



CENTER FOR ADVANCED VEHICULAR SYSTEMS

Mississippi State University

FY08

Third Quarter Report

1 January 2008 to 31 March 2008

EXECUTIVE SUMMARY

Director, Rand M. German

In the third quarter of the 2008 academic year, CAVS has secured a stable condition as evident by the graduation of several students, completion of several “initiative” projects, and placement of six staff into senior management or tenure-track positions. With the program maturation, CAVS is focusing on research and development projects to better match its mission as an interdisciplinary center that provides team-based solutions for complex issues associated with human mobility. During January – March 2008, CAVS faculty and staff proposal activities included 7 awards totaling \$1,624,921 and 3 continuation awards totaling \$1,653,906. This gave a net award inflow of \$3,278,827 while CAVS had a net expenditure of \$2,718,115. Cumulative for the first three-fourths of the academic year are \$8.1M in awards and \$11.3M in expenditures.

CAVS research support for the quarter included:

- 9 academic faculty
- 22 research associates
- 8 postdoctoral fellows
- 51 graduate students
- 51 undergraduate students
- 12 administrative professionals
- 7 administrative staff

Highlights from the detailed report ([CAVS FY08 Quarter 3 Report](#)) include the following:

- 22 proposals, totaling \$44,278,707 were submitted for future funding
- CAVS staff submitted 3 articles for publication and 3 conference submissions
- During the same time CAVS was responsible for
 - 8 published articles
 - 18 presentations
 - 2 patent disclosures

• The following PI’s and Co-PI’s submitted proposals:

Bouvard, Jean Luc -	1	Carruth, Daniel -	1	Crocker, Marshall -	1
El Kadiri, Haitham -	2	German, Rand -	4	Haupt, Tomasz -	6
Horstemeyer, Mark -	4	Kim, Seongjai -	1	Marin, Esteban -	2
Mazzola, Mike -	3	McGinley, John -	1	McCarter, Kelli -	1
Molen, Marshall -	2	Park, Seong Jin -	3	Reeves, Wes -	1
Rowland, Zach -	3	Suri, Pavan -	2	Tian, Guoyun -	1
Wang, Paul -	3	Xue, Anna -	1		

I. Accomplishments

A. Grants and Proposals

1. Submitted Proposals Awarded – Totaling \$1,624,921.28

- “600-A 175° C SiC JFET Intelligent Power Module Research, Phase II, Tasks 1-3,” Molen, M., Mazzola, M., UQM Technologies, Inc., \$200,000.
- “600-A 175° C SiC JFET Intelligent Power Module Research, Phase II, Tasks 4-6,” Molen, M., Mazzola, M., UQM Technologies, Inc., \$500,000.
- “Investigation of the Effects of Increased Coverage Area for Soft Body Armor,” Carruth, D., McGinley, J., Lawrence Technical Institute, \$77,422.
- “Navy Regional Antiterrorism Plan Template & Implementation,” Coltharp, D., Sentel Corporation, \$11,332.
- “Structural Analysis for Drop Deck Trailer,” Wang, P., Wade Services, \$39,027.
- “Updating the Joint Antiterrorism Guide, Joint Forward Operations Base Handbook, & Joint Contingency Operations Base Handbook with New Protective Measures,” Coltharp, D., Sentel Corporation, \$47,265.28.
- “Virtual Soldier Research: Human Factors Development & Evaluation - TCN 07191,” Rowland, Z., Carruth, D., McGinley, J., McFadyen, G., Reeves, K., Battelle, \$749,875.

2. Continuations – Totaling \$1,653,906.61

- “Center for Virtual Design and Manufacturing,” Horstemeyer, M., Kim, S.G., Felicelli, S., Lacy, T., Wang, P., Berry, J., Campbell, C., Lim, H., Elder, S., Daniewicz, S., Gullett, P., Battelle, \$1,584,000.
- “Materials Modeling & Airborne Validation Support for MIMR,” Horstemeyer, M., Miltec Corporation, \$51,231.
- “Run-Flat Modeling and Simulation Project,” Rowland, Z., Wang, P., AmCom Express, \$18,675.61.

B. Publications

Articles in Trade Journals and Popular Press

- “Powder Injection Molding Breaks the One Billion Dollar Barrier,” German, R., *Metal Powder Report*, Feb 2008, 63(3), 8-10.

Peer-Reviewed Journals

- “Divergences in Global Powder Injection Moulding,” German, R., *Powder Injection Moulding International*, Feb 2008, 2(1), 45-49.
- “Fatigue Crack Growth Mechanisms in High Pressure Die-Cast Magnesium Alloys,” El Kadiri, H., Horstemeyer, M., Jordon, J.B., Xue, Y., *Metallurgical and Materials Transactions A*, Jan 2008, 39(1), 190-205.
- “Grain Size Measurement and Modeling for Nano-Structured Tungsten Carbide,” Park, S.J., Cowan, K., Johnson, J.L., German, R., *International Journal of Refractory Metals & Hard Materials*, Feb 2008, 26(3), 152-163.
- “Hydrogen Effects on Nanovoid Nucleation in Face-centered Cubic Single-crystals,” Chandler, M., Horstemeyer, M., Wagner, G.J., Baskes, M.I., Gullett, P., Jelinek, B., *Acta Materialia*, Jan 2008, 56(1), 95-104.
- “Optimization of the LENS™ Process for Steady Molten Pool Size,” Wang, L., Felicelli, S., Gooroochurn, Y., Wang, P., Horstemeyer, M., *Materials Science and Engineering A*, Jan 2008, 474, 148-156.
- “Production of Micro-Porous Austenitic Stainless Steel by Powder Injection Molding,” Gulsoy, H.O., German, R., *Scripta Materialia*, Jan 2008, 58, 295-298.

Peer-Reviewed Conference Papers

- “Biomechanical Validation of Digital Human Models: A Posture and Motion Study with Digital Human Models,” Patnaik, S., McGinley, J., Babski-Reeves, K., Carruth, D., McFadyen, G., Institute of Biological Engineering Conference, Mar 2008.

C. Presentations

- “Atomistic Scale Study on Effect of Pressure on Densification During Sintering Nano Scale Tungsten Powder,” Moitra, A., Kim, S., Kim, S.G., Park, S.J., German, R., Horstemeyer, M., *TMS 2008*, New Orleans, LA, Mar 2008.
- “Calculation of Absorption Energies Using EAM Potential for Al-Mg Alloy Systems,” Liyanage, L., Jelinek, B., Kim, S., Horstemeyer, M., Kim, S.G., *The American Physical Society, March 10-14, 2008*, New Orleans, La., Mar 2008.
- “Characterizing Material Homogeneity in Ceramic Microarrays Fabricated by PIM,” German, R., Wu, C., Simmons, K., Laddha, S., Lee, S., Sr., D., Park, S.J., Atre, S.V., *PIM 2008 Conference*, Long Beach, CA, Mar 2008.
- “Development of the EAM Potential for Fe-C Alloy Systems,” Jelinek, B., Houze, J., Kim, S., Moitra, A., Liyanage, L., Horstemeyer, M., Kim, S.G. *The American Physical Society, March 10-14, 2008*, New Orleans, La., Mar 2008.
- “Effect of Binder System on Mold Filling in Ceramic MicroPIM,” German, R., Laddha, S., Wu, C., Simmons, K., Lee, S., Park, S.J., Atre, S.V., *PIM 2008 Conference*, Long Beach, CA, Mar 2008.
- “Embedded Atom Method (EAM) Interatomic Potential for Zinc (Zn),” Moitra, A., Kim, S., Houze, J., Jelinek, B., Liyanage, L., Horstemeyer, M., Kim, S.G., *The American Physical Society, March 10-14, 2008*, New Orleans, La., Mar 2008.
- “Ground-State Structure of the Hydrogen Double Vacancy on Pd(111),” Kim, S., Kim, S.G., Erwin, S., *The American Physical Society, March 10-14, 2008*, New Orleans, La., Mar 2008.
- “Integral Work Concepts in Materials Processing: Efficient Routes to Computer Simulations,” German, R., Department of Mechanical Engineering, San Diego State University, San Diego, CA, Mar 2008.
- “Mechanical Properties of Various Aluminum Alloys by Powder Metallurgy,” Antonyraj, A., Park, S.J., German, R., *2008 TMS Annual Meeting & Exhibition*, New Orleans, LA, Mar 2008.
- “Physically Motivated Uncertainty-Based Higher Order Damage Model,” Horstemeyer, M., Solanki, K., *The 14th International Symposium on Plasticity*, Kailua/Kona, Hawaii, January 3-8, 2008, Jan 2008.
- “Powder Injection Molding of Metals, Ceramics, and Carbides,” German, R., Mueller, Industries, Fulton, MS, Feb 2008.
- “Proposed Military Product Distribution Center for West Point, MS,” Dennis, H.G., Simmons, L., West Point, MS, Mar 2008.
- “Residual Stresses in LENS Deposited AISI 410 Stainless Steel Plates,” Wang, L., Pratt, P., Felicelli, S., Hubbard, S. D., Berry, J., El Kadiri, H., *2008 TMS Annual Meeting & Exhibition, Symposium on Neutron and X-Ray Studies for Probing Materials Behavior*, New Orleans, LA, Mar 2008.
- “Saving Soldiers Lives - Armored Vehicle Production in Mississippi,” Walden, C., *MEP.ms Advisory Board Meeting*, Jackson, MS: Mississippi Manufacturers Association, Mar 2008.
- “Simulation-Based Integration of Rapid Solidification to Fatigue Prognostic Predictions Using Laser-Deposited High Strength Materials As an Example,” Wang, P., Felicelli, S., Horstemeyer, M., Wang, L., Xue, Y., El Kadiri, H., Potirniche, G., *9th Global Innovations Symposium: Trends in Integrated Computational Materials Engineering for Materials Processing and Manufacturing: Session II, 2008 TMS Annual Meeting & Exhibition*, New Orleans, LA, Mar 2008.
- “The Effect of Fe Atoms on the Adsorption of a W Atom on W Surfaces,” Houze, J., Kim, S., Park, S.J., German, R., Horstemeyer, M., Kim, S.G., *2008 TMS Annual Meeting & Exhibition*, New Orleans, LA, Mar 2008.

- “The Role of CAVS Extension in Armored Vehicle Production in West Point, MS,” Dennis, H.G., *Lions Club*, Starkville, MS, *Rotary Club*, Canton, MS, *Rotary Club*, Flowood, MS, Mar 2008.
- “World Record Thermal Conductivity of Nano-Tungsten-Copper Powder,” Lee, S., Noh, J., Kwon, Y., Johnson, J., Park, S.J., German, R., *TMS 2008*, New Orleans, LA, Mar 2008.

II. Activities

A. Proposal Submissions

- “Advancements in On-Board Vehicle Power - WD 0001,” Molen, M., Mazzola, M., US Army Tank-Automotive Research, Development, & Engineering Center.
- “An Integrated Approach to Develop Cyberinfrastructure Technology Transfer Program for TARDEC/Army Systems,” Horstemeyer, M., Haupt, T., McCarter, K., Wang, P., US Army Tank-Automotive Research, Development, & Engineering Center.
- “CDI-Type II: Informatics and Computational Simulation for Nanoscale Powder Injection Molding for High Performance Micro Devices,” German, R., Park, S.G., Oregon State University.
- “Computational Design Tool Development for Multilevel Optimization of Product-Material Systems under Uncertainty,” Haupt, T., Marin, E., National Science Foundation.
- “EcoCAR: The NeXt Challenge,” Molen, M., General Motors.
- “Innovative Substrate Design for Automotive Electronics: Functional, High Thermal Conductivity Substrates for Inverter-Converter Assembly in Hybrid Vehicles,” Suri, P., Tian, G., German, R., Mazzola, M., Materials Processing, Inc.
- “Integrated Computational Materials Engineering for Magnesium,” Horstemeyer, M., Haupt, T., National Science Foundation.
- “Introduction to Materials and Failure Analysis,” El Kadiri, H., Wang, P., CAVS Extension (via Small Business Administration).
- “Introduction to the Finite Element Method - A Practical Course,” Marin, E., Horstemeyer, H., CAVS Extension (via Small Business Administration).
- “Investigation of Law Enforcement Officer Driving Behavior & Performance in an Advanced Driving Simulator,” Williams, C., Carruth, D., McGinley, J., US Department of Justice.
- “Low Temperature Propane-Diesel Fuel Combustion for Automotive & Stationary Power Generation Applications,” Srinivasan, K., Rowland, Z., Propane Education & Research Council.
- “Multi-Scale Metal Component Reliability/Safety - WD 0005,” Horstemeyer, M., US Army Tank-Automotive Research, Development, & Engineering Center.
- “Nanoparticulate Building Blocks for 3-D Ceramic Microfabrication Using Powder Injection Molding,” German, R., Park, S.J., Kim, S., National Science Foundation.
- “Navy SBIR,” El Kadiri, H., Optomec, Inc.,
- “NEES Computational Simulation: SimPort,” Haupt, T., Network for Earthquake Engineering Simulation (NEES, Inc.).
- “Process-Structure-Property Relations of Injection Molded Polymer/Polymer Composites,” Xue, Y., Bouvard, J.L., American Chemistry Council.
- “Refractory Material with Heat Resistance $\geq 1300^\circ$ C and Conductivity ≤ 0.1 W/mK,” German, R., Park, S.J., Suri, P., NineSigma.
- “Reliability Activity 2.2.1 - AFRL DO3,” Mazzola, M., SemiSouth.
- “Simulation Based Reliability and Safety (SimBRS) Center,” Rowland, Z., Wang, P., US Army Tank-Automotive Research, Development, & Engineering Center.
- “Simulation Environment for FSSIM - Large Volume Space (Task 2),” Haupt, T., Naval Research Lab.

- “Simulation Environment for FSSIM - Shadwell Forward Database Extension (Task 1),” Haupt, T., Naval Research Lab.
- “Vehicle Performance Monitoring System for MDOT Law Enforcement,” Rowland, Z., Crocker, M., Reeves, W., Mississippi Department of Transportation.

B. Publication Submissions

Peer-Reviewed Journals

- “Effect of Temperature on the Dynamic Mechanical Properties of Resin Films and Wood,” Peng, Y., Shi, S., Kim, M., *Forest Products Journal*, Jan 2008.
- “Is Using the Lowest Test Data Conservative Enough?,” An, J., Acar, E., Haftka, R.T., Kim, N.H., Ifju, P.G., Johnson, T.F., *Journal of Aircraft*, Jan 2008.
- “Optimal Parameters in Laplacian Mean-Curvature Flow Denoising,” Banicescu, I., Carino, R., Lim, H., Kim, S., *Journal of Supercomputing*, Jan 2008.

Peer-Reviewed Conference Papers

- “Investigating a Dynamic Loop Scheduling with Reinforcement Learning Approach to Load Balancing in Scientific Applications,” Rashid, M., Banicescu, I., Carino, R., *Proc. 7th International Symposium on Parallel and Distributed Computing*, Krakow, Poland, Mar 2008.

Peer-Reviewed Conference Abstracts

- “Fabrication of 600-A/600-V Power Module Based on 4H-SiC Vertical-Channel JFETs for High-Temperature and High-Power Applications,” Cheng, L., Mazzola, M., Tian, G., Gafford, J., Parker, C., Kelley, R. L., Bondarenko, V., Molen, M., *IEEE 66th Device Research Conference, Technical Digest*, Mar 2008.

Non-Refereed Conference Papers

- “Adaptive ELearning: How Customized, Just-in-time Training Modules Can Make A Difference in Your Workforce,” Brown, D., McCarter, K., Feb 2008.

Professional Presentations

- “Presentation to Dupont Ventures,” McCarter, K., Brown, D., Riddle, M., Mar 2008.
- “Presentation to McAlister,” Brown, D., McCarter, K., Mar 2008.
- “Presentation to SeverCorr Upper Management,” McCarter, K., Mar 2008.

C. Patents (disclosures or applications)

- “Monocular Display Augmented Digitizing,” Littell, N., 06-0608-228.
- “Website Search and Content Delivery Utilizing Abstract Text Strings or Predefined Keywords For User Defined URLs,” Littell, N., 07-1024-333.

E. Participation

Special Guest

- McAlpin, A., Phillips, S., the Challenge X team took the vehicle and were guests at the Greene County Alumni's celebration of MSU's birthday. The team displayed the vehicle and Amanda McAlpin spoke at the ceremony, Feb 2008.
- McAlpin, A., Phillips, S., the Challenge X team took the vehicle and visited the Petal, MS chapter of the Future Farmers of America club. The team presented to the students and showed the vehicle, Feb 2008.

- McAlpin, A., Phillips, S., the Challenge X team exhibited the vehicle at the Walt Massey Chevrolet dealership in Lucedale, MS. The public was invited to see the vehicle, and a local radio station was set up next to the vehicle, and broadcasted during the morning announcing the vehicle and team's visit. Matthew Young interviewed live on the radio and gave a general overview of the vehicle, Mar 2008.
- McAlpin, A., the Challenge X team displayed the vehicle on MSU campus for two days as part of the regional science fair. The vehicle was on view for students attending the fair and their parents and teachers, Mar 2008.
- Park, S.J., invited as a session chair of 2008 International Conference on Tungsten, Refractory & Hardmaterials VII, Washington, D.C., June 8-12, 2008, Jan 2008.
- Kirkland, R., invited Max Rumbaugh, Executive Director of SAE, to visit CAVS, Jan 2008.

Visit

- McAlpin, A., group of 4th graders from the Starkville elementary school made a visit to campus to learn about projects going on and how to write about them as if they were journalists. The students came to CAVS and learned about the Challenge X vehicle. They took notes about the project and will write a story on it when they return to the classroom, Mar 2008.
- Dennis, H.G., Haymon, P. Thompson, J., met with Northrop Grumman Ship Systems to discuss their capabilities to build composite parts for the MRAP project in West Point, Jan 2008.
- Dennis, H.G., Simmons, L., Personnel, B., met with BAE to develop manufacturing plans to build the JLTV vehicles in West Point, Feb 2008.

Meeting/Discussion

- Branch, V., & Committee, CAVS Extension Energy Committee: Entergy, MDA, Bagley, Siemens & CAVSE. Revised 2008 energy saving plan, Jan 2008.
- McCarter, K., Brown, D., Company, I.L., discussed partnership and software scheduling with IntelliGroup LMS company, Jan 2008.
- Brown, D., attended Winter 2008 meeting of the IEEE Standards Activities Board, Mar 2008.
- Brown, D., Riddle, M., McCarter, K., attended "IRB: Computer Confidentiality Issues" training session, Mar 2008.
- Brown, D., McCarter, K., Riddle, M., met with Dr. Dan Brook to discuss potential project partnerships with Center for Educational and Training Technology (CETT) and the Extension Service, Mar 2008.
- Brown, D., Riddle, M., McCarter, K., Burton, C., Littell, N., met with CAVS personnel who are currently responsible for and participate in equipment training to discuss support by Advanced Learning Technologies group, Jan 2008.
- Park, S.J., DOE Quarterly Review Presentation, Feb 2008.
- Park, S.J., ORNL Quarterly Review Presentation, Feb 2008.
- Park, S.J., participated in TMS conference and gave four presentations (two alone), New Orleans, Mar 2008.
- Germany, A., Kirkland, R., updated MDA on CAVS' capabilities and inquiries from UK and Germany, Jan 2008.
- Kirkland, R., meeting with the Automotive R&D Alliance, Jan 2008.
- Henley, C., Kirkland, R., meeting with Halter Marine to kickoff contracted projects: Production Simulation, FSSIM, Composites and Bridge Model, Feb 2008.
- Kirkland, R., meeting with John Kooeinga with Northrop Grumman to discuss expanding the use of the FSSIM, Feb 2008.

Peer Recognition

- Morgan, S., Goff, L., Walden, C., invited to present “Lean Sigma's Myth Buster: Introduction to Factorial Design of Experiments” at the University of Southern Mississippi's Six Sigma workshop hosted at PRCC's Woodall Advanced Technology Center in Hattiesburg, MS, Jan 2008.
- Park, S.J., Review - Science of Sintering, “Prediction and Control of Microstructure Evolution for Micron α -Al₂O₃ During Pressureless Sintering at Low Heating Rate Based on the Master Sintering Curve Theory,” Shao, W.Q., Chen, S.O., Li D., Cao, H.S. Zhang, Y.C., Zhang, S.S., Feb 2008.
- Park, S.J., invited as new Editorial Board member of IJRMHM (International Journal of Refractory Metals and Hard Materials) from Dr. Hugo Ortner, Editor-in-Chief IJRMHM, Jan 2008.
- Park, S.J., invited as new Editorial Manager member of JMS (Journal of Material Science) from Dr. C.B. Carter, Editor-in-Chief JMS, Mar 2008.

Service

- Brown, D., served as IEEE Computer Society Standards Activity Board Secretary, Jan 2008.
- Acar, E., reviewer for IDETC/CIE 2008 conference, Feb 2008.
- Acar, E., reviewer for ASME Journal of Mechanical Design, Feb 2008.
- Acar, E., reviewer for ASME Journal of Engineering Materials and Technology, Mar 2008.
- Park, S.J., review - International Journal of Automotive Technology: “Study on Dynamic Crack Growth at 3PB Steel Specimens by Impact,” by J.U. Cho, C.D. Cho and M.S. Han, Jan 2008.
- Park, S.J., review - International Journal of Refractory Metals and Hard Materials, “Numerical simulation of kinetics of the cobalt gradient change in WC-Co during liquid phase sintering,” by Peng Fan and Zhigang Z Fang, Jan 2008.
- Park, S.J., review - International Journal of Refractory Metals and Hard Materials, “Suppression of Abnormal Grain Growth in WC-Co via Pre-Sintering Treatment,” Dong-Yeol Yang and Suk-Joong L. Kang, Feb 2008.
- Park, S.J., review - International Journal of Automotive Technology: “The Effect of Induction Hardening on Strength and Plane Strain Fracture Toughness of SM53C Steel,” by Man Bae Lim and Won Jo Park, Feb 2008.

Other

- Cuicchi, R. and students, Mission Eggcellence Teacher Workshops for 2007-08 (January 26 – grades K - 6 and February 2 – grades 7 – 12). Student competitions were held February 16 – grades K – 6 and February 23 – grades 7 – 12, Jan 2008.
- Cheng, L., technical Session Chair of “Symposium D: Silicon Carbide - Material, Processing, and Devices, Session D10: Devices I” during the “Materials Research Society 2008 Spring Meeting” in San Francisco, CA, Mar 2008.
- McAlpin, A., the Challenge X vehicle was displayed at the Junction during the Super Bulldog weekend recruiting event, Mar 2008.
- Park, S.J., DOE Monthly Report on 1/11/08, 2/10/08, 3/12/08, January 2008.
- Park, S.J., hosted 3 Korean students from department of Mechanical Engineering, Sung Kyun Kwan University: Hyunjoon Kim (Ph.D), Junghoon Park (Master), and Heejong Shin (Master), Jan 2008.
- Park, S.J., hosted Dr. Yang-Ki Hong, Department of Electrical Engineering, University of Alabama, to discuss collaboration on magnetic powder and polymer mixture, Mar 2008.
- Park, S.J., invited as committee member for Ph.D. candidate Mr. Hyunjoon Kim under Prof. Myung-Won Suh, Mechanical Engineering, Sung KyunK wan University, Jan 2008.
- Park, S.J., poster preparation “NanoPIM Informatics” for Oregon Nanoscience and Microtechnologies Institute, Oregon State University during US Army Visit, Feb 2008.
- Park, S.J., visited Dr. Henry Foust, Department of Applied Science, Nicholls State University with Dr. Pavan Suri to discuss “Ultrafiltration” proposal to NSF, Mar 2008.

- Kirkland, R., met with the MEC council in Jackson, MS as well as met the newly elected officials for the State, Jan 2008.

F. Tours

- Dennis, H.G., MRAP facility in West Point to John Moore's Lean Manufacturing class, Mar 2008.
- Kirkland, R., CAVS to Starkville Cub Scouts, Jan 2008.
- Kirkland, R., CAVS to NASA/DOD Huntsville, AL, Feb 2008.
- Kirkland, R., CAVS to Jones Junior College, Feb 2008.
- Kirkland, R., CAVS to Mc Neese Family, Mar 2008.
- Kirkland, R., CAVS to SeverCorr, Mar 2008.