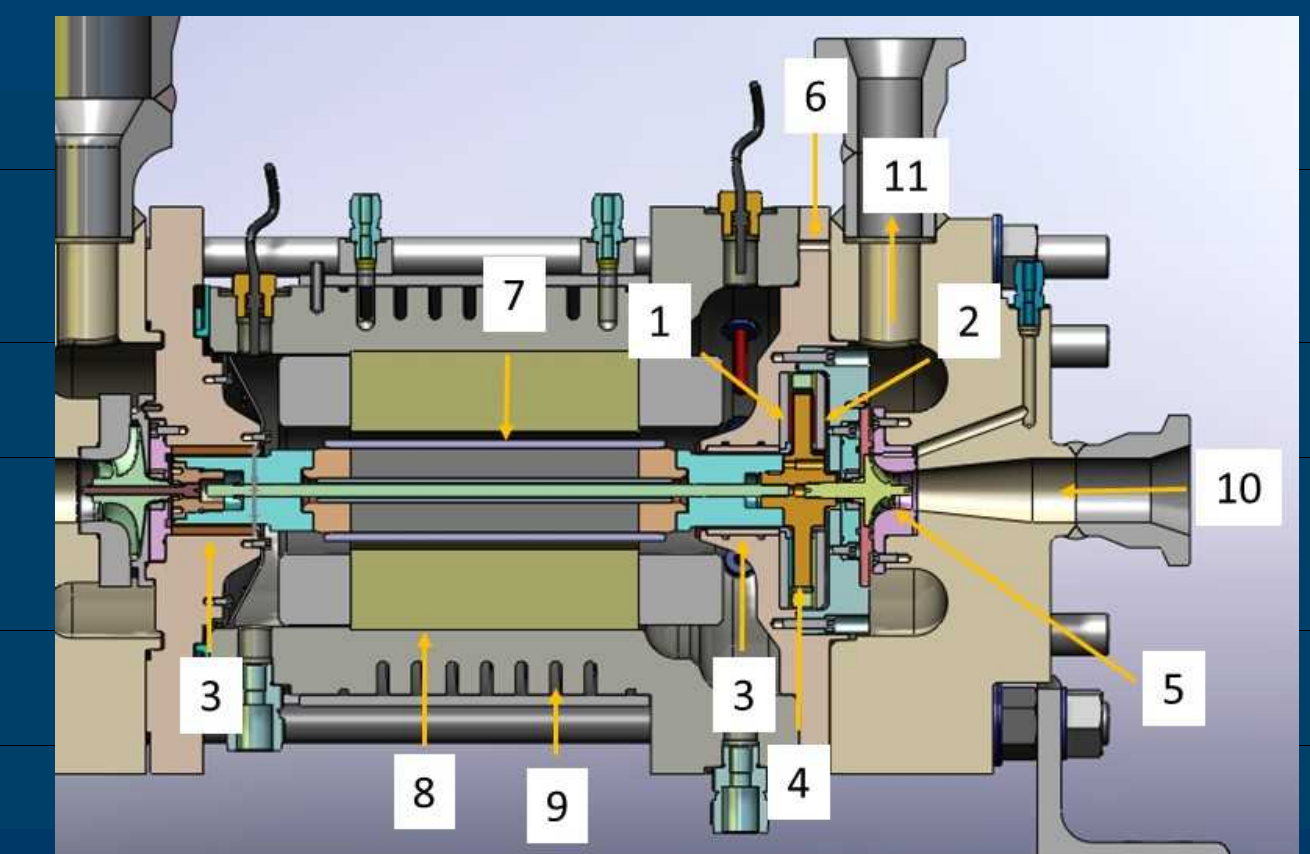
Features

- 400°F (bearing specific)
- 1500 psig
- CO₂ and sCO₂ process gas
- 3.5 kg/s flow rate
- 40,000 rpm
- 2" shaft diameter
- Vibration monitoring

Schematic

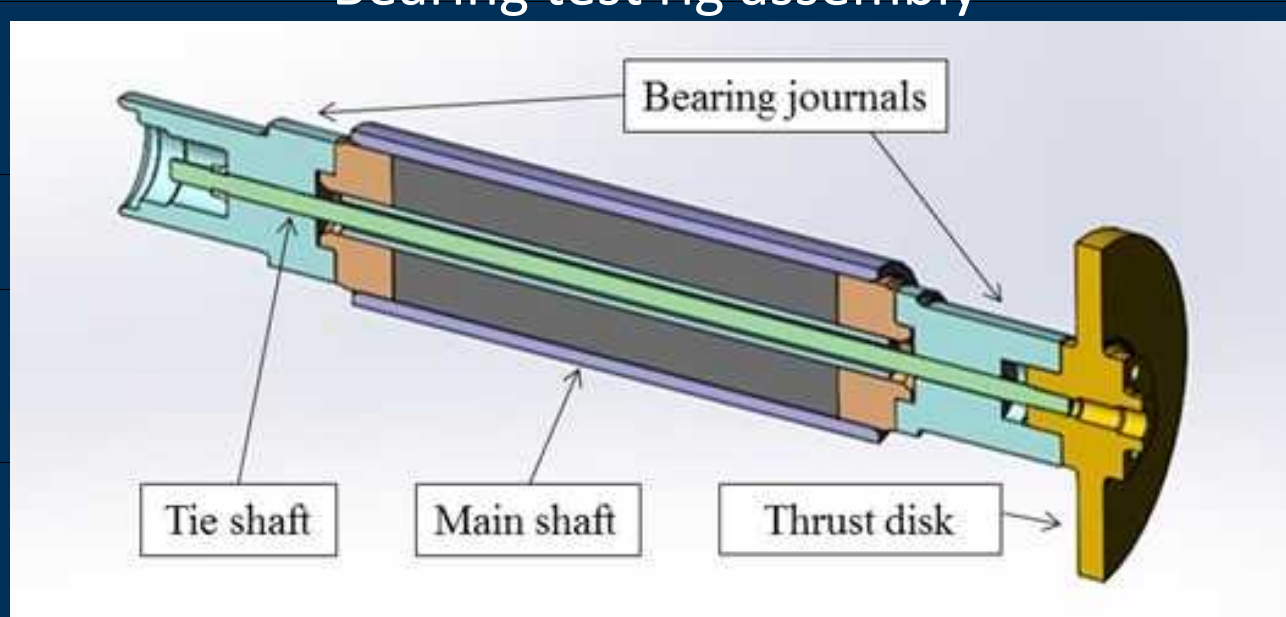


Location of motor components



| | | | |
|-----|------------------------|----|--------------------|
| 1,2 | Thrust bearings | 7 | Rotor |
| 3 | Journal bearings | 8 | Coil windings |
| 4 | Thrust disk | 9 | Integrated cooling |
| 5 | Compressor wheel | 10 | Inlet |
| 6 | Bearing mounting plate | 11 | Outlet |

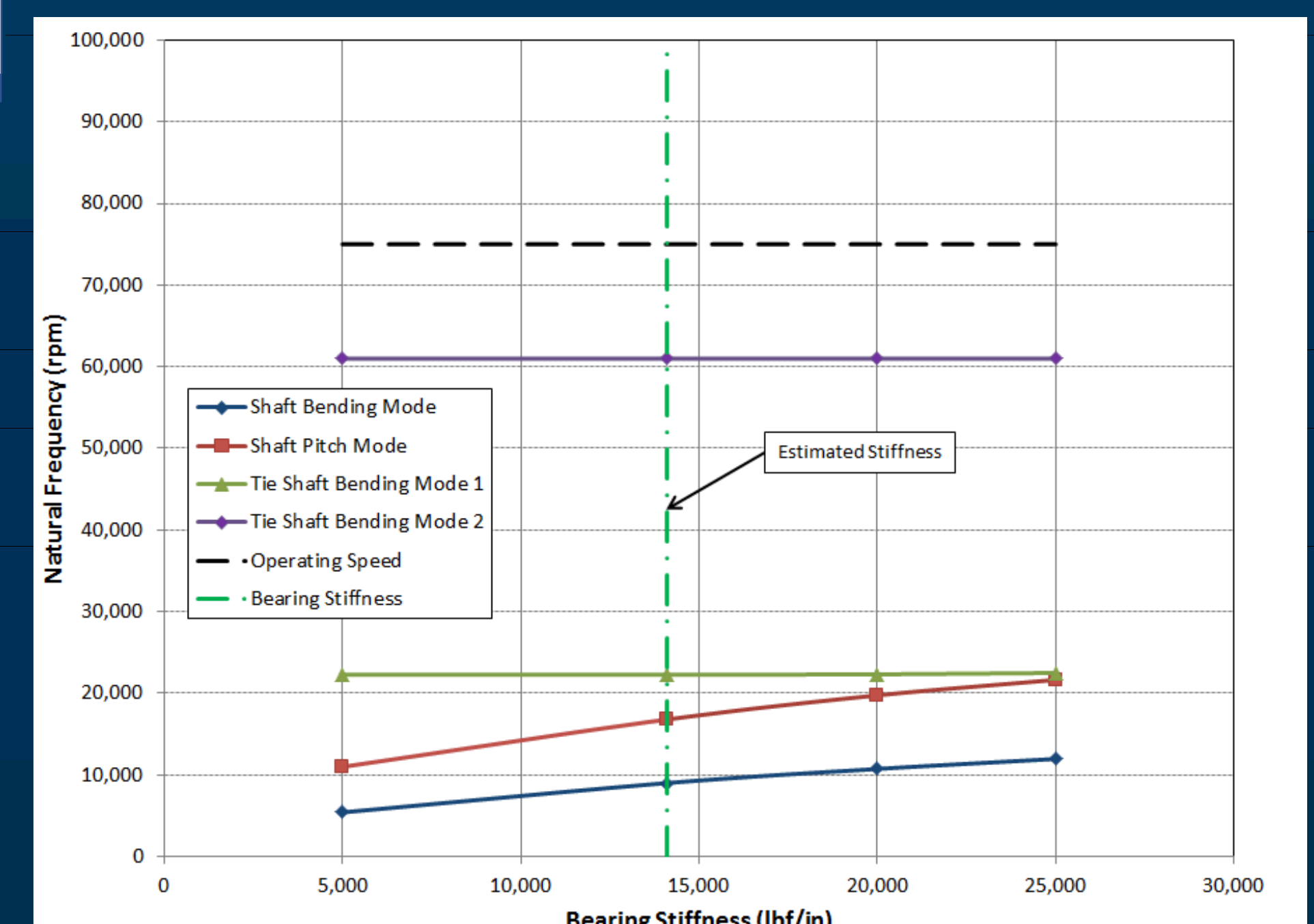
Bearing test rig assembly



Lateral rotordynamics analysis performed on bearing test rig assembly to ID system natural frequencies

Rotordynamics

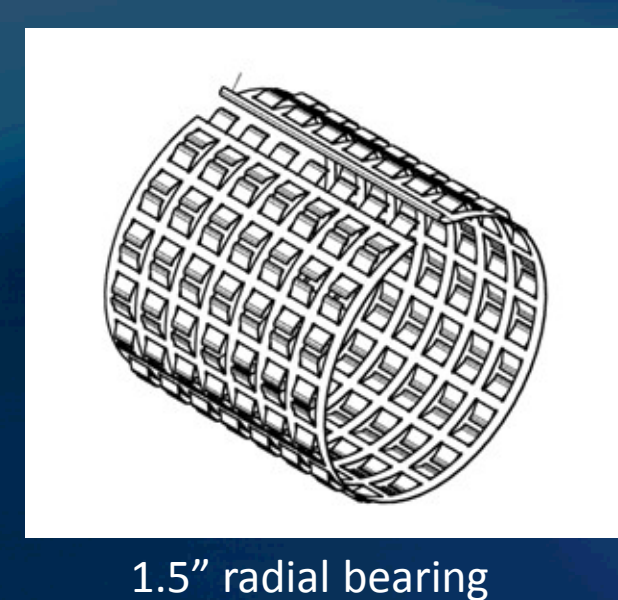
- Original Capstone bearing bump foils estimated to have 14,000 lb_f/in stiffness with 4 lb_f·s/in damping coefficient
- Shaft bounce (cylindrical) mode, shaft pitch (conical) mode, and both tie shaft bending modes do not overlap liftoff (25,000 rpm) or maximum theoretical speed (75,000 rpm)
- Shaft modes offer good opportunity to verify bearing properties
- For testing, unbalance will be introduced in the thrust disk using roll pins



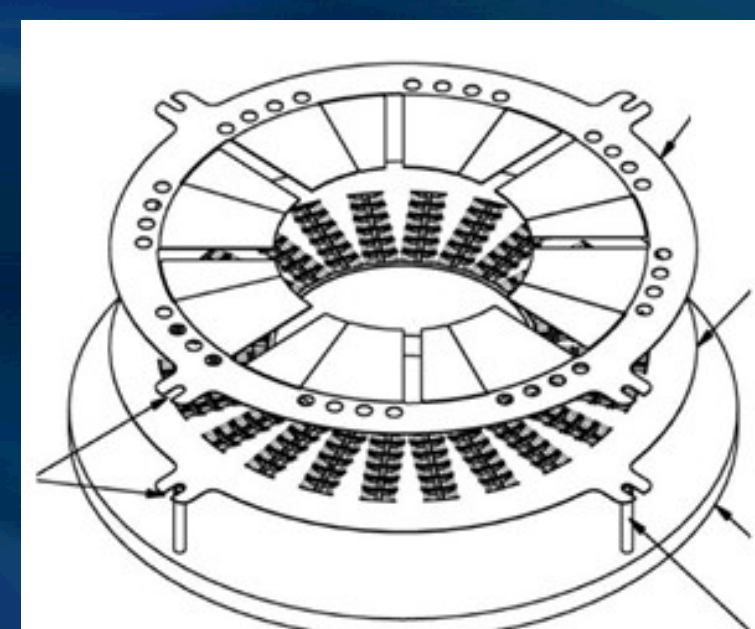
Current status

- Test platform shakedown and Capstone bearings benchmark testing are nearing completion
- Sandia has received Xdot prototype radial bearings for testing
- Sandia is working with Xdot on a thrust bearing design to double bearing thrust capacity

Bearing prototypes



1.5" radial bearing



3.5" thrust bearing



Technical challenges

- Solvent nature of sCO₂ removes coatings and oils from bearing
- Few qualified bearings to operate in a sCO₂ environment



Journal bearing wear