

March 2009						
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15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4

INSIDE VT WOOD

Reminder...

Remember to submit department news items by Friday 3 p.m. of each week to Will Pfeil at wpfeil@vt.edu for inclusion in Inside VT WOOD each Monday morning. All past issues of Inside VT Wood reside on our department website under the publications link.

News From Paul Winistorfer

- Undergraduate students note the information about Fall Semester 2009 classes. Please meet with your advisor to plan now for fall semester. Much information is attached, including information on new courses in the department.
- Our seminar presenter this week is Llyn Sharp coordinator of Virginia Tech's STEM (science, technology, engineering and math) initiative. Come and learn about VT's efforts in the STEM arena with this proactive programming.

Department Seminar Announcement - Wednesday March 25, 1:00 PM Brooks Classroom

·MAR·

Llyn Sharp - VT STEM

25

VT-STEM K-12, or Virginia Tech's Science Technology Engineering and Mathematics K-12 Outreach Initiative, is an interdisciplinary group of people and programs that share research and resources among the university community, K-12 education, and other partners to contribute to Virginia's leadership in

K-12 science, technology, engineering, and mathematics education.

VT-STEM K-12 programs and opportunities are aimed at diverse K-12 student, teacher, and university audiences, including classroom resources, teacher professional development, outreach consulting, education scholarship and K-12 formal and informal outreach.

- This is Graduate Education Week! See the attached information from the Graduate School on events during the week. The College will host a coffee on Friday March 27th at 9:30 in 315 Cheatham Hall for all College graduate students.
- We will co-host a reception on Friday March 27 at 10 a.m. in the lobby of Cheatham Hall for Virginia Tech Art students who are entering the 'corrugated design competition' sponsored by the International Corrugated Packaging Foundation (ICPF). Students in Professor Steve Bickley's (VT School of Visual Arts) class designed chairs for this competition and worked with Ralph Rupert and our Center for Unit Load Design to cut out the chairs on the department's CNC table a gift last year from the ICPF. Don't miss this fun, interesting and collaborative partnership event!

The American Institute of Architecture Students (AIAS) and the International Corrugated Packaging Foundation (ICPF) are pleased to announce a student competition for the Spring 2009 academic semester. Judging will occur in two stages with the top six designs displayed and judged at the 2009 AIA National Convention and Design Exposition in San Francisco prior to determining the winning design. The postmarked deadline for the competition is March 12, 2009.

Sponsored by the ICPF and administered by the AIAS, the program will challenge students, working individually or in teams, to explore a variety of issues related to the use of corrugated board (a non-traditional building material) in design and construction and production. Additionally, the competition introduces students to the dynamic corrugated industry. This





industry offers a breadth of career opportunities to students graduating in architecture and design. For more information on careers in the corrugated packaging industry please visit www.careersincorrugated.org.

Plan to attend the College Spring Awards Banquet, Tuesday March 31 at the German Club. See Peggy Quarterman
in the Dean's Office for tickets and details. We have several special recognitions being awarded to people from our
department — don't miss it!

Graduate Education Week begins March 23

By T. Lynn Caldwell

BLACKSBURG, Va., March 20, 2009 -- The ninth annual Graduate Education Week at Virginia Tech begins on Monday, March 23 with a student appreciation luncheon scheduled for 11:30 a.m. in the Graduate Life Center at Donaldson Brown Multipurpose Room on the university's main campus in Blacksburg, Va.

"There is no better way to begin our week of celebration than to say thank you to Virginia Tech's graduate students for their many contributions to the advancement of learning and research here," said Karen DePauw, Ph.D., vice president and dean for graduate education.

March 23 through 27 daily activities are scheduled for graduate students as well as faculty and staff. Activities include a panel presentation on finding employment after graduate school, an induction ceremony for Alpha Epsilon Lambda, the only honor society dedicated exclusively to graduate and professional students, and seminars on mentoring and leadership.

On Wednesday the Graduate Student Association Research Symposium and Exposition will review the latest research produced by the Virginia Tech graduate student community. The symposium will be held in the Graduate Life Center Multipurpose Room from 8 a.m. to 4 p.m.

A complete Graduate Education Week schedule may be found online. Unless otherwise noted, Graduate Education Week activities are free and open to the public.

Contact T. Lynn Caldwell at tcaldwel@vt.edu or (540) 231-2966

Volunteer to Clean Up the New!

By Jim Bisha

The Institute of Packaging Professionals (IoPP) and the Forest Products Club (FPC) at Virginia Tech have undertaken the task to adopt a portion of the New River. This event happens twice a year (once before the river traffic picks up and once after). This will be the first cleaning of the year. Nearly a 1 ½ mile stretch will be cleaned up from the Montgomery/Giles line on down on both sides of the road. After this cleaning, signs will be issued to hang up in the cleanup area stating this portion of the river has been adopted by the Institute of Packaging Professionals (IoPP) and the Forest Products Club (FPC) at Virginia Tech. The cleanup, including transportation time, will take under 3 hours.

Here are the details:

- Meet March 28, 2009 at Brooks at 12:45 p.m. to fill out paperwork
- Carpool to the river at Ipm
- · Gloves and trash bags will be supplied
- Drinks will be provided

Hope to see you on March 28th!!

James V. Bisha
Doctorial Candidate
VT Wood - Packaging
bishail@vt.edu

Considering Applying to Graduate School?

Attend this seminar to learn how to effectively present yourself when writing personal statements required with your graduate school applications.

Tuesday, March 24 5:00pm – 6:00pm 1045 Pamplin Hall

To register call I-800-KAP-TEST or visit www.kaptest.com (click on Graduate – GRE and then "Find a Free Event")

Co. and a register call I-800-KAP-TEST or visit www.kaptest.com (click on Graduate – GRE and then "Find a Free Event")

Co-sponsored by Kaplan Test Prep and Virginia Tech Career Services. For more information contact Amy McPherson at amcphers@vt.edu.

The Chair – A Vehicle for Learning – On the Move Again to Virginia Tech

Woodlinks students partner with Va. Tech

 $\ @$ 2009 by The News & Record, South Boston, VA

03/19/09 - Students in the Halifax County Public School's WoodLINKS, USA dual enrollment program are partnering with students at Virginia Tech's School of Visual Arts to create one-of-a-kind, customized wooden chairs. The WoodLINKS high school program focuses on product design and development, and is the first step in an eventual Associate's degree in Product Design and Development to be offered at the Southern Virginia Higher Education Center. Click here for the full story in The News & Record.

International Scholarship Opportunity

The Salzburg University of Applied Sciences near Salzburg, Austria is seeking applications for a European exchange under the Marshall Plan Scholarships Program.

We invite you to recruit students who may be interested in coming to Salzburg University of Applied Sciences for a four months research stay (or longer). Students should be majoring in Wood Science and Forest Products.

The exchange can be as late as summer 2010. It is for up to 4 months in Austria. Students must work on a joint research project between faculty in the Department and faculty at Salzburg University of Applied Sciences.

If you are interested, please contact:

Dr. Bob Smith
Professor/Associate Dean for Engagement
Room 324 Cheatham Hall
231-7679
rsmith4@vt.edu

Lean Thinking Simulation Practiced at Brooks Center

In preparation of the Lean Thinking workshop series to be held in four locations throughout Virginia over the next two months, workshop organizers Earl Kline and Urs Buehlmann asked departmental faculty, staff, and students to



help conduct a dry run of the lean simulation exercise. Therefore, on Tuesday, March 17, 2009, the Brooks Center Classroom became a simulation lab and participants discovered the power of lean. The photo shows the team in the middle of simulating the production of drawer boxes and Ralph Rupert (center, blue shirt), consistent with his expertise as Director of the Center for Unit Load Design serving as forklift driver distributing materials to the different workstations.

Lean simulation in the Brooks Center classroom. Participants included (from left to right): Gavin Wherry - graduate research assistant, Henry Queseda - assistant professor, Marc André Gonin - visiting scientist, Tim Stiess - graduate research assistant, Ralph Rupert - director Center for Unit Load Design, Becky Snidder - graduate research assistant, and Earl Kline - professor. Not pictured: Angela Riegel - secretary, Will Pfeil - web specialist, Kevin Knight and Baidy Ba - graduate research assistants, Urs Buehlmann - associate professor.

Thanks to the effort of those individuals, the Lean Thinking workshop now is ready to be held at the following dates and locations: March 24, 2009 in Harrisonburg, VA; April 2, 2009 in Abingdon, VA; May 7, 2009 in Virginia Beach, VA; and on May 14, 2009 in Danville, VA.

For more information on the Lean Thinking workshop series, visit http://www.woodscience.vt.edu/leanthinking/ or contact Urs Buehlmann, Virginia Cooperative Extension and Department of Wood Science and Forest Products at (540) 231-9759, ubuehlm@vt.edu.

VT Wood at the 237th National Meeting of the American Chemical Society

This week, the American Chemical Society is holding its 237th National Meeting in Salt Lake City, UT. The Virginia Tech Department of Wood Science and Forest Products will be represented at this meeting by Profs. Kevin Edgar, Chip Frazier, Scott Renneckar, and Maren Roman, Prof. em. Wolfgang Glasser, and the undergraduate students Dong Chun Choi and Damian Illing. The delegation will deliver four oral and three poster presentations:

Oral presentations:

- Complex coacervation of chitosan and cellulose nanocrystals (Roman)
 Food-related Nanotechnology, Division of Agricultural & Food Chemistry
- Nanocomposite-based lignocellulosic fibers: A simple route for lignocellulosic fiber reinforced inorganic composites (Renneckar)
 - Nanotechnology and Biobased Nanocomposites, Division of Cellulose & Renewable Materials
- Submersion torsion DMA of yellow-poplar wood: Influence of pH and grain orientation (Frazier) Studies of Molecular Structure of Renewable Material, Division of Cellulose & Renewable Materials
- Lignin utilization: Retrospect and prospect (Glasser)
 Advances in Chemistry and Utilization of Lignin, Division of Cellulose & Renewable Materials

Poster presentations:

- Enzymatic degradation of cellulose nanocrystals under physiological conditions (Illing)

 Poster Session of the Division of Cellulose & Renewable Materials and Sci-Mix (a convention-wide poster session)
- Ink-jet printed cellulose nanocrystal substrates for cell micropatterning (Choi) Poster Session of the Division of Cellulose & Renewable Materials and Sci-Mix
- Electrospinning of cellulose scaffolds for tissue engineering (Renneckar)

 Poster Session of the Division of Cellulose & Renewable Materials

STUDENTS: Early Information on Course Changes for Fall 2009

UNDERGRADUATE STUDENTS NOTE THE FOLLOWING PLANNED CHANGES IN OUR COURSES AND CURRICULUM FOR FALL SEMESTER 2009. Watch for further information prior to registration regarding established times for these course changes in our curriculum. Plan to see your advisor as needed for help and clarification.

Undergraduate Students

Options will be Merged:

• Forest Products Marketing and Management and Manufacturing Systems will be merged into a single new option named Forest Products Business

Courses will be Merged:

- Mechanics I & II (WOOD 3315/3316) will be merged into a new single course. For fall this new course will come under the heading of WOOD 4984 Wood Mechanics Special Study (4 credits) Mechanics will not be taught fall semester 2009; it will be taught spring semester 2010.
- Composites I&II (WOOD 4445 and 4446) will be merged into a new single course. For fall this new course will come under the heading of WOOD 4984 Wood Composites Special Study (4 credits)

- Wood Products Operations Management and Forest Products Business Management (WOOD 4624/4634) will be merged into a new single course. For this fall the new course will come under the heading of WOOD 4984 Forest Products Business Systems Special Study (3 credits)
- Lumber Manufacturing & Drying and Secondary Wood Products Manufacturing will be merged into a new single course. For fall this new course will come under the heading of WOOD 4894 Wood Products Manufacturing Special Study (3 credits)

Usual Occurring Fall Semester Courses that Will Not Be Taught Fall Semester 2009

- Wood Mechanics (WOOD 3315/3316 merged course)
- Computer Application Systems in Forest Products (WOOD 4154)

New Courses to be Offered

- WOOD 4984 Wood Enterprise Institute Special Study will be moved into the option checksheet as a requirement for the new Forest Products Business option and is a two semester sequence. For fall this new course will come under the heading of WOOD 4985 Wood Enterprise Institute Special Study (3 credits)
- WOOD 4984 Green Building Systems Special Study is a new course that is planned to be added into the Wood Structures and Materials option. This option will also soon be renamed. For fall this new course will come under the heading of WOOD 4984 Green Building Systems Special Study (3 credits)

Graduate Students

WOOD 5984 Special Study: Fundamentals of Wood Material Science will be offered this fall semester, 2009. A course
proposal to establish this course as Wood 5124 Fundamentals of Wood Material Science has been submitted to the
College Student Policy and Affairs Committee but because there is not sufficient time to get approval prior to the
fall semester, we will again teach this as a special study.

This course is considered the foundation course in wood material science that establishes the base for subsequent indepth graduate courses in wood science. It is required for all incoming graduate students and it will be offered annually in the fall semester. The lecture component is Tues & Thurs 9:30 - 10:45 a.m. and laboratory sessions are Monday 1:30 - 3:30 a.m. The course is 4 credits.

Content includes wood anatomy and formation, wood polymer science, and mechanical and physical properties of wood and wood-based composites.

For more information, contact Dr. Zink-Sharp.



Dr. Paul Winistorfer, Department Head pstorfer@vt.edu 231-8853

Dr. Audrey Zink-Sharp, Associate Department Head agzink@vt.edu 231-8820

New Course Offerings for Fall Semester 2009

WOOD 4984, CRN: 97315

Forest Products Business Process Systems



Location

Fall 2009

Instructor

Dr. D.E. Kline

Class Time

Brooks Forest Products Center

Phone: 231-8841 Email: kline@vt.edu

12:20-1:10	Mon/Wed	132 BROOK
1.25-3.15	Thursday	102 BROOK

Study of the business processes of forest/wood products organizations. Business challenges and current business processes and management practices used to address these challenges. How organizations and groups study their processes and then plan, execute, and evaluate business performance improvements. The application of techniques to strategic planning, strategy deployment, value stream management, and performance assessment. Business case studies of wood products and forest products related organizations.

Pre: Junior Standing (2H, 3L, 3C)

Green building is a recent movement in the construction community to provide a more complete accounting of the resources and energy used in buildings. Green building encompasses the material and energy inputs, environmental impacts of structures, and the quality of life for the house occupants. According to some sources, approximately 30% of green house gases produced in the United States and 70% of electricity produced in the US are used by buildings. Wood frame structures including housing represent a significant portion of the resources used in construction. Any efficiencies which can be realized during home construction can provide monetary savings for

WOOD 4984, CRN: 97319

Green Building Systems

Fall 2009

Instructor



Dr. D.P. HindmanBrooks Forest Products Center

Phone: 231-9442

Email: dhindman@vt.edu

Class Time Location
11:15-12:05 Mon/Wed/Fri 213 JCH

the homeowner, reduction of greenhouse gas emissions from construction and reduced energy load during the structure's use. Several groups have published green building certification standards, which represent measures of how green a building is. This class will discuss green buildings and specifically several popular green building certification programs, including LEED, NAHB Green Scoring Tool and Earthcraft Virginia. No prerequisites are required, but general knowledge of wood construction would be helpful.



WOOD 4984, CRN: 97318

Wood-Based Composite Materials

Fall 2009



Instructor

Dr. C.E. Frazier

Cheatham Hall Phone: 231-8318 Email: cfrazier@vt.edu

Class Time Location
10:10-11:00 Mon/Wed/Fri 213 JCH

11:00-1:50 Tuesday 213 JCH

The study of manufacturing processes used in the primary and secondary wood products industry including: lumber, wood-moisture relations, drying, durability and the processing of lumber into secondary wood products such as flooring, furniture and cabinets. Description, selection, and use of the manufacturing equipment used in wood processing. The selection and use of current industrial engineering and business practices applied in wood products manufacturing. How managers solve production and raw material issues.

WOOD 4984, CRN: 97317

Pre: None (2H, 3L, 3C)

Wood Enterprise Institute

Fall 2009



Instructor

Dr. D.E. Kline

Brooks Forest Products Center

Phone: 231-8841 Email: kline@vt.edu

Class Time		Location		
9:30-10:20	Tue/Thur	102 BROOK		

Lab 2:30-4:45 Tuesday 102 BROOK

Introductory polymer, adhesion, and materials science of wood-based composites. Manufacture, performance, and testing of particulate, strand, and veneer-based composites, including wood-thermoplastic composites. Contemporary wood adhesives, binders, and matrices.

Pre: 2124, 3314, 3434 (3H, 3L, 4C)

WOOD 4984, CRN: 97314

Wood Products Manufacturing

Fall 2009



Instructor

Dr. B.H. Bond

Brooks Forest Products Center

Phone: 231-8752 Email: bbond@vt.edu

Class Time Location
9:05-9:55 Mon/Wed 213 JCH

2:30-4:45 Monday 102 BROOK

Concept to market business project applied to the wood products industry. Wood product design based on consumer need. Writing a business plan including, product development and marketing, strategic planning, production planning, technology utilized, packaging and distribution to final market. 3446: Student run teams and experiential learning to organize and deploy the project according to a business plan, measure key performance areas, and manage the quality of the product and process value streams necessary to create a profitable business. Pre: None (2H, 3L, 3C)



Green Building Systems

OFFERING

Department of Wood Science

Part Head

Dr. Paul Winistorfer, Department Head pstorfer@vt.edu 231-8853

Dr. Audrey Zink-Sharp, Associate Department Head agzink@vt.edu 231-8820

reen building is a recent movement in the construction community to provide a more complete accounting of the resources and energy used in buildings. Green building encompasses the material and energy inputs, environmental impacts of structures, and the quality of life for the house occupants. According to some sources, buildings account for approximately 30% of green house gases produced in the United States and 70% of the electricity produced in the US.

Wood frame structures including housing represent a significant portion of the resources used in construction. Any efficiencies which can be realized during home construction can provide monetary savings for the homeowner, reduction of greenhouse gas emissions from construction and reduced energy load during the structure's use. Several groups have published green building certification standards, which represent measures of how green a building is.

This class will discuss green buildings and specifically several popular green building certification programs, including LEED, NAHB Green Scoring Tool and Earthcraft Virginia.

WOOD 4984, CRN: 97319

Green Building Systems

Fall 2009

S Credit Hours

Instructor

Dr. D.P. Hindman

Brooks Forest Products Center

Phone: 231-9442

Email: dhindman@vt.edu

Class Time

Location

1

11:15-12:05 Mon/Wed/Fri 213 JCH





Wood Enterprise Institute



he goal of the Wood Enterprise Institute (WEI) project is to conceive, develop, test, manufacture, and market a wood consumer product throughout the Fall and Spring Semesters of study. The mission of WEI is to provide sophomore/junior-level students with hands-on experience identifying and solving real-world business problems by developing and

applying technical, personal, and professional skills. Through this experience students will gain significant experiential knowledge in product design, product development, product manufacture, business planning, capital investment, human resource management, as well as the team-building and organizational skills needed to sustain a successful business. WEI provides experiential instruction through the creation of business situations that mimic those of the actual forest products industry. Ultimately, students will be better prepared for business leadership, change management, and problem solving by allowing students to experiment with different management strategies and observe the resulting business performance.

This course is a new course offering to provide the student experience in understanding the business of delivering a product/service to meet a consumer need. The knowledge and experience gained through this course will serve as a springboard from which students can gain appreciation of

WOOD 4984, CRN: 97317
Wood Enterprise
Institute
Fall 2009



Instructor

Dr. D.E. Kline

Brooks Forest Products Center

Phone: 231-8841 Email: kline@vt.edu

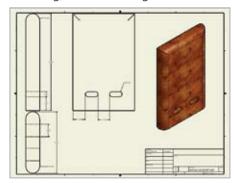
Class Time	Location	
9:30-10:20	Tue/Thur	102 BROOK

2:30-4:45 Tuesday 102 BROOK

the value and role that fundamental disciplines in marketing, product design, production operations, manufacturing systems, and management play in the planning and successful execution of a forest products business.

Upon completion of this course, students will be able to:

- Apply techniques and tools to organize, structure, and monitor an effective business
- Translate market preferences into a functional, cost-effective product specification that can be manufactured and/or outsourced.
- Apply methods to understand the cost to mass produce products within manufacturing technology, labor, time, sales, and cash flow constraints.
- Build skills on how to manage the product concept-to-market process effectively within budget, system capability, and time constraints
- Build skills to organize a group into an effective and cross-functional team including leadership development, time management, training, and mentoring.









Sustainable Green Enterprises



Dr. Paul Winistorfer, Department Head pstorfer@vt.edu 231-8853

Dr. Audrey Zink-Sharp, Associate Department Head agzink@vt.edu 231-8820

he market for green products has shown large growth. The goal of a 'green business' is to manufacture and market products while ensuring sustainability. Ultimately, students who understand the principles of green enterprises will be more competitive in today's business environment. They will be better prepared to provide business leadership, react to changes

in management, and engage in problem solving. This course is a new course offering to provide the student experience in understanding green enterprises.

Included in this course will be applications of planning and enterprise skills in sustainable natural resource-based enterprises. Development of sustainability certification systems for forest products and other natural resource-based products.

Prerequisites: none (3C)

Syllabus

Sustainability 20%

Defining Sustainability

Sustainable Natural Resources

Product and Process Certification 30%

Types of Certification

Goals of Certification

Certification Systems

Evaluating Certification Systems

Sustainable Enterprise Planning 35%

Mission and Vision

Industry Analysis

Strategies

Products and Processes

Market Evaluation and Selection

Resource Needs

Evaluating Sustainable Enterprise Plans 15%

WOOD 2984, CRN: 97492 Sustainable Green Enterprises Fall 2009



Dr. Tom Hammett

Cheatham Hall Phone: 231-2716

Email: himal@vt.edu

Class Time 12:30-1:45 Tues/Thur

133 JCH

Location

Credit Hours

Upon completion of this course, students will be able to:

- Define sustainability in the context of nature-based businesses
- Perform an assessment of the feasibility of green business
- Interpret market preferences so that green products can be manufactured
- Apply methods to understand the opportunities and constraints to certification systems
- Understand and apply the critical factors required to form sustainable green enterprise
- Develop an awareness of the range of certification systems (FSC, ISO, etc.)





Membership in the chapter is not a requirement to attend. SWVa USGBC encourages anyone who is interested to visit.

Please send notification of your attendance so we can plan ahead.

Please RSVP to:

James Ruhland phone: (540) 382-2002 x 348 fax: (540) 381-8270 <u>iruhland3@chpc2.org</u>

Dinner is not part of the program but a restaurant spot is convenient for gathering afterwards.

This presentation will be designed to comply with the AIA standards for self-reporting CES credits. Information will be provided at the meeting for any Virginia registered Architect to report the presentation.

For chapter info. contact: Steve Sunderman (540) 344-1212 ssunderm@rrmm.com

Upcoming Meetings:

April 21 –Home Energy Audits by "Double Trouble" May 19 – Lodge at Lick Creek (tentative) June 16 – "LEED Economics"

As always, if you have any suggestions or ideas for future programs contact James Ruhland at jruhland3@chpc2.org.

Driving Directions

- Take I-81 to US-460 towards Blacksburg.
- Drive approx. 5 mi. Take ramp right and follow signs for South Main Street.
- 3. Drive approx 2.7 mi. Turn right onto Wilson Avenue.
- 4. Turn **left** up a long driveway towards the **Wong Park**.

SOUTHWEST VIRGINIA CHAPTER

http://chapters.usgbc.org/swvirginia/ http://www.usgbcswva.org

MARCH 2009

AFFORDABLE SUSTAINABLE

31 March

Housing and Neighborhood Services 303 Wilson Avenue, Blacksburg, Virginia

5:30pm - Networking, 6:00pm - Presentation

The Duplex of Wilson Avenue

In 2007 the Blacksburg Office of Housing and Neighborhood Services approached Community Housing Partners (CHP) to redevelop a parcel a few blocks away from Main Street. Their goal was to effectively raise the bar for what publicly defines 'affordability' and 'sustainability.' Their project is now complete. On March 31st Blacksburg and CHP will host a series of events dedicating these two homes. The buildings are designed to achieve an EarthCraft of Virginia New Construction Tier 2 certification. The homes feature a solar thermal water heater along with all the regular accourtements synonymous with residential green building. The Community Design Studio (CDS) will host a walking tour through the duplex and review major points of the building's design relative to the EarthCraft of Virginia Residential program.

Josh Holloway

Josh served Community Housing Partners as the project manager for the Wilson Avenue Duplex. He joined the Community Design Studio (CDS) in 2007 and currently serves as an Apprentice Architect. He graduated with his bachelor's in Architecture from Virginia Polytechnic Institute and State University in 2005 and is a LEED® Accredited Professional. Josh brings with him both architecture and construction experience from a variety of organizations.

For more information visit:

http://www.communityhousingpartners.org/ http://www.blacksburg.gov/Index.aspx?page=17 http://www.ecvirginia.org/

