OHIO
UNIVERSITY
Russ College of Engineering
and Technology

Department of Mechanical
Engineering
Stocker Center 251
Athens OH 45701-2979

T: 740.593.1553
F: 740.593.0476
http://www.ent.ohiou.edu/me
medept@bobcat.ent.ohiou.edu

**Mechanical Engineering Department - 2007 Accomplishments**
**Summary Report**

Dean Irwin,

On the following pages you will find a report detailing our department's performance relative to the recently established metrics. I apologize that there were a few categories for which I was not able to find recent data or we did not have the processes in place to collect the data, but next year we will be more prepared now that we have the metrics defined.

I am happy to report that our department performed very well relative to the metrics. Our enrollments are strong (276 undergraduates, 36 MSME students, and 11 PhD students), our student retention rates are high (90% freshman to sophomore), our journal publication rates are high (2 per FTGI grad faculty in 2007), our external funding is high ($3.46 million in the latest ORSP report, or ~$400K per FTGI grad faculty member), Bob Williams co-authored a textbook, and when Dave Bayless was named an ASME fellow in December 2007 he joined Khairul Alam to give our department 2 ASME fellows. Additionally, we met or exceeded our goals for collaborative projects, patents, and conference publications and presentations.

The only metrics we failed to meet were student/faculty ratio (28 versus a goal of 20), female enrollment (10% vs a 26% goal), average time to graduation (4.87 versus a goal of 4.67), and PE Certification (20% versus a goal of 25%).

The spreadsheet of metrics is included on the following pages, followed by supporting data for publications, funded projects, and other metrics. Please let me know if you need additional information.

Greg G Kremer 4/11/08

Gregory G. Kremer
Associate Professor and Chair, Mechanical Engineering

# Mechanical Engineering Department Metrics

| Metric | *Department Goal* | 2007 Performance | |
|---|---|---|---|
| **Faculty Statistics** | | | |
| Faculty Diversity | Institutional Equity goals met | 1 female faculty member. | Yes |
| Student/Faculty Ratio (Headcount/Group I) | < 20 | 28.09 | No |
| Percent SCH taught by Group I | > 90% | 94.34% | Yes |
| Section Size | <25% small sections actual courses; all below 70 | max size =54 | Yes |
| **Cost of Instruction** | | | |
| Direct instructional expenditure per student FTE (Delaware Study) | all engg. programs within 10% of peer average | Unable to find recent data | |
| SUMS Space Study | Inventory within 10% of need | Unable to find recent data | |
| | | | |
| **Student Statistics** | | | |
| Total Majors | | | |
| ugrads | 255 | 276 | Yes |
| masters | 25 | 36 | Yes |
| phd | 10 | 11 (ME track of Integrated Engineering) | Yes |
| Female Enrollment (50% higher than national) | 26% | ~10% | No |
| Minority Enrollment | Top 20% of peers | ~5%. Need peer info for comparison. | |
| Student retention rate | >80% Freshman to Sophomore | 90% | Yes |
| Average enrolled time to grad (less coop quarters) | <4.67 | 4.87 (2000 cohort) | No |
| Entering student profile (Undergrad) | mean ACT new freshmen >24.0 | Unable to find departmental data | |
| Entering student profile (Grad) | 80th percentile or better GRE (quantitative) | 82nd percentile | |
| | | | |
| **Teaching** | | | |
| Student Engagement | All selected NSSE responses >3 | Unable to find departmental data | |
| Grade Stability (undergraduate) | Faculty discussions of fair and appropriate grading | No problems evident. Will discuss more specifically in 2008. | |
| | | | |
| **Scholarship** | | | |
| Journal Publications | average 1 per FTGI grad faculty per year | 2.00 | Yes |
| Conference Publications | average 1 per FTGI per year | 1.73 | Yes |
| Unrefereed Publications | as appropriate | | |
| Conference Presentations (Faculty) | average 1 per FTGI per year | 2.09 | Yes |
| Conference Presentations (Students) | average 1 per FTGI per year | Need to start collecting this data | |
| Books published | one every 6 years | 1 (Dr. Williams co-authored with EECS prof) | Yes |
| Book chapters published | as appropriate | 1 | Yes |
| Conferences Attended | average 1 per FTGI per year | Need to start collecting detailed data | Yes |
| Patents awarded | 1 every 2 years | 2 provisional | Yes |
| Patent applications | 1 | 1 | Yes |
| Patent disclosures | 2 | 2 | Yes |
| External Funding | $200k per FTGI grad faculty per year | $3.46 Million in latest ORSP research awards report (2006-2007), or $400K per FTGI grad faculty. (1.3M Fed, 2.11M State, 10K industry, 202K other). | |
| Proposals written | 2 per FTGI grad faculty per year, each>$50K | >2 | Yes |
| External Graduate Student Support + Fee Paying Students | 60% | 59.3% considerinf full time only, 68.6% when part time students are included | |
| | | | |
| **University Service** | | | |
| University Committee Participation Rate | 25% | 50% | Yes |
| Accreditation | ABET Accredited | Yes | Yes |
| | | | |
| Development (fundraising) activities | Support Dean as appropriate | | |
| | | | |

| **Professional Activities** | | | |
|---|---|---|---|
| Federal Agency Review Panel Service | 1 | 0 | |
| Papers Reviewed | average 2 per FTGI grad faculty per year | >2 | Yes |
| Conference/Workshop chairs | 1 every 3 years | 0 | NA |
| Technical session chairs | avg 1 per FTGI grad faculty per 2 years | 1 | Yes |
| Professional Certification (e.g., PE) | 25% of eligible GI | 20% | No |
| Journal Editor/Associate Editor | 1 every 6 years | 0 | NA |
| Professional Organization Officer (National) | 1 every 6 years | 1 [National (Central Region) Vice President for Pi Tau Sigma] | Yes |
| Professional Organization Membership | 100% | 100% | Yes |
| Accreditation visits conducted | NA (no ABET reviewers on staff) | | |
| | | | |

| **Collaboration University Wide or With Other Institutions** | | | |
|---|---|---|---|
| Collaborative or Interdiscplinary Participation (Joint grants & contracts) | 20% of FTGI grad faculty with active grants or contracts | 33% | Yes |
| Courses Co-taught (within university) | Will look for opportunities | 2 | Yes |
| Courses Co-taught (outside university) | Will look for opportunities | 0 | No |
| Co-Author Papers (within university) | 1 per year | 4 | Yes |
| Co-Author Papers (outside university) | Will look for opportunities | 0 | No |
| | | | |
| **Prominence Misc** | | | |
| Fellow of national/international society | $\geq 1$ | 2 ASME fellows. | Yes |

Note: 12 FTGI in 2006-2007, 11 in 2007-2008. 2 FTG1 w/out grad faculty status, 1 with associate grad faculty status.

**Additional Info on Mechanical Engineering Department - 2007 Accomplishments**

ME Department Research Awards (per latest ORSP annual report 2006-2007): $3.46 million

**List of New Funded Projects:**

- *Corrosive Properties and Suitability for Compression of Separated $CO_2$,* Ohio Coal Development Office, $159,622, 9/1/07-8/31/09 (Dave Bayless with Srdjan Nesic, PI)
- Brentwood Foundation, Robert L. Williams II, John N. Howell, Janet M. Burns, "Haptic Modules for Palpatory Diagnosis Training", Two years, $105,149.
- AFOSR, Jim Zhu, Bob Williams, Greg Kremer et al., "Biomimetic Aerial Robotic Transformer Feasibility", 1 year, $150,000.
- Osteopathic Heritage Foundation, Columbus OH, John N. Howell, Bob Williams et al., "A Pilot MRI Study of Osteopathic Manipulative Treatment of Acute Low Back Pain", 1 year, $39,000.
- Osteopathic Heritage Foundation, Columbus OH, Robert L. Williams II, John N. Howell, Anthony G. Chila, and David C. Eland, "The Virtual Haptic Back for Osteopathic Training", Project GE0012140, $207,603.
- F.F. Kraft, Copper Micro-Channel Tube for Automotive Climate-Control and HVAC Systems, International Copper Association (ICA) and Center for Advanced Interdisciplinary Research in Materials (CIMAT), 3/1/07 – 6/1/08, $100,000 to OU. (student: Victor Vaitkus) New project/grant.
- Hybrid Enclosure for Thermal Management of Electronics (2007 - 2009, jointly with MII), funded by USAF, $50K for OU.
- Khairul Alam, Conducting Polymer for Electrostatic Precipitators, proposed to DOE (jointly with ASI), funded ($225,000 to OU)
- Computer Controlled Mechanical Testing for Materials Research and Education, 1804 fund (with Frank Kraft and Pete Klein), $22,500.
- Fluid mechanics concept inventories: "Windows into their Minds," ($5,000, Awarded) from the Southeast Ohio Center for Excellence in Mathematics and Science (SEOCEMS)

**Partial list of continuing projects:**

Sulfur Tolerance and Improved Performance in SOFCs for Aerospace Applications, NASA, $154,846 (of $786,542 total award), 4/1/06-3/31/08, Dave Bayless, led by Mark DeGuire (Case Western).

Development of Sulfur Tolerant Anodes for Deployment of Coal Syngas with Planar Solid Oxide Fuel Cells for Stationary Power Generation, Ohio Coal Development Office, $159,882, 9/1/05-8/31/07, Dave Bayless with J. Trembly.

Distributed Hydrogen Production, U.S. Department of Energy, $1,091,000, DE-FG36-03GO13059, 9/1/05-8/31/08, Dave Bayless with G. Botte, G. Kremer, M. Prudich, B. Stuart, and S. Rackey.

Adapting Planar Solid Oxide Fuel Cells for use with Solid Fuel Sources in the Production of Distributed Power, United States Department of Energy, DE-FG36-03GO13059, $3,910,000, 8/13/03-9/30/08. Dave Bayless et al.

Robert L. Williams II, John N. Howell, Anthony G. Chila, and David C. Eland, Osteopathic Heritage Foundation, Columbus OH, "The Virtual Haptic Back for Osteopathic Training", Project GE0012140, December 1, 2006 – November 30, 2007, $199,845.

F.F. Kraft, *Rapid Infrared Superheating for Aluminum Alloy Heat Treating*, OU Baker Grant, 6/1/06 – 6/1/07, $11,972 (students: Gowreesan Vamadevan, Devon Poling) Project was completed

H. Mayer (Queen City Forge), F.F. Kraft (Co-PI), *Development of the Hybrid Rapid Infrared Superheating Furnace for the Treatment of Aluminum Alloys*, The Edison Materials Technology Center (EMTEC), Candidate Core Technology Project, 10/04 – 6/07, $100,000 ($47,256 to OU) (students: Gowreesan Vamadevan, Devon Poling) Project was completed

F.F. Kraft, Jay S. Gunasekera, *An Experimental Investigation of Flow Stress of Alloys AISI 4320, 1541, 8820 and 15V41,* American Axle and Manufacturing Company, 6/04 – 6/07, $74,416 (student: Bart Sims) Project was completed

Khairul Alam, Low Cost Polymer Nanocomposite Tooling for Agile Manufacturing, Proposed to Wright Projects (Jointly with UDRI), funded ($416,924 to OU)

Khairul Alam, Conposites With Carbon Nanofibers (2006-2007), funded by EMTEC, $74K to OU.

Rudy Pasic, Pilot testing of Sieving ESP, ($1.95 million joint project with AEP, EPRI, OCDO, and PECO. OU's participation is $418 K)

Khairul Alam, Composite Structures, Proposed to Graffech, funded ($10,000)

**Publications (Journals and textbooks):**

1. Pasic, H. et al., Aerosol modeling and Pressure Drop simulation in a sieving Electrostatic Precipitator, *Computational Methods in Multiphase Flow IV*, editors A. A. Mammoli and C.A. Brebbia, pp 3-9, WIT Press 2007.
2. G. Vamadevan, F.F. Kraft, "*Processing effects in aluminum micro-channel tube for brazed R744 heat exchangers*", *Journal of Materials Processing Technology,* v.191, issue 1-3, August 1, 2007, pp.30-33
3. J. Domblesky, F.F. Kraft, "Metallographic evaluation of welded forging preforms", *Journal of Materials Processing Technology*, v.191, issue 1-3, August 1, 2007, pp.82-86
4. Trembly J., Gemmen R., Bayless D., "The Effect of Coal Syngas Containing $AsH_3$ on the Performance of SOFCs: Investigations into the Effect of Operation Temperature and $AsH_3$ Concentration," *Journal of Power Sources* (171) pp 818-825, 2007.
5. Trembly, J.P., Gemmen, R.S., Bayless, D.J., "The Effect of Coal Syngas Containing HCl on the Performance of Solid Oxide Fuel Cells: Investigations into the Effect of Operational Temperature and HCl Concentration," *Journal of Power Sources*, (169):2, pp.347-354, 2007
6. Shi, L., Bayless, D., Kremer, G., and Stuart, B., "Numerical Investigations of the Flow Pattern in an Electrically Enhanced Cyclone," accepted for publication in *Journal of the Air and Waste Management Association,* (57), pp. 489–496, 2007.
7. Shi, L. and Bayless, D., "Comparison of Boundary Conditions for Predicting the Collection Efficiency of Cyclones," *Powder Technology*, (173) pp. 29–37, 2007.
8. Trembly, J.P., Gemmen, R.S., Bayless, D.J., "The Effect of IGFC Warm Gas Cleanup System Conditions on the Gas-Solid Partitioning and Form of Trace Species in Coal Syngas and Their Interactions with SOFC Anodes," *Journal of Power Sources*, (163):2, pp 986-996, 2007.
9. Marquez, A., Ohrn, T., Trembly, J., Ingram, D., and Bayless, D., "Effects of Coal Syngas and $H_2S$ on the Performance of Solid Oxide Fuel Cells: Part 2: Stack Tests," *Journal of Power Sources*, (164):2, pp 659-667, 2007.

10. Miller, L.E., Wootten D.F., Nickols-Richardson S.M., Ramp W.K., Steele C.R., Cotton J.R., Carneal J.P., Herbert W.G., 2007, "Isokinetic Training Increases Ulnar Bending Stiffness and Bone Mineral in Young Women", Bone, Vol. 41, p. 685-689.
11. Nam, J.-H., J.R. Cotton, and W. Grant, 2007, "A Virtual Hair Cell: I. Addition of Gating Spring Theory Into a 3-D Bundle Mechanical Model", Biophysical Journal, Vol. 92, p. 1-11.
12. Nam, J.-H., J.R. Cotton, and W. Grant, 2007, "A Virtual Hair Cell: II. Evaluation of Mechanoelectric Transduction Parameters", Biophysical Journal, Vol. 92, p. 1-9.
13. Anderson, D.E. and J.R. Cotton , 2007, "Mechanical Analysis of Percutaneous Sacroplasty using CT Image based Finite Element Models", Medical Engineering and Physics, Vol. 29, p. 316-325.
14. P. Bosscher, R.L. Williams II, L.S. Bryson, and D. Castro-Lacouture, 2007, "Cable-Suspended Robotic Contour Crafting System", Journal of Automation in Construction, 17: 45-55.
15. R.L. Williams II, W. Ji, J.N. Howell, and R.R. Conatser Jr., 2007, "Device for Measurement of Human Tissue Properties In Vivo", ASME Journal of Medical Devices, 1(3): 197-205.
16. R.L. Williams II, X. He, T. Franklin, and S. Wang, 2007, "Haptics-Augmented Engineering Mechanics Educational Tools", World Transactions on Engineering and Technology Education, 6(1): 27-30.
17. A. Chatterjee, M.K. Alam, and P. Klein, Electrically Conductive Carbon Nanofiber Composites with High Density Polyethylene and Glass Fibers, *Materials and Manufacturing Processes*, Vol. 22, pp 62-65, 2007.

**Textbook (Graduate Controls):** R.L. Williams II and D.A. Lawrence, 2007, Linear State-Space Control Systems, John Wiley & Sons, Inc.

**Book Chapter:** R.L. Williams II, J.N. Howell, and R.R. Conatser Jr., 2007, "Digital Human Modeling for Palpatory Medical Training with Haptic Feedback", in Handbook of Digital Human Modeling for Applied Ergonomics and Human Factors Engineering.

**Presentations/Conference papers:**

1. Bayless, D., Stuart, B., Kremer, G. and Vis, M. "Photosynthetic Mitigation of Carbon Dioxide Emissions from Coal-to-Liquid (CTL) Plants," 6th Annual BIO Conference, Honolulu, HI, November 2007.
2. Brown, I., Jones, J, Bayless, D., Sarkisova, S., Garrison, D., McKay, D., "Cyanobacteria for Human Habitation beyond Earth," Proceedings of 7th European Workshop on Microalgal Biotechnology; NASA Paper 20070021574, 2007.
3. Cooper, M., and Bayless, D.J., Electrochemical $H_2S$ Scrubbing of a Coal Syngas Fuel Stream via SOFCs, *Fifth International Conference on Fuel Cell Science, Engineering and Technology*, Paper FuelCell2007-25042, New York, June 2007.
4. (Invited) Trembly, J., Gemmen, R., and Bayless, D.J., The Effect of Trace Coal Syngas Species on the Performance of a Solid Oxide Fuel Cell, *Fifth International Conference on Fuel Cell Science, Engineering and Technology*, Paper FuelCell2007-25151, New York, June 2007.
5. D. Castro-Lacouture, L.S. Bryson, C. Maynard, R.L. Williams II, and P. Bosscher, 2007, "Concrete Paving Productivity Improvement Using a Multi-Task Autonomous Robot", 24th

International Symposium on Automation & Robotics in Construction (ISARC-2007), September 19-21, Kochi, Kerala, India.

6. R.L. Williams II, 2007, "Cable-Suspended Vehicle Simulation System Concept", CD Proceedings of the ASME International Design Technical Conferences, 31st Mechanisms and Robotics Conference, Paper # DETC2007-34595, Las Vegas NV, September 4-7.
7. C.R. Terupally, J.J. Zhu, F. van Graas, and R.L. Williams II, 2007, "Trajectory Tracking and Stair Climbing Stabilization of a Skid-Steered Mobile Robot", 2007 IEEE American Control Conference, New York, July 11-13.
8. Y. Liu, J.J. Zhu, R.L. Williams II, and J. Wu, 2007, "Integrated Control and Navigation for an Omni-Directional Mobile Robot Based on Trajectory Linearization", 2007 IEEE American Control Conference, New York, July 11-13.
9. R.L. Williams II, W. Ji, J.N. Howell, and R.R. Conatser Jr., 2007, "In Vivo Measurement of Human Tissue Compliance", SAE Digital Human Modeling Conference, Paper #2007-01-2453, June 12-14, Seattle, WA.
10. L.S. Bryson, D. Castro-Lacouture, C. Maynard, R.L. Williams II, and P. Bosscher, 2007, "Productivity Analysis of a Multi-Task Autonomous Robot for Concrete Paving", P145, ASCE/CIB Construction Research Congress, May 6-8, Grand Bahama Island, Bahamas.
11. J.M. Burns, R.L. Williams II, J.N. Howell, R.R. Conatser Jr., and D.C. Eland, 2007, "Virtual Reality Simulation of Fascial Drag using the PHANToM 3.0 Haptic Interface", First International Fascia Research Congress, October 4-5, Boston MA.
12. J.N. Howell, J.M. Burns, D.C. Eland, R.L. Williams II, and R.R. Conatser Jr., 2007, "Student Achievement in a Virtual Reality Test of Palpatory Diagnosis", 51st Annual AOA Research Conference, September 30 – October 2, San Diego CA.
13. J.N. Howell, R.R. Conatser Jr., R.L. Williams II, J.M. Burns, and D.C. Eland, 2007, "The Virtual Haptic Back (VHB): A Teaching Aid for Palpatory Diagnosis", FASEB Journal, 21 (5 – part 1): A594, presented at Experimental Biology 2007, April 28 – May 2, Washington DC.
14. F.F. Kraft, C. Williams, "The Effect of Sc and Zr Additions on Al Extrusion and Post-Braze Grain Structure", paper submitted and accepted to the *9th International Aluminum Extrusion Technology Seminar (ET '08)*, May 2008, ET Foundation, sponsored by the Aluminum Extruders Council (AEC) and the Aluminum Association (AA)
15. F.F. Kraft, H.S. Miller, "Failure pressure model and validation for aluminum R744 micro-channel tube", *Proceedings of the 2008 Vehicle Thermal Management Systems Conference (VTMS 8)*, sponsored by SAE and I.Mech.E., Nottingham, UK, May 20-24, 2007
16. Womeldorf, C. "An Introduction to the Construction of Engineering Concept Inventories: Tools for impacting teaching, learning, and assessment" presented and published in the Proceedings of the ASEE North Central Section Conference, Charleston, WV, March '07.
17. M. K. Alam, and J. Morosko. "Enhancement of Electrical Conductivity of Continuous Fiber Composite Tapes using Vapor Grown Nanofiber," Proceedings of SAMPE Fall Technical Conference, Cincinnati OH, Oct 29 - Nov. 1, 2007.
18. M.S. Anghelescu and M. K. Alam. "Carbon Foam Tooling for Aerospace Composites," Proceedings of SAMPE Fall Technical Conference, Cincinnati OH., Oct 29 - Nov. 1, 2007.
19. M.S. Anghelescu and M. K. Alam. "Finite Element Modeling of Forced Convection Heat Transfer in Carbon Foams," Proceedings of the International Mechanical Engineering Conference and Exposition (IMECE 2007, Paper #IMECE2006-13186), Chicago, IL. November 5-10, 2007.

**Presentations**

1. Kremer, G., "Lessons Learned from Developing, Implementing and Evaluating an Integrated Departmental Assessment and Continuous Improvement Process" (a 3-hour ABET Assessment Workshop), *ABET Best Assessment Processes IX Symposium*, April 2007.
2. F.F. Kraft, "A Taste of ET'08" (this was a 40 minute, invited presentation of aluminum extrusion related research at Ohio University), 2007 Aluminum Extruders Council (AEC) Management Conference, September 17, 2007, invited presentation
3. Womeldorf, C., Central Ohio Summit on Sustainability & the Environment hosted by the Mid‐Ohio Regional Planning Commission: "WPRA OH‐PR: Wind Power Resource Assessment – An Educational and Bilingual Tool," with Juan Flores Lozada, November 14, 2007.
4. Womeldorf, C.Presentation at the American Institute of Chemical Engineers (AIChE) Annual Meeting "Wet Laminar Electrostatic Precipitator," with Santosh Vijapur, November 6, 2007.

**Patents and Invention Disclosures:**

Provisional patents

1. "High Temperature Carbon Recycling Gasification," 60/911,348, April 12, 2007, Bayless et al.
2. "Carbon Dioxide Based Heat Pump for Water Purification,"60/954,360, (with V. Gowreesan and C. Perrera) Aug. 7, 2007., Bayless et al.

Applications

1. R.L. Williams II, J.N. Howell, R.R. Conatser Jr., David H. Noyes, and Janet M. Burns, "Methods for Measurement of Human Tissue Properties In Vivo", July 2007.

Disclosures:

1. R.L. Williams II, "Whole-Body Haptics Vehicle Simulator System ", Ohio University Invention Disclosure, December, 2007.
2. "Flow controlling Header for Delivering Fluid", Feb 23, 2007. OU # 07002. Bayless, Kremer, et al.

**Awards:**

Dave Bayless selected for ASME Fellow status in December 2007.

**Faculty Instructional Load Report (2006-2007):**

- Mechanical Engineering Sum of WSCH: 21611 (Average of ~2000 per faculty member)