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# WHO WE ARE, WHAT WE DO



- Ahsan Choudhuri, Ph.D.
- Associate VP for Strategic Initiatives
- Professor of Mechanical Engineering
- Director, Center for Space Exploration Technology and Research (cSETR)



- Ryan Wicker, Ph.D.
- Professor of Mechanical Engineering
- Director, W.M. Keck Center for 3D innovation



- Yirong Lin, Ph.D.
- Associate Professor of Mechanical Engineering
- Faculty in both cSETR and Keck Center

- **cSETR:** FOSSIL ENERGY, PROPULSION, UAV
- **KECK CENTER:** ADDITIVE MANUFACTURING OF METALS, POLYMERS, CERAMICS, AND MULTIFUNCTIONAL SYSTEMS

## The University of Texas at El Paso

- Access and Excellence
- Enrollment: 25,000+
- Faculty: 1,200
- R1: Research 1 Carnegie Classification Doctoral University-Highest Research Activity University
- Hispanic Serving Institution (HSI): 82.4% of undergraduate and 61.7% of graduate students are Hispanic.
- Annual Operating Budget: \$500+ million
- Annual Research Expenditures: \$95+ million



cSETR's vision is to establish a minority university Center of Excellence in Aerospace research through strategic partnerships and to educate a diverse future aerospace workforce.

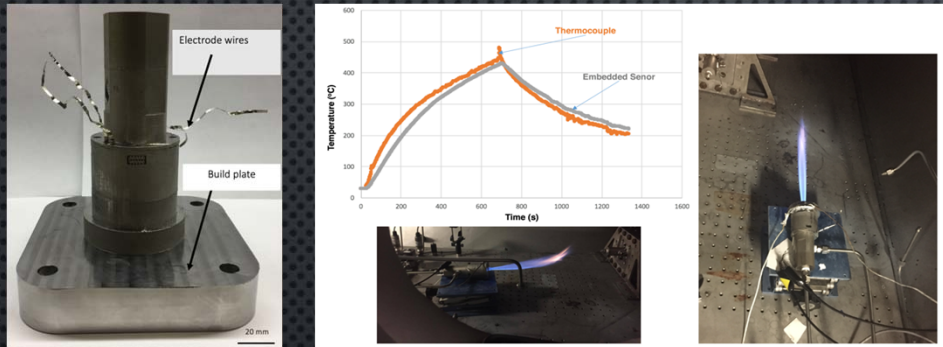


Keck Center's vision is for additive manufacturing (AM) technology to revive the economy through a transformation in the way products are designed and manufactured, taking advantage of distributed manufacturing and 3D multi-functional designs enabled by AM.

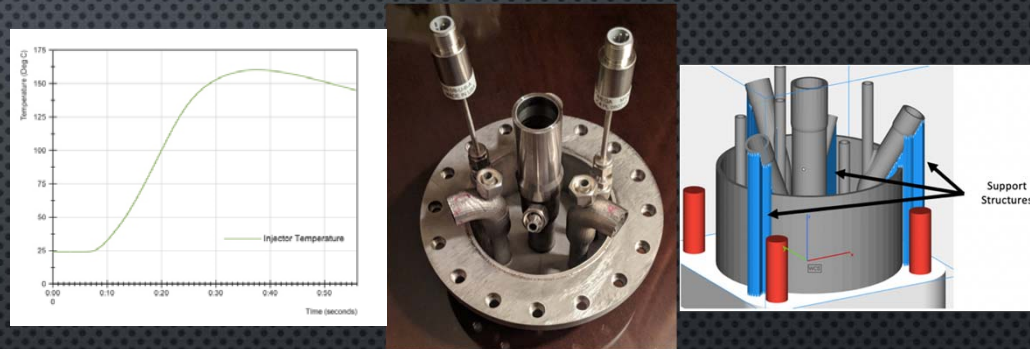


# AM APPROACHES FOR THE FUTURE OF CLEAN COAL

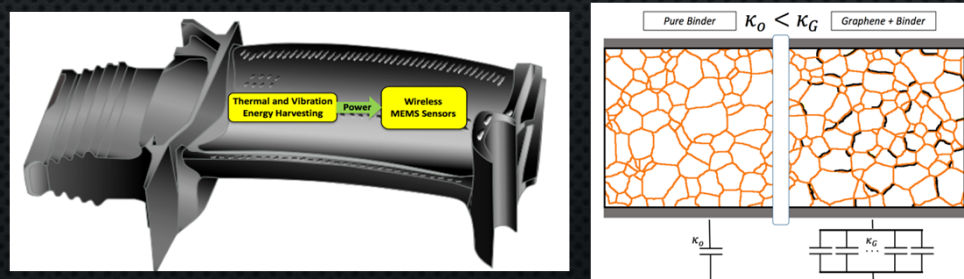
- Smart Parts with embedded pressure/temp sensor
  - Sensor embedded at desire location, no post processing
  - Both pressure and temp can be sensed in fuel injector



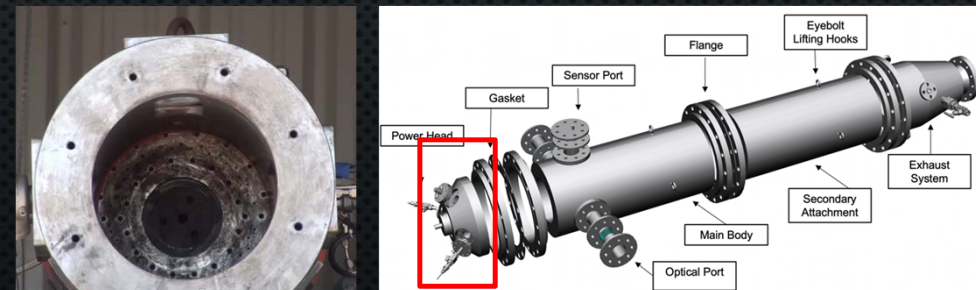
- Smart Injector with integrated thermocouple
  - Design for AM
  - High pressure / high energy compatible



- AM of LiNbO<sub>3</sub>/GRAPHENE FOR ENERGY HARVESTING
  - HARVESTING BOTH THERMAL AND MECHANICAL ENERGY
  - POWER WIRELESS SENSORS IN COAL POWER PLANTS



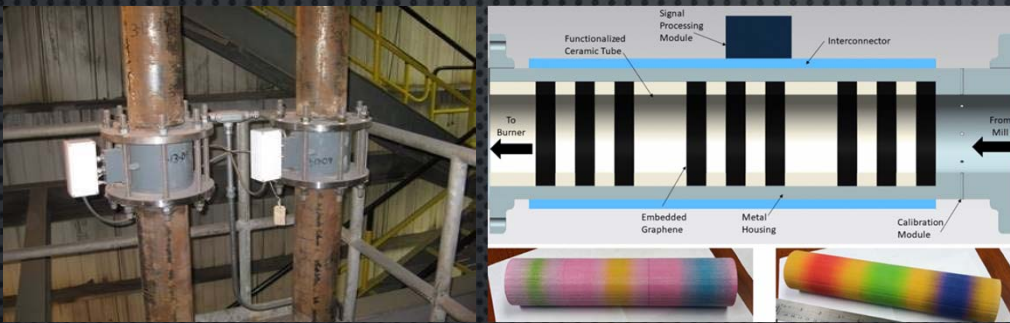
- Pressurized oxy-coal combustion systems
  - ACHIEVE 90% CO<sub>2</sub> CAPTURE
  - RECOVERING LATENT HEAT OF THE STEAM IN THE FLUE GAS





# SEED IDEAS FOR DISCUSSION

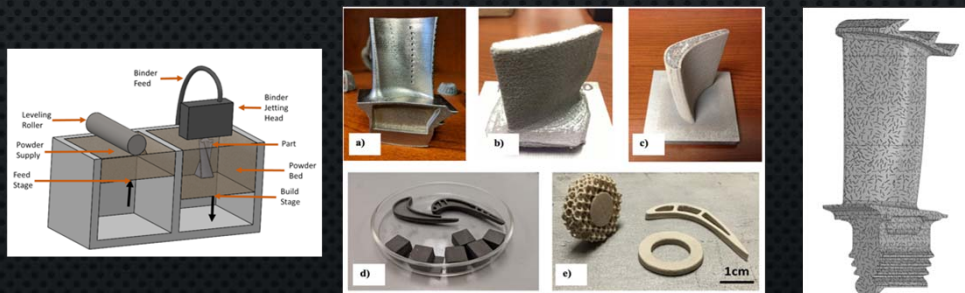
- Smart Ceramic Coal Pipe for PF Flow Monitoring
  - Integrated graphene – ceramic ceramic tube
  - High reliability, high sensitivity, AM enabled
  - Heat rate sensing for lower emission and higher efficiency



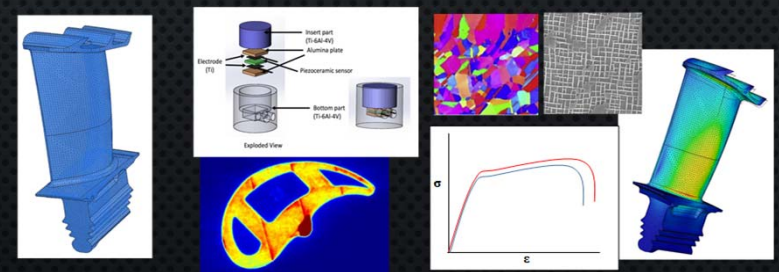
- Smart Coal Burner Head
  - Embedded temperature and pressure sensor
  - Enable enhanced efficiency and lower CO<sub>2</sub> emission



- AM OF CERAMIC MATRIX COMPOSITES FOR TURBINE BLADES
  - FUNCTIONAL GRADIENT BY AM TO REDUCE THERMAL MISMATCH
  - LOWER COST, HIGHER EFFICIENCY, LOWER EMISSION



- AM enabled smart parts for performance prediction
  - MODELING, MONITORING, DATA ANALYTICS
  - ENABLE FAILURE PREDICTION, CONDITION-BASED MAINTENANCE



Thank you!

