Spring Workshop
Center for Acoustics and Vibrations

The Pennsylvania State University
April 25-26, 2017
CAV researchers identify and solve problems that matter

The CAV has three core missions:

- To strengthen basic and applied research in related engineering areas
- To provide a base for technology transfer to industry
- To foster graduate education in acoustics and vibration engineering

- Acoustics, Aerospace, Mechanical, Civil, Architectural, Electrical, Meteorology, Physics, Biology

Contact: George Lesieutre (Director) g-lesieutre@psu.edu
Steve Hambric (Assoc Director) sah19@psu.edu
The CAV Workshop aims to be useful to you

- Lasting partnerships
  - Connections between you and Penn State Center for Acoustics and Vibration other organizations
  - Early access to talent flows
  - Opportunities for investment
  - Research of mutual interest
  - Advisory service
The CAV is organized around communication & technical focus

- **Focal point for acoustics & vibration technology**
  - Focus interest groups
    - Lunch seminars
  - Multi-departmental joint activities

- **Corporate member benefits**
  - Spring Workshop
    - Share tech challenges
    - Newsletter
  - Short course
    - Video-streamed seminars
    - Acoustics distance ed
  - Informal consultation
  - Meet students

Focus us on problems that matter

http://www.cav.psu.edu/corporate.aspx
The CAV is a network of talented and dedicated people

Director – George Lesieutre
Associate Director – Steve Hambric

Technical Groups and Leaders
Acoustic Characterization of Materials - Bernhard Tittmann
Adaptive Structures & Noise Control - George Lesieutre
Flow-Induced Noise – Mike Jonson
Propagation & Radiation - Victor Sparrow
Rotorcraft Acoustics & Dynamics - Edward Smith
Structural and System Health Management – Karl Reichard & Cliff Lissenden
Structural Vibrations & Acoustics – Steve Hambric
Underwater Acoustics – Amanda Hanford
Biomedical Acoustics (working group) – Julianna Simon
CAV faculty received good recognition this year

Vic Sparrow – Rayleigh Lecture, ASME Noise Control and Acoustics Division

Kenji Uchino – International Ceramic Award, Global Academy of Ceramics

Ed Smith – AIAA Associate Fellow

Lyle Long – AIAA Aerospace Software Engineering Award

Richard C. Marboe – Senior VP for Technical Events and Content, ASME

Chris Rahn – Associate Dean for Innovation, Penn State College of Engineering

George Lesieutre – Associate Dean for Research, PSU College of Engineering
CAV students won some nice awards this year, too

2016 American Helicopter Society Vertical Flight Foundation Scholarships
  Miguel Alvarez
  Bryce Connelly
  Ethan Corle
  Jason Cornelius
  Edward T. Rocco
  Jared Soltis
  Belen Veras-Alba

Peter Kerrian – Best Student Paper Award in Structural Acoustics and Vibration, Acoustical Society of America, May 2016

Veronica Koh – Best Student Paper in Engineering Acoustics, Acoustical Society of America, 2016

Minkyu Choi – 2nd place poster, 2016 Int’l Workshop on Acoustic Transduction Materials and Devices

Andrew Suprock – Silver Award for poster at the July 2016 Conference on Progress in Quantitative NDE

Philip Feurtado – 2016 Skudrzyk Award, Graduate Program in Acoustics; ARL Student Contribution Award

Martin Lawless – 2016 Kenneth T. Simowitz Memorial Award, Graduate Program in Acoustics

Matthew Neal – 2016 Kenneth T. Simowitz Memorial Citation, Graduate Program in Acoustics
International Liaisons represent the pulse of global technology

Paul White (Matthew Wright)
Institute of Sound and Vibration Research, U.K.

Lars Enghardt
DLR-Institut fuer Antriebstechnik, Germany

Antonio Concilio
Centro Italiano Ricerche Aerospaziali, Italy

Étienne Parizet (Goran Pavic)
INSA de Lyon, Vibrations and Acoustics Laboratory, France

Jeong-Guon Ih
KAIST, Vibrations and Acoustics Laboratory, Korea

Wim Desmet
Noise and Vibration Research Group, Katholieke University, Leuven, Belgium

Li Cheng
Consortium for Sound and Vibration Research, Hong Kong Polytechnic University

Alain Berry
Groupe d'Acoustique de l'Université de Sherbrooke (GAUS), Canada

Guests: Universita di Napoli Federico II, Bundeswehr Technical Center, DLR Braunschweig, TNO, National Aviation University (Ukraine)
Government Liaisons keep us apprised of opps and advances

JohnPaul Abbott
Keith Gillis
National Institute of Standards and Technology

Hua (Bill) He
Federal Aviation Administration

Richard Szwerc
Kuangcheng Wu
Naval Surface Warfare Center

Alexander Tsirigotis
US Nuclear Regulatory Commission
Vendor Liaisons keep us apprised of needs and available new technology

Kenneth Marchetti
  *PCB Piezotronics*

Martin Alexander
  *Bruel & Kjaer*

Phil Shorter
  *wave six / CD-ADAPCO*

*Romax software*
Corporate Sponsors
focus us on problems that matter

3M – Thomas Herdtl; Zhiming Luo, Fredrick Vance (Aearo Technologies)
American Acoustical Products – Emanuele Bianchini
Babcock & Wilcox – Suzana Rufener
Bechtel Marine Propulsion Corp – Matthew Plutt
Boeing – Aaron Sassoon
Bose – Ray Wakeland
Bridgestone Americas – Yousof Azizi, Jim Sube
Bristol Compressors – David Gilliam
Corning – Keith Fisher, Rohan Galgalikar, Yousef Qaroush, Chao Yu
Emerson / Fisher Controls – Joel Bland, Daniel Eilers, Shawn Anderson
Gulfstream – Kristopher Lynch
ITT Enidine – Mark Ott, Mark Downing
Johnson Controls – Troy Taylor
C.F. Martin Guitars* – Josh Parker
Moog – Chris Layer
Newport News Shipbuilding – Brian Pollard, William Rinehart, Kevin Smith
Praxair – Reh-Lin Chen
Textron Aviation – Zachary Lammi
United Launch Alliance – Matt Bloom
United Technologies Corp. – (Pratt & Whitney) Richard LaBelle, Kerwin Low, Brandon Rapp; (UTRC); (Carrier) – Lee Tetu, Yongxin Wang; (Otis) – Zheng Yu
Volvo Construction Equipment – Hongan Xu

* small company
CAV Short Courses help keep our sponsors current

Workshop
Flow Induced Noise and Vibration: Issues & Aspects (FLINOVIA II)

Organized by:
Steve Hambric and Amanda Hanford
   Center for Acoustics and Vibration, Penn State University, USA
Elena Ciappi
   CNR-INSEAN, The Italian Ship Model Basin, Rome, Italy
Sergio De Rosa and Francesco Franco
   University of Naples “Federico II”, Italy
Jean-Louis Guyader
   CELYA, Lyon Acoustics Centre, University of Lyon, France
Randolph Leung
   Hong Kong Polytechnic, Hong Kong

Two days, following CAV Workshop:
April 27-28, 2017

What would be helpful to you in the future? Let us know!
CAV group seminars can be enjoyed from your desk

Research in the Electroactive Materials Characterization Laboratory

Zoubeida Ounaies and Group
We listen to you, and evolve

- **Workshop**
  - Two full days, travel (Q&A, networking)
  - More students (and poster competition)
  - Short course topics
- Circulate job postings to students
- Send CAV faculty for consultation
  - Contact us!

What’s New-ish?
- **Thesis database**, list in newsletter
CAV Thesis Database puts student research at your fingertips

<table>
<thead>
<tr>
<th>Thesis Title</th>
<th>Author Name</th>
</tr>
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<tbody>
<tr>
<td>Acoustic bubble: controlled and selective micropropulsion and chemical waveform generator</td>
<td>Ahmed, Daniel</td>
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<tr>
<td>Thesis Date: 10/21/2013</td>
<td>PhD Engineering Science and Mechanics</td>
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<td>PDF Available? Yes</td>
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<tr>
<td>Ultrasonic guided wave bondline evaluation of thick metallic structures with viscoelastic coatings and the demonstration of a novel mode sweep technique</td>
<td>Bostron, Jason</td>
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<td>Thesis Date: 10/7/2013</td>
<td>PhD Acoustics</td>
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<tr>
<td>PDF Available? Yes</td>
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<tr>
<td>Computation of Interactional Aerodynamics for Noise Prediction of Heavy Lift Rotorcraft</td>
<td>Hennes, Christopher C.</td>
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<tr>
<td>Thesis Date: 9/27/2013</td>
<td>PhD Aerospace</td>
</tr>
<tr>
<td>PDF Available? Yes</td>
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Penn State is a research powerhouse

• In FY 2016, Penn State people performed $838M of research*
  – ARL/EO $205M; Engineering $128M; Science $101M; EMS $69M; IST $8M
  – Projects with more than 400 companies
  – $83M with non-gov’t sponsors

  http://www.research.psu.edu/industry

• Unique strengths in engineering and the physical sciences
  – 340 Engineering faculty; 650 ARL researchers
  – Positioned to educate the next generation of engineers and scientists
Example: Penn State is advancing rotorcraft research

- 1 of 3 competitively awarded centers in the US (VLRCOE)
- PSU has won 4 competitions since 1996
- Currently ~$5.0M per year (6.1 and 6.2) (incl. ARL, matching)
  - 20+ unique sponsors
  - 25 faculty and 60+ PSU grad students
    - Major source of talent
Example: Penn State is advancing rotorcraft research

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Penn State is educating the next generation of citizens and engineers

• **Penn State**
  - 41,360 undergrads at UP (60% PA) (76,770 total residence)
    • 4810 international
  - 5,900 graduate students at UP (24% PA) 8,960 total)
    • 2530 international
  - 13,410 World Campus students (5,490 grad students)

> 600,000 living and loyal graduates

• **College of Engineering** (#18U; #27G)
  - 8170 undergraduates (+~1800 non-COE/UP; 1425 int’l) (5th/365)
    • 4th in B.S. degrees (1624)
    • Highest math and overall SAT scores (sometimes verbal!)
  - 1380 graduate students (+460 w/PT, non-UP; 950 int’l)
    • 52nd/288 in M.S. degrees (588)
    • 7th/223 in Ph.D. degrees (228)
... in the context of the PSU COE World Class Engineer

• Aware of the world
• Customer-oriented
• Solidly grounded
• Technically broad
• Versatile
• Effective in groups
Our graduates are highly sought after

- *Wall Street Journal* ranked Penn State as the #1 university from which companies like to hire students (best-prepared, most well-rounded, equipped to succeed)
- *Aviation Week & Space Technology* ranked Penn State #1 for aerospace hiring in 4 of the last 6 years
Your companies can engage and have an impact at Penn State

- Visit us (seminars)
- Hire our students
  - Co-ops, internships, undergrads, grads
  - Several CAV students have resumes today
- Advise us (CAV, IPACs, design teams)
  - ABET feedback
- Sponsor student activities
  - Undergrad design projects; society meetings
  - Graduate research; joint proposals
- Provide financial support
  - Scholarships and fellowships
  - Program funds
    - Laboratory facilities and projects; Lecture series; Research
  - Faculty Chairs & Professorships
    - Visiting positions from industry
Partnering with PSU CAV makes good business sense

- **Interdisciplinary Research**
  - Facilitated through University-wide initiatives and fostered by a unique intellectual climate that crosses traditional academic boundaries

- **Well-Prepared Students**
  - Abundant opportunities to put learning into practice and build time-management, organizational and collaborative skills

- **Global Reach, Global Impact**
  - Extensive online World Campus; alumni in leadership positions at major global enterprises

- **Industry-Friendly Partnering**
  - Streamlined contracting procedure, complemented by professional staff

- **Revolutionary IP Posture**
  - Flexible approach to IP management in industry-sponsored research, leading to simplified negotiations and faster time-to-market

- Ranked #1 by WSJ for producing best-prepared, most well-rounded graduates - equipped to succeed

- Ranked #1 in AW&ST survey as the university from which A&D firms like to hire engineers

- ITAR-capable (and beyond)

- PSU does not seek to retain ownership of IP developed from research programs funded by industry
Penn State can help you shape your future and meet objectives

- **Maximize Your Research Investment**
  - Leverage PSU advanced research, and capitalize on outstanding faculty and students and IP policy

- **Strengthen Your Brand Recognition**
  - Put PSU institutional loyalty to work to boost visibility across customers, policy makers and future employees

- **Globalize Your Business**
  - Gain know-how navigating cultural complexities to expand opps, improve profitability and max success

- **Transform Your Workforce**
  - Exploit PSU executive / professional education opps as well as jointly-tailored training programs

- **Acquire Talent to Enhance Your Operations**
  - Establish a conduit to versatile and innovative grads with fresh ideas on driving operational effectiveness and competitive advantage

- **Demonstrate Your Corporate Responsibility**
  - Be pro-active in tackling social, political and environmental challenges
  - Meet and exceed customer and partner expectations

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> $800M per year; 4th in industry-sponsored research
> 1,200 projects & 650 companies

> 600,000 living & loyal grads

Rated #1 online institution; Presence in > 150 countries; Global Engagement

> 96,000 current students; 160 academic majors

Holistic approach to Cyberscience, Energy & Environment, Health Sciences, Life Sciences, Materials, and Social Sciences
CAV Workshop Agenda – Tuesday

8:15 AM  Welcome & Intro  G. Lesieutre / P. Baboo
8:45 AM  Structural Vibration and Acoustics  Steve Hambric
9:15 AM  Int’l Liaison: Hong Kong Polytechnic  Li Cheng
9:45 AM  CAV sponsor: Johnson Controls  Troy Taylor
10:00 AM  Break
10:30 AM  Int’l Liaison: University of Sherbrooke  Alain Berry, O. Robin
11:00 AM  Materials Characterization  Bernhard Tittmann
11:30 AM  Int’l Liaison: INSA de Lyon  Goran Pavic
12:00 PM  Lunch  NLI – Faculty/Staff Club
1:15 PM  Student poster 2-minute overviews  Ed Smith
1:45 PM  Rotorcraft Acoustics and Dynamics  Vic Sparrow
2:15 PM  Propagation and Radiation  Vic Sparrow
2:45 PM  Int’l Guest: Nat’l Aviation Univ. (Ukraine)  Oleksandr Zaporozhets
3:00 PM  PSU Grad Program in Acoustics  Vic Sparrow
3:15 PM  Break
3:45 PM  Int’l Liaison: KU Leuven  Wim Desmet
4:15 PM  Underwater Acoustics  Amanda Hanford
4:45-6:00 PM  open
6:00-9:00 PM  Reception / dinner / posters (6:45-8:00)  Hintz Alumni Ctr /Robb Hall
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>8:15 AM</td>
<td>Adaptive Structures &amp; Noise Control</td>
<td>George Lesieutre</td>
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<td>8:45 AM</td>
<td>Int’l Liaison: CIRA</td>
<td>Antonio Concilio</td>
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<td>Flow-Induced Noise</td>
<td>Mike Jonson</td>
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<td>CAV sponsor: Praxair</td>
<td>Reh-Lin Chen</td>
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<tr>
<td>10:00 AM</td>
<td>Break (poster award recognition)</td>
<td>Lesieutre, Hambric</td>
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<td>10:30 AM</td>
<td>Int’l Liaison: DLR-Berlin</td>
<td>Lars Enghardt</td>
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<td>11:00 AM</td>
<td>Gov’t Liaison: NUWC</td>
<td>Michael Jandron</td>
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<td>11:30 AM</td>
<td>Visitor feedback to CAV</td>
<td>All</td>
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<tr>
<td>12:00 PM</td>
<td>Lunch</td>
<td>NLI Faculty/Staff Club</td>
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<tr>
<td>1:15 PM</td>
<td>Acoustic Metamaterials &amp; Industry</td>
<td>Panel:</td>
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<td>1:45 PM</td>
<td>Int’l Liaison: ISVR</td>
<td>Matthew Wright</td>
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<td>2:15 PM</td>
<td>Systems &amp; Structures Health Mgt</td>
<td>Reichard, Lissenden</td>
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<tr>
<td>2:45 PM</td>
<td>Break</td>
<td>CAV</td>
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<tr>
<td>3:15-4:30</td>
<td>Lab tours</td>
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</tbody>
</table>
CAV presentations and posters are available

  - “Presentations” tab

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**CAV PRESENTATIONS**

**Tuesday, 25 April 2017**

George Lesieutre and Priya Baboo, Penn State, [Welcome and Introductions: What’s new with the CAV](http://tinyurl.com/CAV2017)


Li Cheng, Hong Kong Polytechnic University, [International Liaison: Acoustic black holes for structural wave manipulation and control](http://tinyurl.com/CAV2017)

R. Troy Taylor, Johnson Controls, [CAV sponsor: Overview of Johnson Controls](http://tinyurl.com/CAV2017)