CIVS Newsletter

November 2014 — *"Where Ideas Become Reality"* — Issue 5

CENTER FOR INNOVATION THROUGH VISUALIZATION & SIMULATION

PURDUE UNIVERSITY CALUMET

Giving to CIVS

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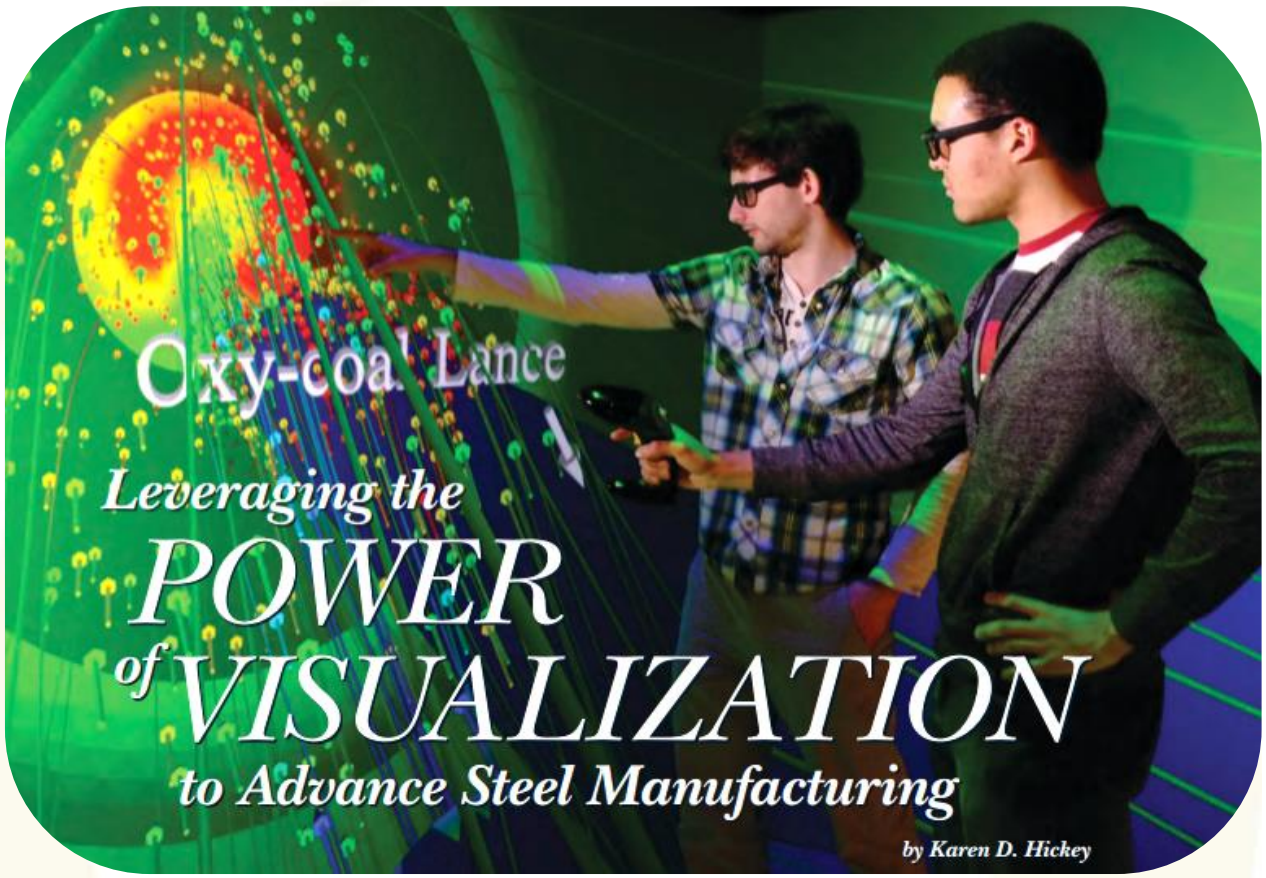
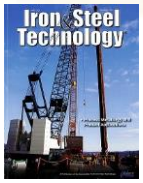


This article appeared in the October 2014 issue of Iron & Steel Technology (pages 148-153). Click the image for the full article in PDF version. Find out more at www.AIST.org.

Imagine seeing a power plant in operation, and training your employees on the operation of that plant, before the plant is even built. Imagine identifying the weakest spots of an overhead crane, without taking it apart at all, in order to develop a methodology that increases both reliability and cost savings. Imagine walking inside a blast furnace, where temperatures reach thousands of degrees, to see how iron ore is turned into liquid metal.

All of this and much more is now possible because of the work being done at the Center for Innovation Through Visualization and Simulation (CIVS) at Purdue University Calumet in Hammond, Ind., USA. Thanks to advanced simulation and visualization technologies, one can now "step inside" a virtual blast furnace, view a fatigue analysis of an overhead crane, and watch a virtual power plant in operation — all based on real data, real processes and real geometry. Different scenarios can be played out interactively in a 3D theater or portable virtual reality (VR) systems, on a personal computer or on a smartphone, showing how manufacturing can work better, how problems can be prevented, the immediate effects of trouble-shooting efforts, the scale-up effects of new concepts and the evaluation of new designs.



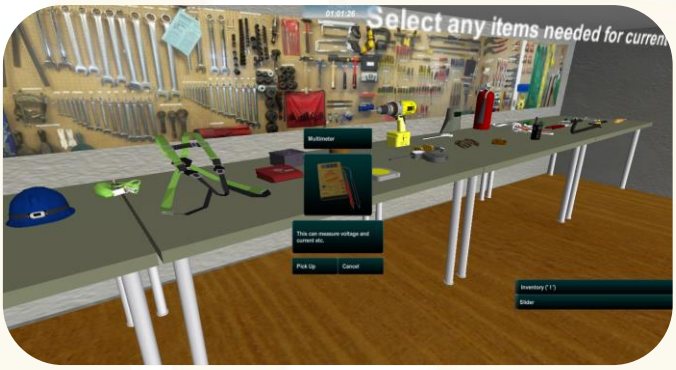
Click picture to read more…

"CFD MODELS developed by Purdue Calumet have helped us solve a variety of complex problems in the steel industry over the last several years. CFD is now widely accepted in the industry as a quick and economical problem-solving and design tool. The addition of virtual reality will now bring process understanding to a much higher level, as the modeler/designer can step inside the process and really get a 'feel' for what is going on."

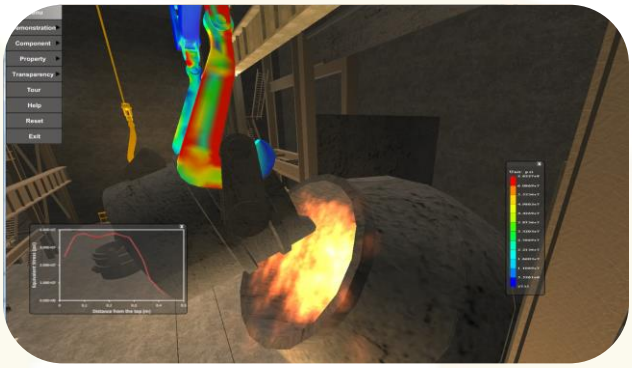
– *David White, Director, Process Research, ArcelorMittal R&D – East Chicago*

Selected Examples of Funded Projects

Project Title	Sponsor
Model of Wrigley Company Manufacturing Facility	Wrigley Company
Comparison and Optimization of Blast Furnace Tuyere Designs	ArcelorMittal
Modeling of Weld Plant Production and Logistics for Rail Products for Steel Dynamics, Structural and Rail Division	Steel Dynamics Inc.
Numerical Simulation and Optimization of Bottom-Blow Basic Oxygen Furnace	Dongying Fangyuan Nonferrous Metals
Optimization of Checker Wall Design in a CO Boiler	Blasch Precision Ceramics
CFD Study of High Rate Injection of Natural Gas in Blast Furnace	U.S. Steel Corporation
Numerical Optimization of a Diesel Engine Exhaust Manifold	LHP International
Development of a Virtual Campus Tour	Purdue Calumet Campus Life



An interactive 3D simulator was developed for wind turbine troubleshooting and includes built-in functionality for reading schematics and problem diagnosis.



A virtual crane simulator is being developed for fatigue analysis and virtual training in the steel industry including operator and safety training.

Steel Optimization Workshop Held in Pittsburgh

CIVS held the first of several workshops to develop an industry-led consortium and technology roadmap for steel optimization using simulation and visualization. The workshop was held October 14 in Pittsburgh with support from the National Institute of Standards and Technology (NIST). The event coincided with the 2014 Materials Science & Technology Conference. The full-day of activities included discussions and working groups with 34 experts and leaders participating from steel companies, suppliers, national labs, research centers, and others. The workshop focused on identifying the largest issues faced by the American steel industry, and discussing ways in which advanced simulation and visualization technologies can be used to help solve those issues and make the steel industry more competitive.

Workshop participants took part in two parallel focus groups. One group focused on Production Efficiency, including issues related to energy efficiency, operation efficiency, and raw materials. The other group focused on Personnel and Steel Applications, including issues related to workplace safety, reliability & maintenance, environmental impacts, and workforce development.

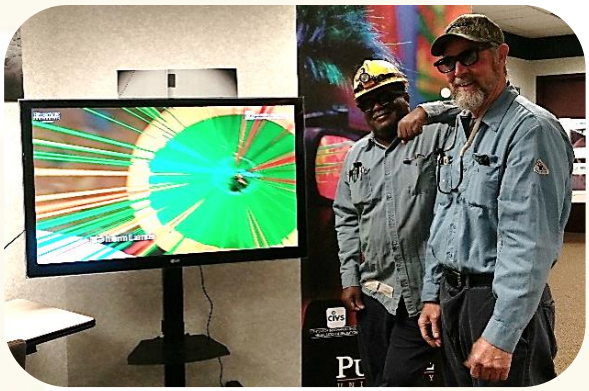
A second workshop is taking place on December 2nd at CIVS' facility located at Purdue University Calumet in Hammond, Indiana. Additional details about the event and other information on the project can be found at www.steelconsortium.org.

CIVS Mentors Senior Design Students

CIVS is mentoring 8 senior design teams this year. The teams are each made up of 2-3 engineering students who will develop solutions to real world problems. Projects include: Design and Life Prediction of Large Industrial Equipment through Finite Element and Fatigue Analysis, Design of a Virtual Power Plant Boiler Training Program using CFD and VR, Design of Fluid Catalytic Cracking Riser using CFD, Design of Fluid Catalytic Cracking Regenerator using CFD, Design of Steel Wheel 3D Processes, Design of Flue Gas Desulfurization Unit Using CFD and VR, Analysis and Planning for Steel Optimization Consortium Financial Impacts, and Evaluation of 3D Printing Design and Process. The student teams will present their project results at the end of the 2015 Spring Semester.

Energy Featured at Burns Harbor

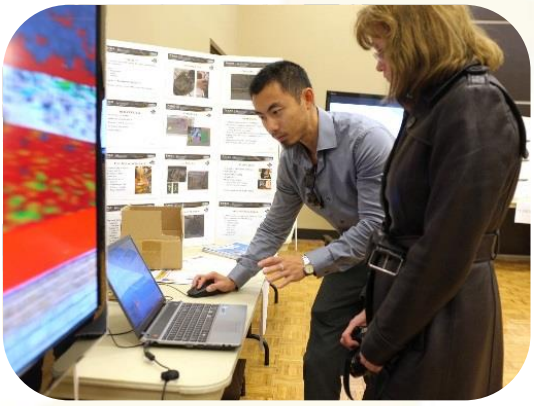
Approximately 900 ArcelorMittal employees visited the third annual Energy Fair on October 1 & 2 which took place at the Deerfield Woods Training Center. CIVS showcased its latest energy-related collaborations with the world's largest steel producer, helping groups within the company to operate more efficiently with less energy usage. 3D demonstrations included projects related to equipment including the vertical edger, boiler, steel ladle, overhead crane, blast furnace, and others.



CIVS Stands Out at Faculty Research Day 2014

CIVS was a heavy contributor at Purdue University Calumet's Annual Faculty Research Day, held Tuesday, October 21st. CIVS presented three posters with interactive demonstrations and collaborated with 7 other faculty presenters from different disciplines on campus including Business, Advancement, Nursing, Civil Engineering, English, and others. Additionally, CIVS students Tyamo Okosun and Phillip Arteaga spoke on a student panel discussing the student perspective of working with faculty on research projects.

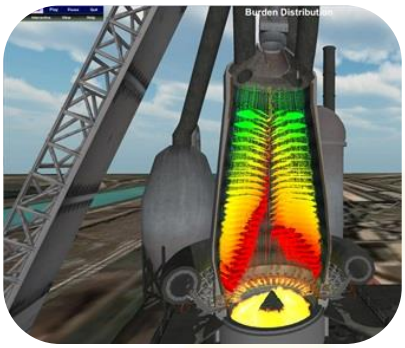
Since the Center was founded in 2009, CIVS has collaborated with 74 faculty and staff from Purdue Calumet in addition to many others at the West Lafayette and North Central campuses on a variety of research.



Student Successes

Philip Mann joined the CIVS research group in 2009 at the beginning of his freshman year and graduated with his degree in Mechanical Engineering in 2012. While at CIVS, he provided valuable contributions to multiple projects sponsored by NIPSCO, ArcelorMittal, BP, US Steel, and others. His research findings won multiple prestigious awards including the LSAMP Presentation Competition (1st place), AIST Undergraduate Presentation Competition (3rd place), and a Student Research Day Award. In addition to research, Philip also participated in the NASA Moon buggy and Human Powered Vehicle competitions and was Speaker of the Senate for the School of Math, Science, and Engineering in Student Government. By working closely with CIVS researchers and industrial collaborators, he developed real-world problem-solving skills which prepared him to be successful in industry. He is now an Engineer and Project Lead at Caterpillar, responsible for designing, managing, and leading projects for engine testing and validation for industry leading technologies.

Steel Research Presented at MS&T



CIVS presented technical papers on two steel-related research projects at the 2014 Materials Science & Technology (MS&T) Conference on October 14 in Pittsburgh, PA. The presentations titled "Development of a Virtual Blast Furnace Training System" and "CFD Analysis of Hot Metal Desulfurization Inside a Torpedo Vessel" were presented with collaborators from U.S. Steel and ArcelorMittal respectively. The presentations were well attended and received positive feedback from conference attendees.

Wind Energy Research Highlighted

CIVS presented research projects on wind energy education at the Ivy Tech Energy Day held on September 26 in Lafayette, Indiana. The event showcased a variety of careers and opportunities related to energy generation including wind, solar, and emerging technologies. CIVS showcased a number of virtual training applications that have been developed in collaboration with community colleges, universities, and wind energy developers. The research is supported by the U.S. Department of Education FIPSE grant. Additional information and educational materials can be found at www.windenergyeducation.org.

Cutting Edge Technology Showcased for Honors College

CIVS hosted students and their parents from the Purdue University Calumet Honors College. The Honors College allows students to attend additional classes that promote expanded classroom learning, many of which are not normally available to the student body. Students in the Honors College also get the benefit of working one on one with professors, gaining guidance from faculty involved in the college, and have the opportunity to network and research with faculty and other students. A variety of research projects were presented to showcase the cutting edge simulation and visualization technology and resources available to students through the Center.

CIVS Facts and Impacts

CIVS's multidisciplinary research projects are having substantial economic and intellectual impacts on local and global communities as well as providing great research opportunities for Purdue Calumet faculty and students. Following are highlights since 2009.

- $38++ million savings for companies
- 3,000+ students used CIVS for experiential learning and virtual labs
- 84 external organizations collaborated with CIVS
- 127 completed projects
- 99 technical publications
- 395 graduate and undergraduate students employed and mentored
- 74 Purdue Calumet collaborators
- 34 student awards
- 147 national and local news
- 12,700+ local, national and international visitors since October 2011

"…Because of the modeling effort it was very simple redesign that provided a huge risk reduction to the refinery and our neighbors. The CIVS Team was very responsive and quickly created the initial models. They offered suggestions on the various runs. Best of all, the way the data was presented was clear and crisp and allowed for a clean and objective comparison between tank designs and runs."

- *Rich Sobilo, P.E., BP, Whiting Refinery*

Office of Institutional Advancement

It begins with an opportunity to GIVE something back to a University you care about. It ends with the realization that you helped that University GROW into something even more worthwhile than before. Are you ready to be a leader and INSPIRE others? Make a gift today by visiting us at www.purduecal.edu/civs and clicking the "Give to CIVS" button. Your INVESTMENT in CIVS at Purdue University Calumet is an investment for your future. *For more information please contact:*
Renee Feldman, Coordinator of Annual Giving Programs,
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