


Overview of AAB Activities

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The background features several decorative elements consisting of concentric circles in shades of blue, resembling ripples in water. These circles are scattered across the lower half of the slide, with a prominent one in the bottom center and others towards the bottom right.

WHO WE ARE

- **Chair:** Karen Thole, VA Tech
- **Co-Chair:** Tim Lieuwen, GA Tech
- **Secretary:** Vince McDonell, U. of CA Irvine
- **Education:** Yongho Sohn, U. of Central FL
- **Combustion:** Dom Santavicca, Penn State
- **Materials:** Eric Jordan, UCONN
- **Aero / Heat Transfer:** Jeffrey Bons, Brigham Young
- **Diagnostics:** Scott Sanders, U. of Wisconsin



WHAT WE DO

- Provide feedback to the UTSR Program
- Propose activities to the Industry Review Board
 - Research topics for the next year solicitation
- Develop short courses on gas turbine technologies
 - 19 courses, see <http://www.clemson.edu/scies/AABShortCourse.pdf>
 - Examples
 - “Experimental Methods in Heat Transfer and Flow Measurements”
 - “Fundamentals of CFD and its application to Turbines”
 - “Combustion Diagnostics”
 - “Combustion Instabilities”
 - “Materials and Coatings for Turbine Applications”
 - “Principles and Applications of NDE”

TECHNICAL FOCUS AREAS

- *Materials*
- *Combustion*
- *Aerodynamics / Heat Transfer*
- *Sensors and Diagnostics*

Key Technical Challenges Addressed by UTSR Research Programs

Materials and Coatings

- Need: durable, reliable materials and coatings for aggressive environments
 - Higher temperatures (max TIT, minimum cooling air extraction)
 - Change in potential source of chemical attack
 - higher levels of steam
 - Hydrogen embrittlement
 - New aggressive contaminants (Ca, Mg, Al, Si, S...)
 - Increase in thermal gradients (sintering resistance important)
- Technical programs:
 - Development : better TBC, ceramics, etc.
 - Testing: Nondestructive evaluation of cracking, spalling, deposit formation
 - Characterization: thermal, mechanical properties, lifetimes, degradation rates

Heat Transfer and Aerothermal

- Need: better understanding of turbine flow and thermal environment
 - Increased flow Reynolds number with move to lower heating value synfuels
 - Higher heat transfer
 - Increased coolant requirements
 - Higher temperatures (max TIT, minimum cooling air extraction)
 - Increased influence of secondary flows (endwalls, tip flows)
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- Technical programs:
 - Design: contoured endwalls, film cooling hole design and layout, internal cooling rib design
 - Flow Characterization: combustor exit flow simulation, endwall flows, rotational effects
 - Surface Characterization: effects of surface roughness and deposit formation on heat transfer and film cooling performance
 - Predictive Capability: fully 3D, unsteady flow and heat transfer calculations of film and internal cooling (LES, URANS)

Combustion

- Need: low emissions, stable combustion systems that are robust to fuel composition variation
 - Significant variation in heating value and constituents of syngas fuels has significant impact on
 - combustor operability
 - Flashback
 - Autoignition
 - Blowoff
 - Combustion instability
 - Emissions
- Technical programs:
 - Measurements/correlations of fuel composition variability on combustor operability and emissions
 - Modeling: reduced order and computational

Sensors and Diagnostics

- Need: Sensors offering information needed to improve / optimize system performance
 - Crosscutting: sensors needed for all areas (aerothermal, materials, and combustion)
 - Various grades: research-grade (e.g., sensors for laboratory tests of components) through production-grade (e.g., integrated sensors for health monitoring and/or system control)
 - Sensor merits: reliability, affordability, flexibility to monitor different problems as dictated by evolving operating regimes, and ability to distribute sensors to multiple locations
 - Challenges: Harsh environments, variable conditions, high-speed rotation, etc.
 - Motivation: FE program goals often require engines to be operated closer to stability/performance limits – improved sensing capabilities enable reliable operation near such limits
- Technical programs:
 - Optical and/or acoustic sensing of gas properties (temperature, equivalence ratio, etc.) – lab tests through production prototypes
 - Optical sensing of material properties (temperature, strain, etc.) – primarily lab tests
 - Imaging of combustion and fluid-mechanics phenomena (e.g., velocity fields, imaging of gas species) – lab tests

AAB Elections

- Nominations needed for:
 - Vice chair: Jeffrey Bons, Uri Vandsburger
 - Education sub-committee: Robert Santoro
 - Sensors and Diagnostics member: Mike Renfro
 - Aero/Heat transfer member: Sumanta Acharya

AAB Meeting

- We will be meeting at 8 o'clock on Tuesday evening