



# Turbomachinery Design Training Week

September 9-13, 2024

## Agenda

**\*\*All times in CDT\*\***

<b>Day 1: Monday, September 9, 2024 – Thermodynamics and Cycles</b>	
8:15 – 8:30 a.m.	Registration / Coffee / Breakfast Reception
8:30 – 8:35 a.m.	A. Introductions and Welcome ( <i>Dr. Tim Allison</i> )
8:35 – 9:30 a.m.	B. Basic Thermodynamics of Heat Engines and Power Cycles Including PV Diagrams, TS Diagrams, Carnot Cycle, and Brayton Cycle ( <i>Dr. Jeff Moore</i> )
9:30 – 10:00 a.m.	<b>Break</b>
10:00 – 11:30 a.m.	C. Component Overview: Compressors and Expanders ( <i>Dr. Jeff Moore</i> )
11:30 – 12:00 p.m.	Aero Design Considerations of Seals and Secondary Flow ( <i>Dr. Jeff Moore</i> )
<b>12:00 – 1:00 p.m.</b>	<b>Lunch</b>
1:00 – 2:00 p.m.	D. Component Overview: Heat Exchangers ( <i>Mrs. Kelsi Katcher</i> )
2:00 – 3:00 p.m.	E. Component Overview: Basics of Combustors and Sizing ( <i>Mr. Seth Cunningham</i> )
3:00 – 3:15 p.m.	<b>Break</b>
3:15 – 4:15 p.m.	F. Cycle Analysis and Optimization / NPSS Teaser ( <i>Mr. George Khawly</i> )
<b>Day 2: Tuesday, September 10, 2024 – Aerothermal Design of Compressors and Expanders</b>	
8:15 – 8:30 a.m.	Registration / Coffee / Breakfast Reception
8:30 – 9:30 a.m.	A. Overview of the Design Process ( <i>Dr. Natalie Smith</i> ) B. Selection of Machine Type: Radial / Axial / PD ( <i>Dr. Natalie Smith</i> )
9:30 – 9:45 a.m.	<b>Break</b>
9:45 – 10:45 a.m.	C. 1-D Design Process ( <i>Mr. Cole Replogle</i> )
10:45 – 12:00 p.m.	D. Blade Definition and Flow Distribution a. Axial ( <i>Mr. Michael Marshall</i> ) b. Radial ( <i>Mr. Michael Marshall</i> )
<b>12:00 – 1:00 p.m.</b>	<b>Lunch</b>
1:00 – 1:30 p.m.	E. Additive Manufacturing for Turbomachinery Components ( <i>Mr. Nathan Andrews</i> )
1:30 – 2:00 p.m.	F. a. CFD Analysis ( <i>Mr. Michael Marshall</i> )
2:00 – 3:00 p.m.	Facility Tour of 278 ( <i>Dr. Jeff Moore / Mr. Aaron Rimpel</i> )
3:00 – 3:15 p.m.	<b>Break</b>
3:15 – 4:15 p.m.	G. Case Studies a. SunShot Dyno – Clean-Sheet Design ( <i>Dr. Natalie Smith</i> ) b. kW-scale sCO <sub>2</sub> – Conceptual Sizing ( <i>Dr. Natalie Smith</i> ) c. IR&D Impeller – Design by Scaling ( <i>Dr. Natalie Smith</i> )
4:15 – 5:00 p.m.	H. Operate Solar T62 Gas Turbine ( <i>Dr. Jeff Moore / Mr. Aaron Rimpel</i> )
5:30 – 6:30 p.m.	<b>Drinks and Appetizers at Saltgrass Steak House</b>



# Turbomachinery Design Training Week

March 25-29, 2024

## Agenda

**\*\*All times in CDT\*\***

<b>Day 3: Wednesday, September 11, 2024 – Rotordynamics and Blade Dynamics</b>	
8:15 – 8:30 a.m.	Registration / Coffee / Breakfast Reception
8:30 – 10:00 a.m.	A. Rotordynamic Analysis ( <i>Mr. Aaron Rimpel</i> )
10:00 – 10:15 a.m.	<b>Break</b>
10:15 – 11:15 a.m.	B. Rotordynamic Instrumentation and Case Studies ( <i>Dr. Tommy Kerr</i> )
11:15 – 12:00 p.m.	C. Live Demo of Rotor Rig ( <i>Mr. Aaron Rimpel</i> )
<b>12:00 – 1:00 p.m.</b>	<b>Lunch</b>
1:00 – 2:00 p.m.	D. Introduction to Blade Dynamics ( <i>Mr. Cole Replogle</i> )
2:00 – 2:45 p.m.	E. Aeromechanical Design ( <i>Mr. John Klaerner</i> )
2:45 – 3:00 p.m.	<b>Break</b>
3:00 – 3:30 p.m.	F. LCF Life Estimation ( <i>Mr. Cole Replogle</i> )
3:30 – 4:15 p.m.	G. Modal Testing Introduction and Demonstration ( <i>Mr. Seth Cunningham</i> )
4:15 – 5:00 p.m.	H. Materials Lab Tour ( <i>Dr. Mirella Vargas</i> )
<b>Day 4: Thursday, September 12, 2024 – Machine Integration and Design Exercise</b>	
8:15 – 8:30 a.m.	Registration / Coffee / Breakfast Reception
8:30 – 9:00 a.m.	A. Machine Design Introduction (Conceptual / Detail Design) ( <i>Dr. Jeff Moore</i> )
9:00 – 9:45 a.m.	B. 2-D Layout ( <i>Mr. Jonathan Wade</i> )
9:45 – 10:00 a.m.	<b>Break</b>
10:00 – 11:00 a.m.	C. Case and Internal Component Design and Pressure Containment ( <i>Mr. Jason Bensmiller</i> )
11:00 – 12:00 p.m.	D. Detail Design Topics ( <i>Mr. Aaron Rimpel</i> )
<b>12:00 – 1:00 p.m.</b>	<b>Lunch</b>
1:00 – 2:00 p.m.	E. Detail Design Topics ( <i>Mr. Aaron Rimpel</i> )
2:00 – 2:30 p.m.	F. Materials ( <i>Mr. Aaron Rimpel</i> )
2:30 – 3:00 p.m.	G. Packaging ( <i>Mr. Jonathan Wade</i> )
3:00 – 3:15 p.m.	<b>Break</b>
3:15 – 5:00 p.m.	H. Design Exercise of Centrifugal Compressor Impeller ( <i>Mr. Jonathan Wade</i> )
<b>Day 5: Friday, September 13, 2024 – Turbomachinery Testing and Data Analysis</b>	
8:15 – 8:30 a.m.	Registration / Coffee / Breakfast Reception
8:30 – 9:45 a.m.	A. Turbomachinery Performance Testing ( <i>Dr. Natalie Smith</i> ) a. Aero Performance & PTC-10 b. Overview of Process Instrumentation
9:45 – 10:00 a.m.	<b>Break</b>
10:00 – 11:15 a.m.	B. Tour ( <i>Dr. Natalie Smith</i> ) a. DR – Apollo closed loop facility b. SSTR – open loop facility
11:15 – 12:00 p.m.	C. Detailed Instrumentation Considerations for Turbomachinery ( <i>Dr. Natalie Smith</i> )