David Riley; Director

The PACE Advisory board meeting held in June provided an opportunity for member firms to share views and perspectives on key challenges facing the building industry. Some of the challenges discussed include the increasingly difficult challenge of finding skilled workers and maintaining quality on construction projects. Missed opportunities to streamline construction through design-build techniques, the engagement of specialty contractors during design, and prefabrication were also discussed. Lessons learned and looming challenges of Building Information Modeling (BIM) implementation were also the subject of discussion.

For all the challenges facing our industry, ideas to advance and improve are still abundant. New programs to grow the construction workforce have been implemented. Inclusive and integrated project delivery methods continue to grow in popularity. Case studies of appropriate and profit enhancing BIM implementation are accumulating.

In recognition of the need to learn as an industry, our goal this year with PACE will be to select and test multiple tactics to enhance our industry in the areas of workforce development, prefabrication, and BIM implementation. We will initiate this effort at our Fall Roundtable meeting, in which diverse panels will discuss these subjects and attempt to identify possible solutions to advance our industry in these topical areas. Our students will investigate these potential solutions and report their results at the Spring Research Seminar. We look forward to another productive and informative year of activity with our PACE participants and Penn State students and faculty.

Interest Article: AIHI

Students, faculty and volunteers collaborating with Penn State’s American Indian Health Initiative (AIHI) project and members of Penn State’s Solar Decathlon Team spent four weeks this summer on a “blitz-build” solar home construction project, MorningStar Montana. Located on Chief Dull Knife Campus, on the Northern Cheyenne Reservation in Lame Deer, MT, this affordable, 1,000 square foot solar strawbale home will be used to house visiting faculty. The high tech educational prototype serves as a key step toward developing a community-based home-building collaborative with the Northern Cheyenne Housing Authority to help alleviate the 200,000 plus shortage of government issued housing units on reservations in the United States.

MorningStar Montana is a hybrid two phase site-built home consisting of a prefabricated technical core and a site built living space. The home cost $110,000 in materials to build. The prefabricated technical core is designed to lend itself to mass production. The rest of the home, built on site provides jobs for community members, help stimulate the local economy, and utilize local resources. Straw, a local fast growing renewable resource, is ideally suited for building construction on Montana’s arid plains. The thick, densely packed bales provide optimal insulation and durability with an R factor of 40, while maintaining cool summer and warm winter temperatures.

The Northern Cheyenne use the term “Morning Star” to refer to both their chief who led his people to Montana and to the planet Venus. It’s presence in the morning sky just before sunrise, brings promise of a new day.

MorningStar Montana, our homage to all Native American people, may be the ray of sunlight that all tribal families hold as they await their much needed homes.
On-Campus Construction Collaboration at Penn State

Penn State’s Office of Physical Plant (OPP), Architectural Engineering department, and students are all reaping benefits from collaboration surrounding on-campus construction projects.

For OPP, AE students represent an exceptional resource as part-time employees. Most of these students already have full or part-time experience in construction or another area of engineering. Since the students often work on research projects associated with their job, they contribute to improving the long-term effectiveness of OPP while also helping with day-to-day issues.

For the AE department, the collaboration is a valuable source of funding to support graduate students and the associated research. In addition to the funding provided, OPP also provides the AE department with access to construction project files. These files are an un-mined data set that is often inaccessible to outside groups.

For the students, the collaboration provides an opportunity to do research using actual data from current and past construction projects and to gain valuable practical experience that enhances their value in the job market. Rather than commuting to Washington or Philadelphia for access to large construction projects, the students are involved in these projects within walking distance of their classes and advisors. Finally, the on-campus projects are a source of great pride to many students as these projects become a permanent part of Penn State’s campus.

CIC Research Initiative Update

The Computer Integrated Construction Research Program members have been steadily advancing their industry case studies and research projects. Case studies focused on implementing Building Information Modeling for construction are continuing for the Dickinson School of Law and the Cancer Institute at Hershey Medical Center. Several graduate students gained valuable experience this summer working on BIM projects with PACE members. They are also continuing to develop the Virtual Construction Simulator, which is an educational simulation application that is used in construction engineering courses.

The CIC Group is proud to welcome three new members: Craig Dubler, Shrimant Jaruhar, and Chitwan Saluja. This Fall they also have a visiting scholar, Amir E. Piroozfar (Poorang), from the University of Sheffield in the UK. The CIC Group is also hosting CONVR 2007, the 7th International conference on Construction Applications for Virtual Reality this October 21-22.

The CIC Research Program has recently gained a new collaborative overseas partner through a shared project with VTT, the Technical Research Centre of Finland. VTT is the largest contract research organization in Northern Europe. In their Building Design and Construction research, they have gained notoriety in the past few years for their work with Building Information Models (BIM). VTT has been actively working with Finland’s Senate Properties, the counterpart of the General Services Administration in the US, to develop their new BIM Guidelines just released in October, which require full BIM for all new projects over $7 Million.

To strengthen the relationship with VTT, Rob Leicht spent the summer working in Finland on a joint project focused on identifying the relationship between BIM software and virtual environments. The research included field visits and interviews of 15 Finnish companies at the forefront of BIM implementation, a roundtable discussion with industry members on the strategic factors affecting BIM and virtual environment use, and experiments where teams used different media forms (drawings, a laptop, or an Immersive display) to perform a design review task. The research has advanced the CIC programs work in Virtual Facility Prototyping as well as creating a basis for ongoing collaboration.
ECOBUILD FALL

Ecobuild fall and AEC-ST fall is an annual event that takes place in Washington D.C. It covers topics such as renewable energy, sustainable design, green building, environmental planning processes and information collaboration strategies for construction.

The event will run from December 10th to the 13th. It consists of both a conference and an exhibit. For more information, visit the Ecobuild website at www.ecobuildamerica.com.

The 2008 Annual
PACE Research Seminar
“Building Collaboration”

April 22 - 23, 2008 at the
Penn Stater Research and Conference Hotel

Register Online!
www.engr.psu.edu/PACE

CONVR2007
22-23 October
www.engr.psu.edu/convr

Construction Virtual Reality: Virtual Reality (VR) and Augmented Reality (AR) are exciting technologies that offer considerable benefits in all stages of the Architecture, Engineering and Construction (AEC) process, from initial planning and conceptual design to facility management and operations. VR and AR allow people to see and interact with a building or infrastructure design and construction process prior to it being constructed.

2008 Annual PACE Research Seminar

PACEMembers help Penn State Solar Decathlon Team

The Penn State Solar Decathlon team finished 4th place last week Washington, DC after a strong showing in the highly competitive event. Sponsored by the US Department of Energy, the Solar Decathlon challenges student teams to design, build and operate the most attractive and energy-efficient solar-powered home. Teams transported their respective 800 square foot homes to the National Mall to show them off to the public. Expert juries judge each team in ten contest categories, such as Energy Balance, Engineering, Lighting, Comfort Zone, and Market Viability.

Penn State’s strategy extends beyond the Decathlon. The competition version, MorningStar Pennsylvania, will return to campus as a renewable energy research lab. The marketable prototype version, MorningStar Montana, was also built this summer on the Northern Cheyenne Reservation, and will help to introduce solar energy to the Northern Cheyenne Tribe.

Many PACE members helped the Penn State team. Balfour Beatty was one of the first industry sponsors of our team. Gilbane hosted our team on their construction site and provided much assistance during construction.

Southland Industries and Truland Systems provided extensive help getting the home up and running in Washington. James G. Davis arranged for all of the team’s equipment and provided safety workshops for the team. We’d like to thank all PACE members who supported the team:

Alexander Building Company,
Balfour Beatty Construction,
Barton Malow Company,
James G. Davis Construction,
EDiS Company,
Forman Construction Managers,
Forrester Construction Company,
Gilbane Building Company,
Holder Construction Company,
McClure Company,
Southland Industries, and
Truland Systems Corporation

A Solar Village on the Mall: Penn State will be among 20 top universities competing in the 2007 Solar Decathlon competition next September.

Southland Industries and Truland Systems provided extensive help getting the home up and running in Washington.

James G. Davis arranged for all of the team’s equipment and provided safety workshops for the team.


The 2008 Annual PACE Research Seminar

“Building Collaboration”

April 22 - 23, 2008 at the
Penn Stater Research and Conference Hotel

Register Online!
www.engr.psu.edu/PACE

Have you visited the PACE Website recently?

Look for:
Recruiting Information
Upcoming Events
Research Results
New Membership Information
http://www.engr.psu.edu/PACE
Interested in helping us advance the building industry?

Please contact us if you would like to become involved in a research project, or learn more about our research program and results.

Faculty Research Programs

**Michael Horman, PhD - mjorman@engr.psu.edu**
- Director of Lean and Green Research Initiative
- www.engr.psu.edu/leanandgreen/

**John Messner, PhD - jmessner@engr.psu.edu**
- Director of Computer Integrated Construction Research Initiative
- www.engr.psu.edu/ae/cic/facilities/ICon/

**David Riley, PhD - driley@engr.psu.edu**
- Director of PACE, and Executive Director of the Penn State Center for Sustainability
- www.engr.psu.edu/PACE

Graduate Student Research

<table>
<thead>
<tr>
<th>Topic</th>
<th>Name</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>“A Hybrid - Prefabricated / Site-Built - Strategy for Sustainable Housing”</td>
<td>Claudia Torres Arriaga</td>
<td><a href="mailto:cxt313@psu.edu">cxt313@psu.edu</a></td>
</tr>
<tr>
<td>“Characteristics of Immersive Virtual Environments to Support Design and Construction”</td>
<td>Nevena Zikic</td>
<td><a href="mailto:nuz102@psu.edu">nuz102@psu.edu</a></td>
</tr>
<tr>
<td>“Decision Support for Prefabrication Applications on Building Systems in Green Projects”</td>
<td>Vivien (Yupeng) Luo</td>
<td><a href="mailto:yzl119@psu.edu">yzl119@psu.edu</a></td>
</tr>
<tr>
<td>“Green Building Delivery Strategies in Healthcare”</td>
<td>Elena Enache-Pommer</td>
<td><a href="mailto:eue110@psu.edu">eue110@psu.edu</a></td>
</tr>
<tr>
<td>“Information Management in the Design and Construction of Green Healthcare Facilities”</td>
<td>Andreas Phelps</td>
<td><a href="mailto:afp112@psu.edu">afp112@psu.edu</a></td>
</tr>
<tr>
<td>“High Performance Green Building Project Delivery”</td>
<td>Sinem Korkmaz</td>
<td><a href="mailto:szk146@psu.edu">szk146@psu.edu</a></td>
</tr>
<tr>
<td>“Implementing Building Information Modeling (BIM) Applications in Education”</td>
<td>Dragana Nikolic</td>
<td><a href="mailto:dragana@psu.edu">dragana@psu.edu</a></td>
</tr>
<tr>
<td>“Increasing Transparency of Sustainable Project Delivery at Penn State's Office of the Physical Plant”</td>
<td>Leidy Klotz</td>
<td><a href="mailto:lek161@psu.edu">lek161@psu.edu</a></td>
</tr>
<tr>
<td>“Optimizing the Healthcare Construction Process”</td>
<td>Russ Manning</td>
<td><a href="mailto:rwm108@psu.edu">rwm108@psu.edu</a></td>
</tr>
<tr>
<td>“Planning Tool for Implementing Building Information Modeling”</td>
<td>Rob Leicht</td>
<td><a href="mailto:rml167@psu.edu">rml167@psu.edu</a></td>
</tr>
<tr>
<td>“Sustaining Sustainability at the Pentagon”</td>
<td>Pete Dahl</td>
<td><a href="mailto:pkd109@psu.edu">pkd109@psu.edu</a></td>
</tr>
<tr>
<td>“Building Information Modeling”</td>
<td>Craig Dubler</td>
<td><a href="mailto:crd137@psu.edu">crd137@psu.edu</a></td>
</tr>
<tr>
<td>“A Virtual Construction Simulator for Construction Education”</td>
<td>Shrimant Jaruhar</td>
<td><a href="mailto:suj131@psu.edu">suj131@psu.edu</a></td>
</tr>
<tr>
<td>“Virtual Reality for Construction Visualization”</td>
<td>Chitwan Saluja</td>
<td><a href="mailto:cus182@psu.edu">cus182@psu.edu</a></td>
</tr>
</tbody>
</table>