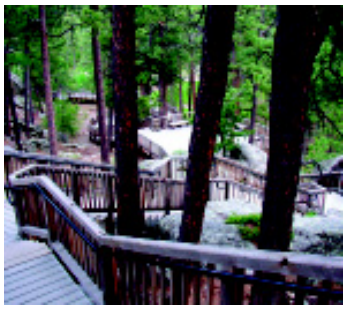
Celebrating 25 years of creating and disseminating knowledge about wood, forest products, and their utilization



THE DEPARTMENT OF WOOD SCIENCE AND FOREST PRODUCTS

The College of Natural Resources

Where nature meets technology...

...and science meets application

Creative Achievements 2004

www.woodscience.vt.edu

Virginia Tech

www.vt.edu

2004 at a Glance

Virginia Tech Duck Pond

Number of Research Proposals Funded	**24**
Total Funding Secured via Proposals	**$2,999,249**
Research Expenditures	**$1,698,750***
Number of Graduate Degrees Conferred	**7**
Number of Classes Offered by Department Faculty	**27**
Number of Students Taught in Departmental Classes	**336**
Number of Continuing Education/Short Courses	**27**
Refereed Journal Publications	**26**
Trade Journal Publications	**18**
Other Publications	**22**
Radio Broadcasts	**1**
Software	**1**
Editorials	**2**
Editorships Held by Faculty	**3**
Encyclopedia Articles Published	**3**
Conference Proceedings	**15**
Presentations Made by Faculty	**108**
Awards and Honors Received by Faculty	**16**

*Includes $366,417 in research expenditures by the Sustainable Engineered Materials Institute (SEMI). SEMI is a College-level Center affiliated with the departments of Computer Science, Forestry, and Wood Science and Forest Products. Does not include research expenditures from the Sloan Forest Industries Center.

Table of Contents

Mission of the Department

Our mission is to advance the sustainable use of the forest resource for the benefit of society by creating and disseminating knowledge about wood, forest products, and their utilization.

Department Head's Message

Welcome to our annual report of Creative Achievements summarizing our work for the calendar year 2004*. The year 2004 marked our 25th year as a department in the College of Natural Resources. The contributions of our program over the past 25 years have been substantial. We celebrated the occasion by hosting a 25th Anniversary Celebration in October. About 80 friends, alum, faculty, and staff participated in an evening reception and short program and a display of photos and information from our program over the past 25 years. Former Department Head Dr. Geza Ifju assembled a written summary of events over the past 25 years for the Anniversary Celebration. You will find that summary on our departmental website. Most notable has been the graduation of over 100 Ph.D.'s during our 25-year history. Certainly the contributions we make to our students' personal and professional development are the longest-lasting measure of our program success. Thanks to all of you that attended the Anniversary Celebration and continue to support our program. We look forward to another productive 25 years for our program.

This report summarizes our important contributions in outreach, research, and teaching activities. In addition to these Creative Achievements, we have other news to report about our program.

Dr. Maren Roman

Personnel

Dr. Maren Roman joined our program in August as an assistant professor of natural and bio-based polymers and composites. Her background is in chemistry with an emphasis on polymer chemistry. Dr. Roman received her Ph.D. degree from the SUNY College of Environmental Science and Forestry. Prior to joining the department, she held a postdoctoral position at the Pulp and Paper Research Centre at McGill University. Dr. Roman's research program is centered around the properties and applications of cellulose nanocrystals. The program spans both fundamental and applied projects in wood and materials science. Dr. Roman teaches Wood Chemistry, Products, and Processes. Her areas of expertise include chiral and self-assembly properties of cellulose, molecular organization and interactions of polymers in wood, interactions of natural and synthetic polymers with native cellulose surfaces, cellulose reinforced polymer composites and nanocomposites, and isolation and utilization of wood components. We welcome Dr. Roman to our program. Dr. Roman's office and laboratory are located in Cheatham Hall.

Dr. Jongkoo Han

Dr. Jongkoo Han joined our program in September as an assistant professor of packaging science. Dr. Han will help lead our new packaging science option at the undergraduate level and will work cooperatively with the faculty and staff in the Center for Unit Load Design on research programming. Dr. Han works in the area of logistics and packaging. His background is in chemical engineering with an emphasis on materials application to packaging. Dr. Han received his Ph.D. degree in packaging from the Michigan State University. Prior to joining the department, he served as a visiting assistant professor at the Indiana State University and instructor at the Michigan State University. He was a packaging research scientist in the Korea Design and Packaging Center for 15 years. Dr. Han's research program is centered on the

*Creative Achievements will not be published again until August 2006. This change from annual calendar year reporting to fiscal year reporting is being made to coincide with the University fiscal and academic year reporting.

Department Head's Message

interactions among product, package, and the environment. The program spans interdisciplinary and applied projects in logistics and packaging. Dr. Han will develop and teach packaging related courses including "Paper and Paperboard Packaging." His areas of expertise include interaction among product/package/environment including mass transfer, standardization of packaging for efficient logistics, materials application to packaging, and environmental aspects of packaging. Dr. Han's office and laboratory is located at the Brooks Center.

Many of our faculty, staff, students and alumni garnered awards and recognition this past year.

Dr. Audrey Zink-Sharp

- Dr. Audrey Zink-Sharp was named President of the Society of Wood Science and Technology and is providing leadership to that organization. Audrey also received the College's Award for Outreach Excellence for her continued effort in bringing Wood Magic to students and teachers throughout Virginia.
- Dr. Tom Hammett was promoted to the rank of Professor in the department, based on his contributions in his research, teaching and outreach programs.
- Dr. Bob Youngs was named the first honorary Fellow by the Society of Wood Science and Technology for his sustained contributions to the profession.
- Dr. Geza Ifju was recognized for his contributions to the Society of Wood Science and Technology with the SWST Distinguished Service Award at the annual meeting in June 2004.
- Dr. Nichole Brown, recent Ph.D. graduate of our program under the guidance of Dr. Chip Frazier, was awarded the first place Wood Award by the Forest Products Society in recognition of her outstanding Ph.D. research.

Dr. Joseph Loferski

- Dr. Joe Loferski received the College's Curriculum Club Award for Teaching Excellence. Joe provided remarks at the spring College graduation ceremony.
- Dr. Brian Bond received the Curriculum Club Award for recognition of outstanding teaching in the department.
- Dr. Fred Kamke and the late Dr. Balazs Zombori received the George Marra Award of Excellence for excellence in scientific writing for articles published in *Wood and Fiber Science*.
- Dr. Paul Winistorfer was elected a Fellow in the International Academy of Wood Science.
- Dr. Wolfgang Glasser was listed in *Who's Who in the World.*

Our faculty continue to be leaders in the discipline and profession. Additional accomplishments and recognition by our faculty can be found throughout this document.

Rick Caudill, engineering lab manager, was recognized in 2004 as the outstanding staff person in the College of Natural Resources. Rick received the Dean's Award at the College Awards Banquet in March 2004. Rick has done a masterful job of reinvigorating the operation of our wood engineering laboratory. Rick enjoys very high compliments from the faculty and students with whom he works. This is the second year in a row that a department staff member has received the Dean's Award. In the past decade five of our department staff members have been recognized for their excellent contributions through receipt of the Dean's Award (Rick Caudill 2004; Angela Riegel 2003; Kenny Albert 2001; Debbie Garnand 1996; Carlile Price 1994).

Rick Caudill

Department Head's Message

Our students continue to be recognized for their achievements. Senior Chris Gabrielli was awarded the Composite Panel Association Scholarship this academic year. This award carried a $5,000 stipend for Chris. Graduate student Patrick Rappold was recognized at the College spring awards banquet as the outstanding graduate student in the department. Our undergraduate students competed again in the National Timber Bridge Design Competition and received recognition again for their design and performance.

Randy Bush, President of the Virginia Forest Products Association and a 1973 graduate of our program, was recognized at the College spring awards banquet as the Outstanding Alumni of the College of Natural Resources. Congratulations Randy for your lengthy contributions to the Virginia industry and for the continued support you and the VFPA provide our programs at Virginia Tech.

Donor Support

Many of our students received scholarship support through our association with our industry partners and the interaction with our Wood-Based Composites Center and the Center for Forest Products Marketing and Management. The Virginia Forestry Educational Foundation also contributes to student scholarships in the department.

We also have individual donors who contribute to several scholarships in the department, notably the Bryan Graeser Memorial Scholarhship in honor of the late Bryan Graeser, given by Hank and Peggy Graeser of Chester, Virginia; the George Stern Scholarship in honor of the late George Stern, given by Mrs. Marianne Stern and the Stern family; and numerous individual donors to the Geza Ifju Memorial Scholarship, in honor of Geza's tremendous contributions to our program over many decades serving as department head. We also received donations for general support of our program and students from alumni and donors. We thank you all. Your support for our students is critical for us to attract and support the best and brightest students in our program. A complete listing of all scholarship support for our students begins on page 17.

Students

Judith Araman joined our program as a student recruiter and advisor this past year. Judith comes to us from the University Studies program where she was an academic advisor. Judith's extensive knowledge of people and programs on campus has already been fruitful for our recruiting efforts. We have fundamentally changed our recruiting focus to the undeclared freshman students on campus. We are making much needed progress to increase enrollment in our major to meet employment opportunities for our graduates. Starting salaries and employment opportunities continue to be strong for our students.

We continue to conduct exit interviews of our graduating students. This process captures student's thoughts about our program and has been useful in providing feedback regarding curriculum, student club activities, use of computer technology, quality of advising and a host of other program attributes. In summary, the students report that we do an excellent job in our program and they are very satisfied with their wood science and Virginia Tech education.

Seven graduate degrees were awarded in calendar year 2004; five M.S. degrees and two Ph.D. degrees. Fourteen B.S. degrees were awarded in the calendar year.

Curriculum

Our entire new undergraduate curriculum was approved at the university-level in 2004. The new single major is **Wood Science and Forest Products** and the six options are:

- Adhesion Science
- Manufacturing Systems
- Marketing and Management
- Non-timber Forest Products
- Packaging Science
- Wood Materials and Structures (pending)

Department Head's Message

The Wood Materials and Structures option has been submitted and is pending approval through University governance. Each of the six options is made up of 15 credit hours of coursework in the option, in addition to the common department core curriculum for all department majors. New option courses are being taught this academic year, and all students are making the transition to the new curriculum. Our undergraduate curriculum, and all six new options, were reviewed in February 2005, for reaccredidation by the Society of Wood Science and Technology. Description of the new options are shown beginning on page 20.

We have begun to examine our graduate curriculum–looking at courses offered, timing, sequence, and material content. We anticipate completing our review of the graduate curriculum by mid-2005.

Research

The entrepreneurial efforts of our faculty in their research endeavors drive our program. We have 100 percent participation of our department faculty in our research efforts. Our research is supported by and administered through the Virginia Agricultural Experiment Station in the form of faculty salaries, operating monies, and reporting. The pursuit of external funding to support our investigations is a critical first-step in moving our research agenda forward. Faculty should be recognized for their individual efforts to bring their creative ideas and inquiry to fruition. We are appreciative of the cooperative financial support we receive from our research partners.

There are many ways to evaluate our research impacts. You can read of our faculty accomplishments in this document in the areas of publications, grants procured, patents received, reporting of research findings in other publications, at conferences, and in short courses. Graduate students are a critical component of the research process, and the names of those students successfully completing degree requirements in 2004 are shown herein, along with the titles of their research project.

Grants successfully garnered by faculty during 2004 are shown by title, sponsor, and grant amount. Grants procured in calendar year 2004 totaled $2,999,249. This listing does not include grants awarded in 2003 that carry over to 2004 or beyond. Research expenditures, or the actual amount spent on research for calendar year 2004, totaled $1,332,333. This does not include monies brought into our program through the Virginia Tech Foundation or monies from outreach and continuing education. In addition to the department's overall expenditure, the Sustainable Engineered Materials Institute (SEMI), a college-level center with affiliations in our department and the departments of Forestry and Computer Science, had research expenditures of $366,417 for the calendar year. Research expenditures for the Sloan Forest Industries Center were not included in this total.

Outreach

We continue to fulfill our outreach mission by offering timely and relevant continuing education programs, workshops, and targeted programs and by working with the wood industry in the state and region. We offered 27 outreach short courses during the past calendar year, reaching a wide range of clientele, both in Virginia and the region. We have three faculty appointments in outreach, but continue to have participation by our entire faculty in our outreach mission. Our outreach mission is partially supported by and administered through Virginia Cooperative Extension. Program Development of Outreach and International Affairs provides logistical and meeting support for our programs. A complete listing of programs, locations, and dates is summarized beginning on page 24.

Equipment and Facilities

We continue to make improvements to our facilities infrastructure.

- We have renamed the former chemistry laboratory at our Brooks facility the Packaging Science Laboratory to accommodate the new teaching and research program of Dr. Han.
- We have established a new student computer lab at Brooks with 8 new desktop machines that is seeing immediate high-use by our students. The lab will also be used for teaching of some of our courses that require software use.

Department Head's Message

- We consolidated our chemistry and thermal analysis equipment in Cheatham Hall from three labs into two labs, making room for a new laboratory named the Advanced Biopolymer Materials Laboratory (room 225 Cheatham Hall) to accommodate the new teaching and research program of Dr. Roman. This laboratory received a cosmetic make-over with a new floor, paint, and lighting. Dr. Roman will be procuring significant equipment for the laboratory in the coming months.

- Dr. Frazier has acquired new equipment for his adhesion research program with the support of competitive external funding from the USDA and the DOE. This new equipment has been installed in our Thermal Analysis lab in Cheatham Hall.

- Our entire Brooks facility has received an exterior face-lift thanks to our University Physical Plant. We are appreciative of some replaced siding materials, new exterior paint, and attention to various roof issues. Our Brooks facility will be recarpeted in the coming months. Brooks looks great and continues to serve our program well.

However, we are at capacity with our existing facilities, both for housing personnel and equipment. Our research program continues to grow and we anticipate future growth in many program areas. We are having internal discussions regarding our facilities needs and any future plans we might put in place for enhancement, consolidation, or enlargement.

USDA Forest Service Research Stations

Throughout the past year we have benefited from our collaboration and cooperation with the Forest Service Southern Research Station – Research Work Unit SRS-4702 located at our Brooks Forest Products Center. Phil Araman, project leader, and his team of scientists and staff add greatly to our educational, research, and outreach programs in the department. Many of the accomplishments of the research work unit are included in this Creative Achievements report. We also maintain close ties to the Northeastern Research Station in Princeton, West Virginia, and the scientists and projects there. We benefit from the mutual close proximity and collaborative research work with these Forest Service Research Work Units.

Advisory Board

Our advisory board met in March to review our program and give us guidance on a range of issues. We are appreciative of board members serving at their own time and expense and for spending several days in Blacksburg reviewing our program. The following board members attended our spring 2004 meeting:

- Dan DiCarlo (chair), Georgia-Pacific Resins
- Derwood Brady, Trus Joist – A Weyerhaeuser Business
- Randy Bush, Virginia Forest Products Association
- Brad Douglas, American Wood Council – AF&PA
- Ken Morgan, Morgan Lumber Company
- David Olah, Georgia-Pacific Hardwoods
- Chris Risbrudt, USDA Forest Products Lab
- John Sebelius, USDA Forest Service

The board members recommended action on these items:

1. To support the establishment of the Sloan Forest Industries Center at Virginia Tech as a cross-college initiative between the Colleges of Natural Resources and Business.
2. Recommend University passage of the undergraduate curriculum revisions proposed by the department.
3. Recommend continued support for the new position in student advising/recruiting and the efforts of Judith Araman.
4. Recommend support of the faculty position in packaging science and moving forward with the search process.
5. Recommend enlarging the department board to 12-15 members.
6. Recommend that the Board Chair person serve a 2-year term to provide continuity and identifiable action items for the Board.

Department Head's Message

David Olah was elected as chair of the department Advisory Board for the coming two years. Late in 2004 the College moved to make some changes to the logistics of how we convene the various department advisory boards. The department will likely move to a single fall meeting of our advisory board, in association with some other department activities. More information on a refreshed approach to our board and how we continue to work together for the betterment of our program will be coming the near future. We value and appreciate the Advisory Board and the commitment of the board members to our program. Thanks to you all.

Emerging Initiatives

- Emerging last calendar year was the Sloan Foundation Center proposal. The Sloan Foundation approved the proposal, and the Alfred P. Sloan Forest Industries Center has been established at Virginia Tech. This Center is a partnership between the College of Business and the College of Natural Resources. Announcing the establishment of the Forest Industries Center at Virginia Tech during a conference in November in Reston, Virginia. Virginia Secretary of Commerce and Trade Michael J. Schewel said the center will assist the nation's forest industries through research, teaching, and industry outreach programs that will enhance the industries' manufacturing technology and efficiency and workforce education and skills. "The center will bring together all the key stakeholders in forest industries to address the challenges facing this sector," Schewel said. "The center will help the commonwealth leverage its investments in worker training and research and development to attract new businesses and support our current industries." In December we received word of $100,000 of support for the Center from the Governor of Virginia the Honorable Mark Warner. The Sloan Foundation has made an additional financial contribution to the center, as well as numerous industry and association partners. More information about the Center can be found at *www.forestindustries.vt.edu*. Dr. David Brinberg, professor of Marketing in the College of Business, is the Center Director.

Alfred P. Sloan Foundation
www.sloan.org

- We participated in the past year in the organization of the Virginia Forest Industries Summit–convened in May by Governor Warner. About 80 invited participants representing industry, government and education came together to enter into a discussion about the future of the forest industries in Virginia. Competitive off-shore pressures, management pressures, and other emerging issues significantly impact our management and use of our forest resources in the Commonwealth. We intend to stay involved in the summit and the ensuing work that will follow.

- We are hopeful of several faculty search opportunities in early 2005 and anticipate successful searches and additional new faculty hires in the coming year.

- We are targeting growth in our Ph.D. program in the coming years, with support from an initiative on campus. We have received two Ph.D. stipends for the coming year from the Graduate School.

- We are laying the foundation for a new student-oriented manufacturing enterprise experience. We seek to develop a unique, experiential, real-world problem-solving setting that will involve our students in market assessment, product design, product development and manufacture, personnel management, distribution, financial management, and business management. We are planning a summer 2006 launch for this new student experience.

- We are participating in a bio-processing, materials, and products cluster hire proposal on our campus with the departments of Biological Systems Engineering and Materials Science and Engineering. We seek to create a cluster of nine faculty working in the bio-processing, materials, and products arena.

Department Head's Message

New College Leadership

Dr. Mike Kelly has joined us as Dean of the College of Natural Resources, following the retirement of Dr. Greg Brown. Dr. Kelly comes to Virginia Tech from Iowa State University in Ames, Iowa, where he was head of the department of Natural Resources Management and Ecology. We welcome Dr. Kelly to our college and look forward to his leadership and in working together to make our department and the college even stronger and relevant in the coming years. Welcome Dr. Kelly!

We could not accomplish our work without the support of the administration, alumni, industry cooperators, state and federal partners, graduate students, and undergraduate students. We have a highly productive and creative faculty whose commitment and enthusiasm for the students and their own work drive our program. We have a highly skilled and committed department staff that help us achieve our goals. Thanks to each of you for your role in supporting our program and our mission.

J. Michael Kelly

Please contact me or our faculty directly, if you have any questions about these creative achievements or other aspects of our program.

Paul M. Winistorfer

Paul M. Winistorfer, Ph.D.
Professor and Department Head
January 2005

Departmental Strategic Goals

Goal 1. Strengthen our commitment to producing high-quality wood science and forest products graduates responsive to the needs of employers and broad societal needs.

Goal 2. Increase emphasis on graduate education, and in particular Ph.D. education per the University goal of increasing Ph.D.enrollment at Virginia Tech.

Goal 3. Focus faculty efforts on a strong, discovery-oriented research program for wood science and forest products.

Goal 4. Ensure that we have a viable and responsive outreach/extension program that successfully meets the needs of the industry and citizenry and enhances the department's reputation and credibility throughout the Commonwealth, the region, the nation, and beyond.

Goal 5. Develop the staffing, support, facilities, and administrative systems that will increase the efficiency and effectiveness of our department's operations.

Goal 6. Establish the department as the repository and node of knowledge for renewable materials science and utilization education in the university, state, region and beyond.

Moving On. . .

At the end of 2004, Dr. Fred Kamke, Thomas M. Brooks Professor, accepted a chair faculty position in wood composites at Oregon State University, commencing March 2005. Dr. Kamke has made significant contributions to our program over the past twenty years, including the establishment of the Wood-based Composites Center and the Sustainable Engineered Materials Institute (SEMI), as well as mentoring many graduate students. Drs. Chip Frazier and Audrey Zink-Sharp have been named the new directors for both of these Centers to replace Dr. Kamke. We wish Dr. Kamke well in his new endeavors.

Outstanding Alumni Award Receipient

College of Natural Resources Outstanding Alumni Award J. R. (Randy) Bush

Randy Bush was the 2004 recipient of the College of Natural Resources' Outstanding Alumni Award presented at the spring awards banquet. Presently the President and Chief Staff Executive of the Virginia Forest Products Association (VFPA), Randy assumed his position in 1976 after serving as the organization's Field Director for two years. He began with the association following his 1973 graduation from Virginia Polytechnic Institute and State University (B.S., Forestry and Wildlife/Wood Science and Technology).

The Virginia Forest Products Association represents the forest products industry in Virginia with membership comprised of approximately 325 companies involved in the Commonwealth's $25 billion forest products industry. The members represent all regions of Virginia, and include a diverse sampling of the entire spectrum of the forest products industry (i.e., sawmills, planing mills, timber harvesters, paper mills, pallet plants, etc.) Although the association has both large and small producers, the typical company can be characterized as small business, with the overwhelming majority being family-owned and operated. VFPA provides many services to the industry, including EXPO Richmond, one of the premier forest product trade shows in the nation. In recognition of his service to the association, the organization presented him with a special "Distinguished Service Award" in 1998.

He has chaired the Advisory Board of Virginia Tech's College of Natural Resources and currently serves as an ex-officio member. During the formative years of Virginia Tech's Ag Alumni Association, Randy represented forest products on the Ag Alumni Board, and in 1986 was presented with a "Distinguished Service Citation" from the organization for his service to the industry and the University.

He has spoken numerous times on a variety of association management topics and has consulted with many nonprofit organizations. In 1986 he received the prestigious "Award of Excellence" from the Virginia Society of Association Executives, the organization's highest honor.

Randy currently lives in Hanover County, Virginia, with his wife Gayle. They have two children, Jeffrey and April.

Congratulations, Randy!

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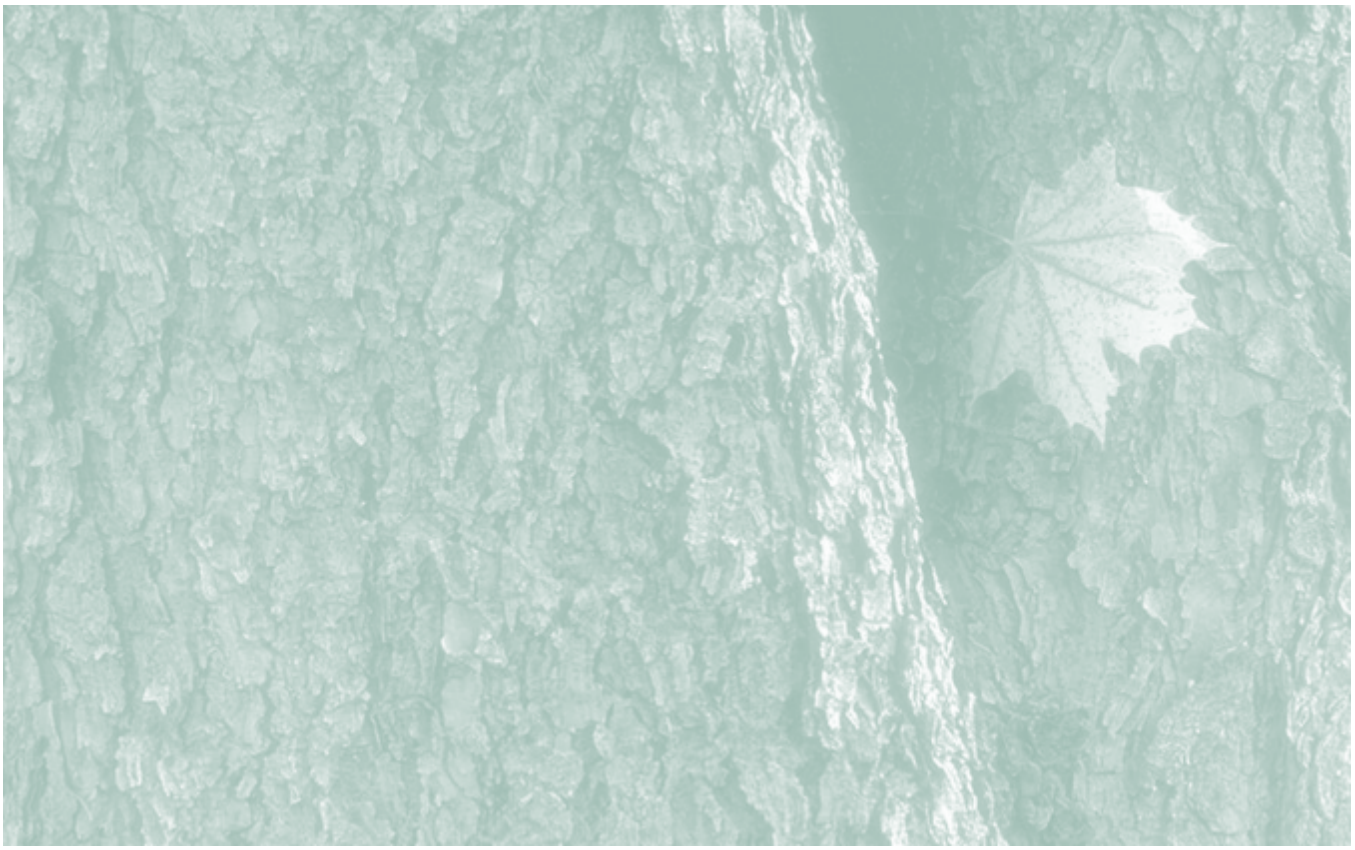


Awards and Honors

Brian H. Bond

Recipient, Curriculum Club Award for Teaching Excellence.

Wolfgang G. Glasser

Accepted an invitation to serve as External Examiner ("Opponent") and to participate in the defense of a doctoral dissertation at the Institut National Polytechnique de Toulouse (INP, School of Engineering at the University of Toulouse) in Toulouse, France.

Invited to present one of six plenary lectures at the Polydays 2004 conference by the Berlin-Brandenburg Society of Polymer Research. The title of the lecture was "Fiber Composites with Cellulose," and Dr. Audrey Zink-Sharp served as co-author of the paper. The conference was held in Potsdam, Germany, October 4-6.

Wolfgang Glasser has been listed in the 2004-edition of *Who's Who in the World*. He was previously listed in *Who's Who in the South and Southwest*, *Who's Who in Science and Engineering*, and *Who's Who in America*.

Geza Ifju

Received the Distinguished Service Award from the Society of Wood Science & Technology at the Annual SWST Meeting held in Grand Rapids, Michigan, June 27.

Fred A. Kamke

Recipient, George Marra Award of Excellence. Presented by Society of Wood Science and Technology for the best article (Balazs G. Zombori, Fred A. Kamke and Layne T. Watson) in the journal *Wood and Fiber Science*, Volume 35.

Joseph R. Loferski

Recipient, College Certificate for Teaching Excellence.

Robert L. Smith

Visiting Scholar at National Chung Hsing University in Taichung City, Taiwan.

Paul M. Winistorfer

Appointed as Deputy Director, IUFRO Research Group 5.14.00, Forest Products Education.

Elected Fellow. International Academy of Wood Science, September 2004.

Awards and Honors

Robert L. Youngs

The first to be awarded "Fellow" status by the Society of Wood Science and Technology, June 2004.

Invited Visiting Scholar.
National Chung Hsing University, Tai Chung, Taiwan, October-November 2004.

Audrey Zink-Sharp

President, Society of Wood Science and Technology, June 2004 through June 2005.

Recipient, College Award for Outreach Excellence, College of Natural Resources, Virginia Tech, 2004.

Selected, U.S. Delegate to European Society of Wood Mechanics, September 2004.

Professional Service

Brian H. Bond

- Chair of the Temperate and Tropical Hardwood Technical Interest Group.
- Chair of the Drying and Storage Technical Interest Group of the Forest Products Society.
- Reviewer for the *Forest Products Journal* and *Wood and Fiber Science*.

Robert J. Bush

- Named an affiliate in the Sloan Industry Centers Program.

Fred A. Kamke

- Served as Chair on the Robert Dougherty Scholarship Committee in 2004.
- Moderated a technical session at the OSB World Symposium, Niagara Falls, Ontario, May 2004.
- Moderated technical session at the 7th Pacific-Rim Bio-Based Composites Symposium, Nanjing, China, October 2004.

D. Earl Kline

- Associate Editor, Wood and Fiber Science, Society of Wood Science and Technology.
- Associate Editor, Computer and Electronics in Agriculture, Elsevier Science.
- Examiner, U.S. Senate Productivity and Quality Award (SPQA) for Virginia.
- Steering Committee on Virginia Forest Industries, Office of the Secretary of Commerce and Trade, Commonwealth of Virginia.

Professional Service

Joseph R. Loferski

- Reviewer for United States Department of Agriculture (USDA), *Wood and Fiber Science*, *Forest Products Journal*, American Society of Civil Engineers, *Structural Engineering Journal,* and *Journal of Bamboo and Ratan*.

Robert L. Smith

- Session Chair: Session 19: Extension and Technology Transfer Practices in Forest Products. Thornapply Room (3rd floor, 9:00 am – noon). Sponsor: FPS Extension and Technology Transfer Group, 58th Annual Meeting of the Forest Products Society. June 27-30. Grand Rapids, Michigan.

Marshall S. White

- Head of U.S. Delegation.
  Served as Head of US delegation to ISO TC51 Meeting (Pallet Standards), Seoul, Korea, November 2-5, 2004.
- Convener.
  Convened ASME ISO TC51 U.S. Technical Advisory Group (International Pallet Standards), Blacksburg, VA, March 9, 2004.
- Convener.
  Convened ASME ISO TC51 U.S. Technical Advisory Group (International Pallet Standards), Blacksburg, VA, July 16, 2004.
- Reviewing Agent.
  Served on CSREES (USDA/Cooperative State Research, Education and Extension Service) reviewing committee for Mississippi State University (Forest and Wildlife Research Center), February 1-5, 2004.

Paul M. Winistorfer

- President, Forest Products Society.
- Vice President and Board Member, WoodLINKS, U.S.A.
- Research Grant Application Reviewer for USDA-SBIR Program, USDA-CSREES National Research Initiative Competitive Grants Program, Improved Utilization of Wood and Wood Fiber.
- Reviewer for *Wood and Fiber Science*.
- Steering Committee on Virginia Forest Industries, Office of the Secretary of Commerce and Trade, Commonwealth of Virginia.

Audrey Zink-Sharp

- Member, Annals of Botany International Review Board, 2004.
- Chair, two technical sessions at the 3rd International Meeting of the European Society of Wood Mechanics, Villa Real, Portugal, September, 2004.
- Organized and moderated SWST Annual Technical Meeting. Better Ways to Connect: Going Beyond the Technical Report, Grand Rapids, MI, June 2004. Attended by 84 participants.
- Reviewer for Annals of Botany, Cellulose, Environmental & Experimental Biology, IAWA Journal, and *Wood and Fiber Science* journals.

University Service

Robert J. Bush

- Member, Geography Ph.D. Program Planning Committee, 2004.
- Member, College of Natural Resources Space Committee, 2004-2005.
- College of Natural Resources Centers Liaison to the Office of the Provost.
- Member, University CARS/CAGS Committee.
- Coordinator for the College of Natural Resources Northern Virginia graduate program and the Distance Education Consortium.
- Served on Department, College, and University Promotion and Tenure Committees, 2004.

Charles E. Frazier

- Committee for the establishment of the Institute for Macromolecules and Interfaces.
- Co-Associate Director for Industry and Outreach of the Institute for Macromolecules and Interfaces.
- Faculty advisor, Virginia Tech Student Chapter of the Forest Products Society, 1999-2004.
- Served on the Search Committee for the biopolymer materials faculty position in the Department of Wood Science and Forest Products.
- Served on the Search Committee for the packaging faculty position in the Department of Wood Science and Forest Products.

A. L. Hammett

- Faculty Senate Member 2002-2005.
- University Faculty Ethics Committee.

Fred A. Kamke

- Served on the College of Natural Resources Space Committee, 2004.
- Served on the Search Committee for the biopolymer materials faculty position in the Department of Wood Science and Forest Products.
- Served on the Search Committee for the Dean position in the College of Natural Resources.

Marshall S. White

- Served on the Search Committee for the packaging faculty position in the Department of Wood Science and Forest Products.

Audrey Zink-Sharp

- Member, Committee on Commencement, 2004.
- Served on the Search Committee for the biopolymer materials faculty position in the Department of Wood Science and Forest Products.
- Served on the Search Committee for the packaging faculty position in the Department of Wood Science and Forest Products.
- Member, Conflict of Interest Committee, 2000-present.
- Member, Committee on Faculty Ethics, 2000-present.
- Member, Conflict of Commitment Committee, 2001-present.
- Member, Faculty Search Committee, Packaging Science, 2004.

Scholarship Opportunities through the Generous Support of Industry Partners and Individuals

The Department of Wood Science and Forest Products and our students receive substantial scholarship support from our industry partners and individual supporters. The following is a list of recent scholarship opportunities in the department. A full description and list of student recipients is available on our website at *www.woodscience.vt.edu*. We thank all of our scholarship supporters for your financial contributions to the education of the future industry leaders. We could not do it without you!

Anderson-Tully Lumber Company Management Scholarship
Anderson-Tully Lumber Company, founded in 1889, is a large producer and distributor of high-quality FSC certified hardwood lumber. Recipients of the Anderson-Tully Lumber Company Management Scholarship will be selected based on academic achievement, leadership qualities, and desire to pursue a career in the forest products industry.

Appalachian Hardwood Manufacturers, Inc. Scholarship
Appalachian Hardwood Manufacturers, Inc., founded in 1928, is an association of Appalachian lumbermen wholesalers, landowners, and hardwood consumers. Their focus is to promote the distinct advantages of hardwoods produced in the Appalachian region of the United States, and promote sound forestry practices to ensure a steady supply of wood for the future. The Appalachian Hardwood Manufacturers, Inc. Scholarship is designed for an outstanding student in the department.

Baillie Lumber Company Scholarship
Baillie Lumber Company, founded in 1923, is a large producer and distributor of high-quality hardwoods, recognized both domestically and internationally. Acknowledging the need for scholarships to attract, retain, encourage, and support students in the field of forest products, Baillie Lumber Company provides financial support to an outstanding students enrolled in the department.

Boehm-Madisen Lumber Company, Inc. Scholarship
Boehm-Madisen Lumber Company, Inc., founded in 1934, is a wholesale distributor of hardwood and softwood lumber, as well as a number of specialty products. The Boehm-Madisen Lumber Company, Inc. Scholarship was established to provide financial assistance to an outstanding student in the department.

Bryan Graeser Memorial Scholarship
This scholarship is given by the Graeser family in memory of the late Bryan Graeser, a student enrolled in the Department of Wood Science and Forest Products, and the son of Hank and Peggy Graeser of Chester, Virginia. The award is made based on academic performance, financial needs, and professional promise.

Columbia Forest Products Company Scholarship
The Columbia Forest Products Company Scholarship is awarded to an outstanding student in the Department of Wood Science and Forest Products. Preference will be given to any candidate who successfully completes a summer internship with Columbia Forest Products. Further preference will be given to a student from the areas of Danville, Virginia, and Pittsylvania County, Virgina; Thomasville, North Carolina; McDowell County, North Carolina; and Craigsville, West Virginia.

Danzer Group Scholarship
The Danzer Group Scholarship is intended to recognize, encourage, and provide financial assistance to outstanding students enrolled in the Department of Wood Science and Forest Products who plan a career in the forest products industry. Recipients for the Danzer Group Scholarship will be selected from graduate or undergraduate students in the department based on academic achievement, and the desire to pursue a career in the forest products industry.

Frank Miller Lumber Company Freshman Scholarship
The Frank Miller Lumber Company Freshman Scholarship is intended to recruit and provide financial assistance to an outstanding student enrolled in the Department of Wood Science and Forest Products, and who plans to have a career in the forest products industry. The scholarship provides financial support to an outstanding freshman.

George E. Stern Memorial Scholarship
This scholarship is in memory of the late Dr. George E. Stern, former director of the Sardo Pallet and Container Research Laboratory. The scholarship was endowed by Mrs. Marianne Stern and the Stern family, and is awarded to a deserving student in the Department of Wood Science and Forest Products based on academic performance, financial need, and professional accomplishment.

Scholarship Opportunities through the Generous Support of Industry Partners and Individuals

Geza Ifju Scholarship
Dr. Geza Ifju was the founding head of the department of Wood Science and Forest Products. Friends and alumni provided donations to this scholarship fund in honor of Geza. The Ifju scholarship is awarded to a deserving student who exemplifies professional and leadership promise for the forest products industry.

Hardwood Publishing Company Inc. Scholarship in Forest Products Marketing
The Hardwood Publishing Company Inc. Scholarship is intended to recognize, encourage, and provide financial assistance to outstanding students enrolled in the Forest Products Marketing and Management option in the Department of Wood Science and Forest Products. Recipients of the Hardwood Publishing Company Inc. Scholarship will be selected based on academic achievement, leadership qualities, and the desire to pursue a career in the forest products industry.

J. T. Shannon Lumber Company Scholarship
J. T. Shannon Lumber Company is a manufacturer and distributor of hardwood lumber, with locations in Tennessee, Mississippi, Kentucky, Pennsylvania, Indiana, and Arkansas. This scholarship is offered to an outstanding undergraduate or graduate student in the Department of Wood Science and Forest Products.

James W. Howard/Atlanta Hardwood Corporation Internship Scholarship
Recognizing the need for scholarships to attract, retain, encourage, and support students in the field of forest products, the donor established the James W. Howard/Atlanta Hardwood Corporation Internship Scholarship to be awarded to an outstanding summer intern.

Jeld-Wen Scholarship(s)
Jeld-Wen awards two scholarships over fall and spring semesters. The scholarships are to be used for tuition, fees, and books. Entering freshman students will be given preference for the scholarships. Although there are no Jeld-Wen facilities in Virginia, preference will be given to those facilities located in neighboring states. These communities are: Craigsville, WV; Sparta, TN; and Lexington and Marion, NC. Merit and academic performance will be significant factors in selecting the scholarship recipients. Preference will be given to students with demonstrated financial need.

Joseph W. Fitzpatrick Scholarship
The scholarship is in honor of Joseph W. Fitzpatrick and given by Fitzpatrick and Weller, Inc. Fitzpatrick and Weller, Inc. is a leader in the hardwood dimension industry and is managed by the brothers of Joseph W. Fitzpatrick, Dana and Gerald Fitzpatrick. The scholarship provides financial support to an outstanding student in the Department of Wood Science and Forest Products.

Linden Lumber Company Scholarship in Forest Products
Linden Lumber Company is a nationally recognized hardwood lumber manufacturer located throughout the South. The Linden Lumber Company Scholarship in Forest Products was established to provide financial assistance to an outstanding student in the Department of Wood Science and Forest Products.

Morgan Lumber Company Scholarship
Morgan Lumber Company is a privately held manufacturer of southern yellow pine lumber. The scholarship assists with the cost of tuition to an outstanding student in the Department of Wood Science and Forest Products. The recipient must have prior work experience, through a pervious job, summer internship, or co-op. Preference will be given to students with experience in softwoods and solid wood products. The Morgan Lumber Company Scholarship is the second scholarship to be endowed with the Center of Forest Products Marketing and Management.

Robert R. Bushman/The Mann and Parker Lumber Company Scholarship
This scholarship is in honor of Robert R. Bushman, Chairman and Chief Executive Officer of the Mann and Parker Lumber Company. The Mann and Parker Company is a major wholesaler of wood products and specializes in hardwood lumber. This scholarship provides support to an outstanding student in the Department of Wood Science and Forest Products.

Scholarship Opportunities through the Generous Support of Industry Partners and Individuals

SE Dry Kiln Club Scholarship
This scholarship is provided to an outstanding student enrolled in an institution of higher education in the Southeastern United States who is pursuing a career in the wood products industry.

Snavely Forest Products Scholarship
The Snavely Forest Products Scholarship is intended to recognize, encourage, and provide financial assistance to an outstanding student enrolled in the Forest Products Marketing option in the Department of Wood Science and Forest Products. The scholarship will provide a student with financial support for tuition for each semester.

Steven A. Sinclair Scholarship in Forest Products Marketing and Management
Steven A. Sinclair was a professor with the Department of Wood Science and Forest Products and an internationally recognized leader in the field of Forest Products Marketing. Dr. Sinclair started the Forest Products Marketing Program at Virginia Tech in the early 1980s. Also, he initiated the Center for Forest Products Marketing and Management and served as its first Director. Upon his death in 1993, many friends, colleagues, former students, and Center for Forest Products Marketing and Management members contributed to a scholarship fund in Dr. Sinclair's name. Because of Dr. Sinclair's interest and leadership in forest products marketing research, the scholarship is awarded to an outstanding graduate student studying in this area or to an outstanding undergraduate who plans to attend graduate school to study forest products marketing.

Victor Clay Barringer Scholarships
These scholarships are in honor of Victor Clay Barringer and given by Costal Lumber Company, Inc. Victor Barringer founded Costal Lumber Company in 1937. Today it is one of the largest privately held forest products companies in the United States. Victor Barringer's father, Paul B. Barringer, was President of Virginia Tech from 1907 to 1913. Costal Lumber Company is now guided by Victor Barringer's son, Paul B. Barringer II, Chairman and CEO, and his grandson, Victor C. Barringer II, Vice Chairman. The scholarships provide support to two outstanding students in the Department of Wood Science and Forest Products. The Victor Clay Barringer Scholarships were the first to be endowed with the Center of Forest Products Marketing and Management.

Virginia Forest Products Association Scholarship
This scholarship is presented by the Virginia Forest Products Association, an industry group that supports forest products enterprises in the Commonwealth of Virginia. The scholarship supports a promising Wood Science and Forest Products student who has an interest in working with the Virginia forest products industry.

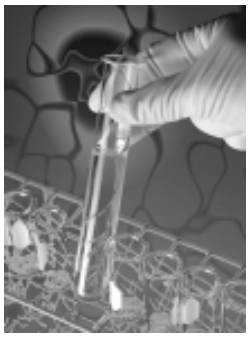
Wood Component Manufacturers Association Scholarship
The Wood Component Manufactures Association Scholarship provides support to an outstanding student enrolled full-time in wood products. Preference is given to students with a strong desire to pursue a career in the secondary wood products manufacturing field.

The Wood-Based Composites Center Scholarships
The Wood-Based Composites (WBC) Center, in addition to the department, offers undergraduate scholarship and graduate fellowship funding through the generous support of its member companies, including:

- Bayer MaterialScience
- Boise
- Borden Chemical
- Columbia Forest Products
- Dynea
- Georgia-Pacific Resins
- Grant Forest Products
- Huber Engineered Woods, LLC
- Huntsman Polyurethanes
- National Starch and Chemical
- Weyerhaeuser Company

Industry support for the WBC Center comes from businesses involved in the manufacture of wood and fiber-based composites throughout North America. Scholarships have been awarded through the Center since its inception in 1999. Internships with member companies are often available to qualified students interested in pursuing a career in the composites industry. To learn more about the members and activities of the Center, as well as opportunities for fellowship and scholarship funding, please visit the WBC website at *www.wbc.vt.edu*.

Major Options and Department Core of Courses



Adhesion Science Option is rooted in chemistry and introductory polymer science. It prepares students for numerous career tracks that include the adhesives industry, the wood-based composites industry, and other disciplines in which the unique combination of chemistry, polymer, science and wood science hold great value. This option satisfies the requirements for a minor in chemistry.

Forest Products Marketing and Management Option provides students with an industry-specific background through its combination of business and wood science coursework. There are numerous career opportunities for this option in both the private and public sectors. Employment experiences can include management of wood products manufacturing operations, marketing and sales in the wood products sector, utilization of wood to create innovative products, as well as coordination of international trade to match forest products producers to export market opportunities.

▲ Photo credit: APA - The Engineered Wood Association

Manufacturing Systems Option

This option, with its industrial engineering and production/operations management coursework, provides a solid foundation for individuals seeking to manage wood products manufacturing operations in internationally competitive environments. With in this option, students gain interdisciplinary knowledge and skills to drive creative product and process development, to utilize effectively the latest in technological innovations to assure quality in manufactured wood products, and to assure efficient and timely delivery to the customer.

Non-Timber Forest Products (NTFPs) Option

This option focuses on the socio-economic aspects of the products originating from forest other than industrial timber and how those products can impact the local and national economies of both industrialized and non-industrialized countries. Career opportunities are global and range from technical assistance to support sustainable use, management, and development of NTFPs to consulting assistance to find markets and develop management plans for NTFPs.

Major Options and Department Core of Courses

Packaging Science Option

Significant opportunities exist to improve the efficiency and safety of the global unit load logistics system of product storage and distribution by understanding how critical components in the system interact during use. Graduates of this option will be unique in the industry with an understanding of transport packaging and unit load systems-based design technologies, which include the interactions of packaging, pallets, and unit load material handling equipment. Interdisciplinary education and research will include all components of the unit load logistics system, including packaging design, pallet design, unit load stabilization, dunnage, blocking and bracing, unit load handling equipment design, and associated interactions and includes courses in wood science and forest products, industrial and systems engineering, material science engineering, and graphic arts.

▲ Photo credit: APA - The Engineered Wood Association

Wood Structures and Materials Option

This option focuses on the study and development of better ways to use wood in buildings. The principals of engineering and physics are used to help designers and builders produce economical and durable buildings and structures. With the invention of modern wood-based composites such as oriented strand board, laminated veneer lumber, and parallel strand lumber, new possibilities for building construction are being explored and developed. The industry needs people who understand the unique engineering properties of wood and wood-based composites so that new products can be developed and that existing products are used in the proper way.

Department Core of Courses

(In addition, the student must select one of the listed options that includes 15 credit hours of option elective coursework. 128 total hours required for graduation.)

Freshman Year
Principles of Biology (4 credits)
General Chemistry (7 credits)
Introduction to Natural Resources (2 credits)
Introduction to Wood Science and Forest Products (2 credits)

Sophomore Year
Forest Biology & Dendrology with lab (3 credits)
Statistical Methods (6 credits)
General Physics (3 credits)
World Forests and Forest Products (3 credits)
Forest Products Marketing (3 credits)
Wood Materials Science &Technology (2 credits)
Survey of Organic Chemistry (3 credits)

Junior Year
Economics of the Food & Fiber System (3 credits)
Management Theory & Leadership Practice (3 credits)
Engineering Economy (2 credits)
Mechanical Properties of Wood I & II (3 credits)
Lumber Manufacturing & Drying (3 credits)
Wood Chemistry, Products, & Processes (3 credits)
Secondary Wood Products Manufacturing (3 credits)

Senior Year
Computer Application Systems in Forest Products (3 credits)
Forest Products Business Management (3 credits)
Wood Adhesion & Composites (6 credits)
Wood Industry Production Operations Management (3 credits)
Wood Performance in Construction (3 credits)

Undergraduate and Graduate Courses Taught by Department Faculty

	*Course Number	Course Title	Credit Hours	Instructor	Number of Students
Spring Semester	NR 4964/5964	The Global Seminar	3	Tom Hammett	12
	WOOD 3114 (First 10 weeks)	Wood Structure, Properties, and Processing Lab	3	Audrey Zink-Sharp	35
	WOOD 3234 (Last 5 weeks)	Wood Properties Lab	1	Audrey Zink-Sharp	9
	WOOD 3434	Wood Chemistry, Products, and Processes	3	Chip Frazier	12
	WOOD 4154	Computer Control Systems in Forest Products	3	Earl Kline	6
	WOOD 4316	Mechanical Properties of Wood	3	Dan Hindman	12
	WOOD 4446	Wood Adhesion and Composites II Lab	4	Fred Kamke	11
	WOOD 4524	Wood Drying and Durability	3	Brian Bond	9
	WOOD 4614	Distribution and Marketing of Wood Products	3	Bob Bush	9
	WOOD 4714	Wood Performance in Building Construction	3	Joe Loferski	13
	WOOD 5004	Graduate Seminar	1	Paul Winistorfer	14
	WOOD 5614	Forest Products Marketing Strategies	3	Bob Smith	4
Fall Semester	CEE 3414	Design of Wood Structures	3	Dan Hindman	41
	NR 1114	Introduction to Renewable Natural Resources	2	Dan Hindman	15
	NR 1114	Introduction to Renewable Natural Resources	2	Maren Roman	7
	NR/WOOD 3974/5794	Study Abroad Course	3	Tom Hammett	14
	NR 4404	Skills and Approaches in International Development	1	Tom Hammett	8
	WOOD 3114	Wood Structure, Properties, and Processing	3	Audrey Zink-Sharp	13
	WOOD 3534	Lumber Manufacturing and Drying	3	Mark White/Brian Bond	4
	WOOD/FOR 3784	World Forestry and Forest Products	3	Tom Hammett	34
	WOOD 4154	Computers in Forest Products	3	Earl Kline	6
	WOOD 4315	Mechanical Properties of Wood	2	Bob Wright	5
	WOOD 4445	Wood Adhesion and Composites	3	Chip Frazier	16
	WOOD 4624	Wood Products Operations Management	3	Earl Kline	12
	WOOD 5004	Graduate Seminar	1	Paul Winistorfer	13
	WOOD 5314	Physical and Mechanical Behavior of Wood	4	Joe Loferski/Fred Kamke	8
	WOOD 5414	Advanced Wood Chemistry and Structure	4	Audrey Zink-Sharp/ Wolfgang Glasser	8

*These course number designations reflect the academic department where the course originates and level of the course. WOOD is the designation for courses originating from the Department of Wood Science and Forest Products. NR is the designation for courses originating from the College of Natural Resources. CEE is the designation of courses originating from the Department of Civil and Environmental Engineering.

Short Courses/Continuing Education Programs

Course Title	Instructor	Location	Dates
Introduction to Wood Science, Preservatives, and the Wood Industry	Joseph R. Loferski, Robert L. Smith, and Brian H. Bond	Blacksburg, VA	January 14-15
Wood Treating Recertification	Robert L. Smith	Lexington, VA	January 23
Learning to Conduct Wood Magic Activities. Virginia Cooperative Extension 4-H In-Service Training Workshop	Audrey Zink-Sharp	Blacksburg, VA	January 28-30
Marine Antifoulant Paint Recertification	Robert L. Smith	Newport News, VA	January 30
Weyerhaeuser Corrugated Packaging Workshop	Ralph L. Rupert	Aurora, IL	February 11-13, April 14-16, May 12-14, June 9-11, August 4-6, October 6-8, and November 3-5
Deck Design and Inspection. Professional Deck Builders	Joseph R. Loferski and Frank E. Woeste	Reno, NV	February 11-12
Wood Treating Recertification	Robert L. Smith	Madison, VA	February 20
Introductory Pallet Design System Short Course	Marshall S. White and John A. McLeod, III	Falls Church, VA	March 11-13
Unit Load Design Short Course	Mark S. White and Ralph L. Rupert	Blacksburg, VA	April 28-30
Design and Safety of Decks and Balconies	Joseph R. Loferski and Frank E. Woeste	Blacksburg, VA	April 28-30
Lean Manufacturing in the Wood Products Industry	Dan W. Cumbo, D. Earl Kline, and Robert L. Smith	Blacksburg, VA	May 10-12
Center for Adhesive and Sealant Science Annual Adhesion Science Short Course	Thomas C. Ward, John G. Dillard, David A. Dillard, Charles E. Frazier, R. Davis, and T. E. Long	Blacksburg, VA	May 17-21
Wood Adhesion Short Course	Charles E. Frazier, Fred A. Kamke, and Joseph R. Loferski	Blacksburg, VA	May 26-27
Conducting Wood Magic Activities. Virginia Cooperative Extension Holida Lake 4-H Educational Center	Audrey Zink-Sharp	Appomattox, VA	May 28

Short Courses/Continuing Education Programs

Course Title	Instructor	Location	Dates
Contemporary Analytical Tools and Methods for Wood-Based Composites R&D	Charles E. Frazier, Timothy Rials, and Audrey Zink-Sharp	Blacksburg, VA	June 8-9
The Marketing Professional's Guide to Wood Adhesion, Structure and Properties in Relation to OSB Manufacture	Fred A. Kamke and Charles E. Frazier	Charlotte, NC	August 10-11
International Marketing of Forest Products	Robert L. Smith and A. L. Hammett	LaPaz, Bolivia	August 10-11
International Marketing of Forest Products	Robert L. Smith and A. L. Hammett	Santa Cruz, Bolivia	August 16-17
Forest Products Marketing Workshop	Robert L. Smith	Delaware County SWCD, Watershed Agricultural Council, Walton, NY	September 16-17
Portable Sawmill and Drying Workshop, sponsored by VA Cooperative Extension, VA Department of Forestry, and Virginia Tech Department of Forestry	Brian H. Bond, Robert L. Smith and Adam Downing	Madison, VA	September 20-21
Kiln Drying Lumber for Managers and Operators for USAID/CADEFOR	Brian H. Bond	Santa Cruz, Bolivia	September 11
Unit Load Design Short Course	Marshall S. White and Ralph L. Rupert	Blacksburg, VA	September 22-24
Advanced Sales Training in the Forest Products Industry	Robert L. Smith	Blacksburg, VA	September 23-24
Lean Manufacturing in the Wood Products Industry	Dan W. Cumbo and D. Earl Kline	Blacksburg, VA	October 20-22
Introductory Pallet Design System Course	Marshall S. White and John McLeod, III	Falls Church, VA	November10-12
Wood Adhesion Problem Solving	Fred A. Kamke, Charles E. Frazier, Limei Lu, Don Mente, Chris Moriarty, and Gordon Oppenheimer	Blacksburg, VA	November 16-17
Structural Design with Wood	Fred E. Woeste, D. A. Bender, Joseph R. Loferski	Blacksburg, VA	November 16-18
22nd Oak Drying Workshop	Brian H. Bond	Roanoke, VA	December 7-9

Graduate Theses–Dissertations Completed

Mary A. Billings. 2004. M.S. Investigation of the Effects of Spacing Between Bolts in a Row in a Single Shear Timber Connection Subjected to Reversed Cyclic Loading.
Major Professor: Joseph R. Loferski and W. Samuel Easterling

Paul M. Duvall. 2004. M.S. Assessing Eastern White Pine Lumber Production and Use in the Eastern United States.
Major Professor: Robert L. Smith

Jonathan Hood. 2004. M.S. Changes of Permeability of OSB Mats During Hot-Pressing.
Major Professor: Fred A. Kamke

Richard Johnson. 2004. M.S. Mechanical and Sorption Characteristics of Cellulose Fiber-Reinforced Thermoplastic Composites.
Major Professor: Audrey Zink-Sharp and Wolfgang Glasser

Scott Renneckar. 2004. Ph.D. Modification of Wood Fiber with Thermoplastics by Reactive Steam-Explosion Processing.
Major Professor: Audrey Zink-Sharp and Wolfgang Glasser

Jeffrey S. Smith. 2004. M.S. An Investigation of Nailed Connection Performance in a Cyclic Humidity Environment.
Major Professor: Joseph R. Loferski

Xiangyu Xiao. 2004. Ph.D. A Multiple Sensors Approach to Wood Defect Detection.
Major Professor: *D. Earl Kline and Richard W. Conners*

A complete database of all graduate thesis and dissertation research projects completed in the Department of Wood Science and Forest products is available on-line via the department website (*www.woodscience.vt.edu*), and is searchable by degree, year, and major professor.

Proposals Funded

Distance Education Joint Venture Agreement
Investigator(s): **Robert J. Bush**
Sponsor: USDA - Forest Service
Amount: $196,915
7/04 to 6/05

Strategic Funding for the College of Natural Resources Program in Northern Virginia
Investigator(s): **Robert J. Bush** and David Trauger
Sponsor: Virginia Tech Graduate School
Amount: $42,500
2004

Updated Pallet and Container Industry Production and Recycling Research
Investigator(s): **Robert J. Bush**
Sponsor: USDA Forest Service
Amount: $46,339
9/04 to 8/07

Novel Isocyanate-Reactive Adhesives for Structural Wood-Based Composites
Investigator(s): **Charles E. Frazier**
Sponsor: U.S. Department of Energy, Agenda 2020
Amount: $479,053
10/04 to 10/07

Multiphase Thermosetting Wood Adhesives
Investigator(s): **Charles E. Frazier**
Sponsor: USDA, CSREES, National Research Initiative
Amount: $442,000
12/04 to 1/08

Wood-Based Composites Center
Investigator(s): **Fred A. Kamke, Charles E. Frazier, Daniel P. Hindman, Joseph R. Loferski, Maren Roman, Robert L. Smith,** and **Audrey Zink-Sharp**
Sponsor: Various corporations
Amount: $166,500
1/04 to 12/04

Proposals Funded

*Sustainable Engineered Materials from Renewable Resources: Resource Characterization
Investigator(s): **Fred A. Kamke**, Shepherd M. Zedaker, Layne T. Watson, **Joseph R. Loferski**, **Charles E. Frazier**, **Robert L. Smith**, **Audrey Zink-Sharp**, Tom R. Fox, Steve P. Prisley, Philip J. Radtke, **Jong-Nam Lee**, **Daniel P. Hindman**
Sponsor: USDA Special Grant
Amount: $497,747
7/04 to 6/05

**Sloan Industry Center for Forest Industries
Investigator(s): David Brinberg, **D. Earl Kline**, Harold Burkhart, Sam Albimino, Nancy Parsons, Kent Nakamoto, **Robert J. Bush**, Delton Alderman.
Sponsor: Alfred P. Sloan Foundation
Amount: $145,000
10/04 to 10/07

*The Sustainable Engineered Materials Institute (SEMI). SEMI is a College-level Center affiliated with the departments of Computer Science, Forestry, and Wood Science and Forest Products.

** The Forest Industries Center at Virginia Tech is a Sloan Foundation Industry Center. The Sloan Forest Industries Center is a partnership between the College of Business, Department of Marketing and the College of Natural Resources, Department of Wood Science and Forest Products and the Department of Forestry.

Development of a Lean Manufacturing Based Management Tool for the Secondary Hardwood Manufacturing Industry
Investigator(s): **D. Earl Kline** and **Dan W. Cumbo**
Sponsor: USDA Forest Service, Northeastern Research Station
Amount: $8,000
7/04 to 12/05

Bolivia Forestry and Forest Products
Investigator(s): **A. L. Hammett**
Sponsor: Southeast Consortium for International Development
Amount: $90,000
1/04 to 12/04

Establishment of a Small Business Assistance Center at Kathmandu University
Investigator(s): C. Miller, **A. L. Hammett** and J. Politis
Sponsor: U. S. State Department
Amount: $182,814
2/04 to 2/06

Manufacturing and Marketing Natural Hardwood Charcoal in Virginia
Investigator(s): **A. L. Hammett**
Sponsor: Virginia Department of Forestry
Amount: $22,953
9/15/04 to 9/30/04

Natural Resources Information Center (NRIC)
Investigator(s): **A. L. Hammett**
Sponsor: BIOFOR task order funded by USAID through Chemonics Inc
Amount: $366,451
10/02 to 3/07

Sustainable Forestry, Bolivia
Investigator(s): S. DeDatta, M. Bertelsen, James Johnson, **A. L. Hammett**, J. Rien Visser, **Robert L. Smith**, Firoz Kabir
Sponsor: Southeast Consortium for International Development
Amount: $125,701
1/1/04 to 12/31/04

Product Analysis for Small Diameter Timber in Mississippi
Investigator(s): **Robert L. Smith**
Sponsor: USDA Forest Service
Amount: $19,875
2/15/04 to 3/31/05

Analysis of the Transportation Needs in the Wood Products Industry in Distressed Appalachian Regions
Investigator(s): Chad Miller and **Robert L. Smith**
Sponsor: Appalachian Regional Commission
Amount: $35,000
12/1/04 to 12/31/05

Commercial Feasibility of Vacuum to Control Insects in Raw Wood Packaging Materials
Investigator(s): **Marshall S. White**
Sponsor: Limestone Bluffs RC&D Inc.
Amount: $24,998
2/04 to 8/04

Rapid, Low-Temperature Electron, X-ray and Gamma-curable Resins
Investigator(s): **Paul M. Winistorfer**
Sponsor: Department of Energy, Oak Ridge National Laboratory
Amount: $10,000
10/03 to 9/04

Proposals Funded

Forest Products Conservation
Investigator(s): **Paul M. Winistorfer**
Sponsor: USDA Forest Service
Amount: $80,003
10/04 to 9/05

International Travel Supplemental Grant
Investigator(s): **Audrey Zink-Sharp**
Sponsor: International Travel Supplemental Grant, Virginia Tech
Amount: $1,000
9/04

3-D Wood Micrographic Library
Investigator(s): **Audrey Zink-Sharp**
Sponsor: Department of Wood Science and Forest Products
Amount: $3,500
11/04 to 11/05

Wood Magic at Virginia Tech
Investigator(s): **Audrey Zink-Sharp**
Sponsor: Virginia Forest Products Association
Amount: $10,000
1/04

Wood Magic at Virginia Tech
Investigator(s): **Audrey Zink-Sharp**
Sponsor: Virginia Forestry Education Foundation
Amount: $2,400
5/04

Award for Outreach Excellence
Investigator(s): **Audrey Zink-Sharp**
Sponsor: College of Natural Resources, Virginia Tech
Amount: $500
6/04

Refereed Journal Publications

Barany, Marc E., **A. L. Hammett**, K. Stadler and E. Kegni. 2004. Non-timber forest products in the food security and nutrition of smallholder households afflicted by HIV/AIDS in sub-Saharan Africa. *Forests, Trees and Livelihoods* 14:3-18.

Bailey, David S., **Robert L. Smith**, and **Philip A. Araman**. 2004. An analysis of the physical properties of recovered CCA-treated wood from residential decks. *Wood and Fiber Science* 36(2):278-288.

Cai, Zhiyong, Qinglin Wu, **Jong N. Lee** and Salim Hiziroglu. 2004. Influence of board density, mat construction and chiptype on performance of particleboard made from eastern redcedar. *Forest Products Journal* 54(12):226-232.

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Carradine, David M., **Frank E. Woeste**, J. Daniel Dolan, and **Joseph R. Loferski**. 2004. Utilizing diaphragm action for wind load design of timber frame and structural insulated panel buildings. *Forest Products Journal* 54(5):73-80.

Chen, Zhangjing and **Fred M. Lamb**. 2004. A vacuum drying system for green hardwood parts. *Drying Technology* 22(3):577-595.

Cumbo, Dan W., **Robert L. Smith**, and C. W. Becker III. 2004. Value analysis of lumber produced from small diameter timber. *Forest Products Journal* 54 (10):29-34.

Deomano, Edgar and **Audrey Zink-Sharp**. 2004. Bending properties of wood flakes of three southern species. *Wood and Fiber Science* 36(4):493-499.

Gradwell, Sheila E., **Scott Renneckar**, Alan R. Esker, Thomas Heinze, **Paul Gatenholm**, Carlos Vaca-Garcia, and **Wolfgang G. Glasser**. 2004. Surface modification of cellulose fibers: towards wood composites by biomimetics. *Comptes Rendus Biologies* 327(9-10):945-953.

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Lee, Sunyoung, Han-Seung Yang, Hyun-Joong Kim, Chan-Seo Jeong, Byeong-Soo Lim, and **Jong-Nam Lee**. 2004. Creep behavior and manufacturing parameters of wood flour filled polypropylene composites. *Composite Structures* 65:459–469.

Refereed Journal Publications

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Renneckar, Scott, **Audrey Zink-Sharp**, Thomas C. Ward, and **Wolfgang G. Glasser**. 2004. Compositional analysis of thermoplastic wood composites by TGA. *Journal of Applied Polymer Science* 93(3):1484-92.

Sernek, Milan, **Fred A. Kamke** and **Wolfgang G. Glasser**. 2004. Comparative analysis of inactivated wood surface. *Holzforschung* 58(1):22-31.

Shepley, Brian P., Janice K. Wiedenbeck, and **Robert L. Smith**. 2004. Opportunities for expanded and higher value utilization of No. 3A Common hardwood lumber. *Forest Products Journal* 54(9):77-85.

Shu, Jiang, Layne T. Watson, N. Ramakrishnan, **Fred A. Kamke**; and Balazs G. Zombori. 2004. An experiment management component for the WBCSim problem solving environment. *Advances in Engineering Software* 35:115-123.

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Taib, Razaina M., Z. A. M. Ishak, R. H. Din, and **Wolfgang G. Glasser**. 2004. Alkali extracted steam-exploded *Acacia mangium* wood fiber as reinforcing material for polypropylene-based composites. *Journal of Natural Fibers* 1(1):67-84.

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Hamner, Peter C. and **Marshall S. White**. 2004. The effect of curve sawing hardwood logs on pallet part yield and quality. *Pallet Central*, April. Pp. 14-15.

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Lamb, Fred M. 2004. Rough mill upgrades: Some technical and operational considerations. *Modern Woodworking* 18(1):36-37.

Lamb, Fred M. 2004. Practicing good kiln start-up procedures. *Modern Woodworking* 18(2):25-27.

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Lamb, Fred M. 2004. Some comments on troubleshooting drying defects. Part 1: Checks and splits. *Modern Woodworking* 18(5):21-23.

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Chen, Zhangjing, **Marshall S. White** and William H. Robinson. 2004. Commercial feasibility of vacuum to control insects in raw wood packaging materials. Report submitted to Limestone Bluffs Resource Conservation and Development. 23 pp.

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Glasser, Wolfgang G. 2004. Prospects for future applications of cellulose acetate. Chapter 6 in Cellulose Acetates, H. Rustemeier, editor, Wiley-VCH Verlag GimbH&Co, Weinheim, Germany, Macromolecular Symposia 208. Pp. 371-394.

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Rupert, Ralph L., **Marshall S. White**. 2004. Optiledge product development project: Test results of prototype HP-85-AD and LP-45-AD. Report for Optilogistics, Dallas, TX, May 28, 2004. 19 pp.

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Rupert, Ralph L. and Marshall S. White. 2004. Comparative performance evaluation of Stanley Fastening Systems Pallet Plus Nails. Report for Stanley Bostitch, East Greenwhich, Rhode Island, January 19, 2004. 19 pp.

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Smith, Robert L., Paul W. McDaniel, **Dan W. Cumbo**, and David Fell. 2004. Wood material use trends in the dimension and components industry. Research Report to Center for Forest Products Marketing and Management membership. April. 14 pp.

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Presentations

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Dammstroem, S. H., A. Bodin, **Wolfgang G. Glasser**, and **Paul Gatenholm**. 2004. Cellulose/xylan nancomposites that mimick cell wall structures. Paper presented at the 227th ACS National Meeting, Anaheim, California. Abstract CELL 170, March 28-April 1.

Das, Sudipto and **Charles E. Frazier**. 2004. Probing the wood/adhesive interphase morphology by dynamic mechanical analysis. Presented at the 27th Annual Meeting of the Adhesion Society, Wilmington, North Carolina, February 17.

Das, Sudipto and **Charles E. Frazier**. 2004. Dynamic mechanical analysis of the species-dependent performance of polymeric isocyanate resins. Presented at the 32nd Annual Conference on Thermal Analysis and Applications. The North American Thermal Analysis Society, Williamsburg, Virginia., October 4-6.

Glasser, Wolfgang G. 2004. Recent advances in the conversion of biomass to composites. Plenary lecture presented at the symposium Inspired by Nature: From Biosynthesis to Advanced Renewable Materials of the 227th National ACS Meeting, Anaheim, California, Abstract CELL 11, March 28-April 1.

Glasser, Wolfgang G. and **Audrey Zink-Sharp**. 2004. Fiber composites with cellulose. Presented at the POLYDAYS 2004, University of Potsdam, Germany, October 4-6.

Groendahl, M. H., K. Tommeraas, **Wolfgang G. Glasser**, and **Paul Gatenholm**. 2004. Isolation, characterization and material properties of arabinoxylans from barley husks. Paper presented at the 227th ACS National Meeting, Anaheim, California. Abstract CELL 27. March 28-April 1.

Hammett, A. L. 2004. NTFPs in forest management. Presented at the Forest Farmer Video Conference, Clemson University, Clemson, South Carolina, March 15.

Hansen, Eric, **Robert J. Bush**, Heikki Juslin, Robert Kozak, Cynthia West, Steve Shook, Lucie Ozanne, Susan Stamm and Chris Knowles. 2004. Announcing the first issue - The Journal of Forest Products Business Research. Poster displayed at the registration desk, Forest Products Society 58th Annual Meeting, Grand Rapids, Michigan, June 27-30.

Hood, Jonathan (speaker) and **Fred A. Kamke**. 2004. Changes in OSB mat permeability during hot-pressing. Presented at the 58th Annual meeting of the Forest Products Society, Grand Rapids, Michigan, June 27-30.

Johnson, Richard, **Audrey Zink-Sharp**, and **Wolfgang G. Glasser**. 2004. Wetlaid cellulose fiber thermoplastic composites. Presented at the MACRO Conference, Blacksburg, Virginia, September 14.

Presentations

Kamke, Fred A., **Joseph R. Loferski**, Christopher D. Kamke, and D. Keene. 2004. 3D visualization of an adhesive bondline. Presented at the Wood-Based Composites Center Advisory Board Meeting, St. Paul, Minnesota, April 24-25.

Kamke, Fred A., Milan Sernek, Brian C. Scott, and **Charles E. Frazier**. 2004. Modeling the cure of a phenol-formaldehyde adhesive. 7th European Panel Products Symp., Llandudno, Wales, October 12-15.

Kamke, Fred A. 2004. A novel structural composite from low density wood. Presented at the 7th Pacific-Rim Bio-Composites Symposium, Nanjing, China, October 31-November 2.

Karlsson, P., J. P. Roubroeks, **Wolfgang G. Glasser**, P. Larsson, and **Paul Gatenholm**. 2004. Effect of molecular relocation of xylan on properties of pulp. Paper presented at the 227th ACS National Meeting, Anaheim, California, Abstract CELL 35, March 28-April 1.

Kline, D. Earl. 2004. Creating a sustainable forestry industry in Virginia - a New Initiative at Virginia Tech. Presented at the 46th Annual Convention, Virginia Forest Products Association, Williamsburg, Virginia, January 30-February 1.

Kline, D. Earl. 2004. Integrating lean manufacturing into your business. Invited presentation, KCMA 16th Annual Management Conference, Sioux Falls, South Dakota, September 19.

Lee, Jong-Nam, **Fred A. Kamke**, Jiang Shu, and Layne T. Watson. 2004. WBCSim V2: Hot-pressing Simulation of Three-layer OSB. 2004 FPS annual meeting, Grand Rapid, Michigan, June, 24-27.

Lee, Jong-Nam, **Fred A. Kamke**, Balazs G. Zombori, Jiang Shu, and Layne T. Watson. 2004. WBCSim status report: Newly added modeling works. Presented at Industry Advisory Board meeting of Wood-Based Composite Center at Virginia Tech, Blacksburg, Virginia, September 22.

Loferski, Joseph. R. 2004. The safety of exterior wood decks on residential buildings. Presented at the World Conference on Timber Engineering in Lahti, Finland, June 14.

Loferski, Joseph R. and Frank E. Woeste. 2004. Elimination of CCA: Understanding new preservative treated wood, Deck Expo, Reno Nevada, February 13.

Loferski, Joseph R. 2004. Visiting Scholar. University of Pennsylvania Department of Historic Preservation, College of Architecture. Presented lectures on Wood Science in Historic Preservation, State College, Pennsylvania, March 29-31.

Lopez-Suevos, Francisco and **Charles E. Frazier**. 2004. Rheological analysis of PVA latex adhesives: Towards the influence of phenolic additives. Presented at the 58th Annual Meeting of the Forest Products Society, Grand Rapids, Michigan, June 27-30.

Lopez-Suevos, Francisco and **Charles E. Frazier**. 2004. Parallel-plate rheology of PVAc latex films bonded to wood. Presented at the 32nd Annual Conference on Thermal Analysis and Applications. The North American Thermal Analysis Society, Williamsburg, Virginia, October 4-6.

Maccubbin, Bonnie J. and **Ralph L. Rupert**. 2004. NA2004. Exhibitor at the Material Handling and Logistics Tradeshow and Conference, IX Center, Cleveland, Ohio, March 29-April 1.

Maccubbin, Bonnie J., **Ralph L. Rupert**, **Peter C. Hamner**, and **Marshall S. White**. 2004. Expo Richmond 2004. Exhibited in tradeshow, June 4-5.

McLeod, John A. 2004. Revolutionizing the product packaging, storage, and distribution function. Presented at the Manufacturing Competitiveness of the Forest Products Industry: Competing in Today's Global Manufacturing and Consumer Marketplace conference, New Orleans, Louisiana, November 3-5.

Molina-Murillo, Sergio A., Timothy M. Smith, Michael R. Reichenbach, and **Robert L. Smith**. 2004. Wood solid packaging materials and the new international phytosanitary regulations. Presented at the 58th Annual Forest Products Society Meeting, Amway Grant Plaza Hotel, Grand Rapids, Michigan, June 27-30.

Presentations

Parhizkar, Omid and **Robert L. Smith**. 2004. Evaluation of wood residues received at Virginia Landfills. Poster presented at the 58th Annual Forest Products Society Meeting. Amway Grant Plaza Hotel, Grand Rapids, Michigan, June 27-30.

Renneckar, Scott, Richard Johnson, **Audrey Zink-Sharp**, and **Wolfgang G. Glasser**. 2004. Modification of wood fiber with thermoplastics by reactive steam-explosion processing. Presented at the MACRO Conference, Blacksburg, Virginia, September 14.

Riedlinger, Darren A. and **Charles E. Frazier**. 2004. Hybrid thermosetting wood adhesives: Optimized performance through tailored emulsions. Presented at the 58th Annual Meeting of the Forest Products Society, Grand Rapids, Michigan, June 27-30.

Reichenbach, Michael R., Timothy M. Smith, Sergio A. Molina-Murillo and **Robert L. Smith**. 2004. Treatment requirements for solid wood packaging and use of wood by exporters. Poster presented at the Minnesota Society of American Foresters, Annual Meeting, Olgebay Resort, Minnesota, February.

Roberts, Edward T., Robert M. Shaffer and **Robert J. Bush**. 2004. Injuries on Feller-Buncher/Grapply skidder lodging operations in the Southeastern United States. Presented at the Annual Meeting of the Council of Forest Engineers, Hot Springs, Arkansas, April 28-30.

Roman, Maren. 2004. Wood-based nanocomposites. Poster presented at The 2004 MACRO Conference and Review, Blacksburg, Virginia, September 13-15.

Roman, Maren. 2004. Wood-based nanocomposites. Poster presented at the WBC Center Fall 2004 Industry Advisory Board Meeting, Blacksburg, Virginia, September 22-23.

Roman, Maren. 2004. Cellulose nanocrystals: Tiny particles – giant potential. Invited seminar presented to Specialty Minerals Inc., Bethlehem, Pennsylvania, November 10.

Rupert, Ralph L. 2004. Global standards for reusable pallets and containers. Presented at the RPCC Conference, Dallas, Texas, March 11.

Rupert, Ralph L. 2004. Factors that effect corrugated box compression. Presented to Harper-Love Adhesives, Charlotte, North Carolina, June 30.

Rupert, Ralph L. and **Bonnie J. Maccubbin**. 2004. PackExpo 2004. Exhibited in packaging tradeshow, Chicago, Illinois, November 8-11.

Rupert, Ralph L. 2004. Factors that effect corrugated box compression. Presented to Harper-Love Adhesives, Nashville, Tennessee, September 6.

Scott, Brian C. and **Fred A. Kamke**. 2004. Dielectric characterization of phenol-formaldehyde cure. Annual meeting of the Forest Products Society, Grand Rapids, Michigan, June 27-30.

Smith, Robert L., David Bailey, and **Philip A. Araman**. 2004. Niche market strategies. Presented at the Environmental Impacts of Preservative Treated Wood meeting, Orlando, Florida, February 8-10.

Smith, Robert L., David S. Bailey, and **Philip A. Araman**. 2004. Characterizing properties and products of spent CCA from residential decks. Presented at the Environmental Impacts of Preservative Treated Wood meeting, Orlando, Florida, February 8-10.

Smith, Robert L. 2004. Wood Preservative Safety. Farmville, Virginia. Presented at a recertification meeting sponsored by VCE, February 25.

Smith, Robert L. 2004. Introduction to the wood products industry and markets in the U.S. Presentation to visiting Russian Delegation. Blacksburg, Virginia, March 22.

Smith, Robert L. 2004. Forest Products Marketing. Presentation: Visiting Russian delegation. Blacksburg, Virginia, March 23.

Smith, Robert L. 2004. Marketing of wood products. "Forestry on the Grow." Exploring Opportunities and New Technologies for Woodland Management and the Wood Products Industry, Wagoner, Oklahoma, April 27-29.

Presentations

Smith, Robert L. and **A. L. Hammett**. 2004. Forest Based Economic Development. Presentation, Wheeling, West Virginia. Presented at the Association of Natural Resource Extension Professionals (ANREP) - 4th Natural Resource Extension Professionals Conference, Wheeling, West Virginia, May 16-19.

Smith, Robert L. and **A. L. Hammett**. 2004. Wood products programming to the economic development community. Presented at the Association of Natural Resource Extension Professionals (ANREP) - 4th Natural Resource Extension Professionals Conference, Wheeling, West Virginia, May 16-19.

Smith, Robert L. and **A. L. Hammett**. 2004. Introduction to the wood products industry and markets in the U.S. Presented at the Association of Natural Resource Extension Professionals (ANREP) - 4th Natural Resource Extension Professionals Conference, Wheeling, West Virginia, May 16-19.

Smith, Robert L. 2004. Selling your business in international markets. Invited Presentation: Penn State University Hardwood Leadership Conference, State College, Pennsylvania, May 24.

Smith, Robert L., Paul M. Duvall, and Delton Alderman. 2004. Changing markets for white pine lumber. Poster presented at the 58th Annual Forest Products Society Meeting, Amway Grant Plaza Hotel, Grand Rapids, Michigan, June 27-30.

Smith, Robert L. 2004. U.S. Wood Products, Markets, and Trends. Presentation: To faculty, students, and industry participants at National Chung Hsing University. Tai Chung, Taiwan, October 20.

Smith, Robert L. 2004. The role of marketing in the wood products industry. Presentation: To the faculty, students, and industry participants, National Chiayi University, Chiayi, Taiwan, October 27.

Smith, Robert L. 2004. The role of marketing and management education in the efficient production and utilization of forest products in the United States. Invited Presentation: International Symposium on Multilateral Cooperation in Agriculture Biotechnology Exchange in the Pan Pacific Area. National Pingtung University of Science and Technology, Pingtung, Taiwan, November 11.

Smith, Robert L. 2004. Marketing forest products. Invited Presentation: Presented to faculty, students, and industry participants. National Pingtung University of Science and Technology, Pingtung, Taiwan, November 11.

Smith, Robert L. 2004. Issues affecting the U.S. wood products industry. Invited Presentation to faculty, students, and industry participants, National Cheng Chi University, Taipei, Taiwan, November 26.

Smith, Timothy M., Michael R. Reichenbach, and **Robert L. Smith**. 2004. Globalization and the potential effect of treatment standards for solid wood packaging on small scale forestry. Abstract: Presented at the ANREP - 4th Natural Resource Extension Professionals Conference. Oglebay Resort and Conference Center, Wheeling, West Virginia, May 16-19.

Sun, Nanjian, Sudipto Das and **Charles E. Frazier**. 2004. Dynamic mechanical analysis of the species-dependent performance of polymeric isocyanate resins. Presented at the 32nd Annual Conference on Thermal Analysis and Applications. The North American Thermal Analysis Society, Williamsburg, Virginia, October 4-6.

Wallace, Elena K. and **Fred A. Kamke**. 2004. Influence of processing parameters on failure behavior of wood strand composites. Presented at the annual meeting of the Forest Products Society, Grand Rapids, Michigan, June 27-30.

White, Marshall S. 2004. U.S. Wood Pallet Industry: A Brief Overview. Presented to Appalachian Lumberman Club, Greensboro, North Carolina, January 13.

White, Marshall S. 2004. International phytosanitation regulation of raw wood packaging and its impact on lumber, pallet, and container manufacturers: The latest developments. Lead seminar in conjunction with Expo Richmond 2004, June 3.

Presentations

White, Marshall S. 2004. Molds on wood pallets and containers: Control and prevention. Presented at the Wooden Pallet Seminar, Houston, Texas, August 26.

White, Marshall S. 2004. Overview of the U.S. pallet industry. ISO TC51 Special Seminar, presented in Seoul, Korea, November 1.

White, Marshall S. 2004. Wood packaging regulations for export & import. A seminar addressing ISPM #15 Guidelines for Regulation of Wood Packaging Material in International Trade (A Virginia Economic Development Partnership), Abingdon, Virginia, December 7.

Wiedenbeck, Janice K and **Philip A. Araman**. 2004. North and South: The Aspen-Magnolia Line on Hardwood Research. Hardwood Research Review 2004. NHLA Annual Convention, Toronto, Canada, October 2.

Winistorfer, Paul M. 2004. What's good about wood. Virginia Forest Products Association Winter Meeting. Williamsburg, Virginia, January 30-31.

Winistorfer, Paul M. 2004. Wood as a biobased material. Presented at the USDA Biobased Products and Bioenergy Coordination Council Strategic Planning Meeting. Greenbelt, Maryland, April 13-14.

Winistorfer, Paul M. 2004. The Forest Products Society, professionalism, and student responsibility and stewardship. Presented at the student chapter meeting of the Forest Products Society. The University of Idaho, Moscow, Idaho, April 19.

Winistorfer, Paul. M. 2004. The role of education in the supply chain for the forest products industry. Penn State University Hardwood Leadership Conference. State College, Pennsylvania, May 24.

Winistorfer, Paul M. 2004. The role of a competitive forest products manufacturing industry in a healthy forest resources system. Mississippi State University College of Forest Resources 50th Anniversary Celebration. Starkville, Mississippi, September 24.

Zink-Sharp, Audrey. 2004. Career opportunities in wood science. 4-H Career Awareness Tours at Virginia Tech, Blacksburg, Virginia, April 8, 13, 16, 23 and 30.

Zink-Sharp, Audrey. 2004. Wood Magic. 29th East Coast Sawmill and Logging Equipment Exposition, Richmond, Virginia, June 4-5.

Zink-Sharp, Audrey. 2004. Opportunities in wood science. Access Virginia Gear Up. Presented to Virginia High School Students, Blacksburg, Virginia, July 19.

Zink-Sharp, Audrey and Carlile Price. 2004. Micromechanical evaluation of wood. Presented at the 3rd International Conference ESWM2004, Villa Real, Portugal, September 5-8.

Zink-Sharp, Audrey. 2004. Intra-ring variability and surface properties. Presented at the Sustainable Engineered Materials Institute Annual Meeting, Blacksburg, Virginia, September 21.

Radio Broadcasts

Joseph Loferski. Safety of Residential Decks and Balconies: What Every Home Owner Should Know. Radio Show Home Innovations. ABC WMAL AM 630. April 18.

Report of Activities – 2004

Student Recruiting Efforts

Judith Araman, Recruiter/Academic Advisor
Email: jaca@vt.edu

Departmental display at the Majors Fair.

Recruitment

Student recruitment was a priority for the Department of Wood Science and Forest Products in 2004. Previous efforts were evaluated in terms of the venues and the student populations targeted. The consensus was that attracting students to the department required not only developing new promotional materials, but also establishing new ties to the University Academic Advising Center and Career Services, both of which service "undecided" students at Virginia Tech, as well as to introductory courses for freshmen with a focus on deciding on a major.

Materials were developed in terms of the populations to receive them: University Studies Advisors, undecided students, science-oriented students, and parents of entering freshmen. Formats included brochures, postcards, and folders. Information ranged from descriptions of the department, curriculum, and options to student scholarships, internship opportunities, and career opportunities.

To establish a relationship with University Studies Advisors, a presentation of the new curriculum was given in early 2004 in preparation for fall registration and summer orientation. The department, in partnership with Beverlyn Samuels, recruiter for the College of Natural Resources, requested time to address parents of entering University Studies students, with interests in business, engineering, science, or computers, to introduce the Department of Wood Science and Forest Products and the College of Natural Resources. Over 1,200 contacts were made through this University Studies summer orientation venue.

The Career Services course "Exploring Careers" and the College of Agriculture and Life Sciences course "Life Sciences in the 21st Century" were new venues for recruiting in 2004. Nine presentations to over 130 students in these courses generated interest in the department's Wood 1234 course "Introduction to Wood Science and Forest Products" for spring 2005.

Postcard mailings to over 1,300 University Studies students to remind them to see department representatives at the Majors Fair on October 14, and the textbook voucher giveaway at the fair drew a record 237 visits to the department's display in Cassell Coliseum. From the e-mails collect via the giveaway, students were invited to attend information sessions prior to spring registration. Four students attended the evening meeting and signed up for the WOOD 1234 course for spring.

Report of Activities – 2004

Additional promotions for the department included a highly visible display in Squires Student Center during summer orientation, a full-page college ad in the *Collegiate Times* in the first-ever Orientation edition sent to all entering freshmen, distribution of brochures next to the information desk in Squires, and course-description flyers for "Introduction to Wood Science and Forest Products" and "Introduction to Packaging Science" distributed to advisors in University Studies and to students in NR 1114 during course registration for spring 2005.

With the nearly 3,000 contacts generated through various recruiting efforts, the department has experienced a rejuvenation of interest on which to build in 2005. We anticipate a fall 2005 sophomore class of 20 students in the major. Our overall department goal is to reach 80-100 students in the major.

For information about student recruiting, please contact Ms. Judith Araman at (540) 231-8853 or by email at jaca@vt.edu.

Forest Products Club

President: Chris Gabrielli
Vice President: Isaac (Zack) Rickman
Secretary: Samuel Street
Treasurer: Patrick Rappold
Social Chair: Katie Harrison
Advisor: Dr. Brian Bond

The Forest Products Club is a student chapter of the Forest Products Society (*www.forestprod.org*). The club is one of the strongest of the seventeen Forest Products Society student chapters in the United States. The year saw a changing of the guard for the club; a new president, Chris Gabrielli; vice president, Zack Rickman; secretary, Sam Street; and social chair, Katie Harrison were elected. Dr. Brian Bond was welcomed as the new advisor for the club.

In 2004, the Forest Products Club was active by sponsoring a spring and fall picnic, assisting in the Wood Magic Show, and volunteering at various department recruiting activities around campus. The club also participated in other campus activities including recreational softball and football leagues.

The headliner for the year was the Timber Bridge Competition. With the help of Snavely Forest Products (*www.snavelyforest.com*), club members designed, built, and tested a bridge that placed fourth out of the fourteen bridges in the Best Support Structure category. The National Timber Bridge Design Competition is open to student chapters of the American Society of Civil Engineers (ASCE) and Forest Products Society (FPS) in the United States and Canada. The competition provides a chance for students to showcase their design and building abilities, while competing against various universities. With donations from many of the Center for Forest Products Marketing and Managements member companies, the students had a chance to work directly with industry.

Six student representatives from the club had the chance to attend the Manufacturing Competitiveness Conference sponsored by the Forest Products Society in New Orleans. The club was also represented at the Forest Products Society Annual Meeting in Grand Rapids, Michigan.

For information about the Forest Products Club, please contact Dr. Brian Bond at (540) 231-8752 or at bbond@vt.edu.

2004 Timber Bridge and a few of the students involved in the Forest Products Club.

Report of Activities – 2004

Center for Forest Products Marketing and Management

Director: Dr. Robert Smith
Participating Virginia Tech Faculty: Dr. Robert Bush, Dr. D. Earl Kline, and Dr. A. L. Hammett
Senior Secretary: Joanne Buckner
www.cfpmm.vt.edu

The Center for Forest Products Marketing and Management was established in 1991 by the late Dr. Steven Sinclair. The center was established to bridge the gap between academia and the industry and to support the marketing efforts of member companies. The center is a cooperative between the Department of Wood Science and Forest Products, trade associations, and companies in various aspects of the forest products industry. With increased international and domestic competition within the forest products industry, the Center for Forest Products Marketing and Management strives to assist member companies by providing marketing/management education and conducting specific topical research for the industry. The mission of the center is to assist firms in the forest products industry to improve the management of their operations and the marketing of their products.

Over the past year, the center has been represented at many industry and association meetings and conferences. Representatives of the Center have been at the Appalachian Hardwood Manufacturers Association summer meeting in Ashville, NC, Virginia Forest Products Association summer meeting in Virginia Beach, VA, International Woodworkers Fair, Atlanta, GA, Hardwood Distributors Association annual meeting, Toronto, Ontario, Canada, and the Forest Products Society annual meeting in Grand Rapids, MI. The center has continued to host short courses to further educate those in the forest products industry. Short courses hosted on the Blacksburg campus in 2004 included two Lean Manufacturing Courses, an Advanced Sales Training Course, and a Forest Products Marketing course. While some participating center faculty were out in the industry assisting companies with problems in the field, their travels includes trips to Bolivia, Florida, Taiwan, and numerous facilities throughout Virginia.

The mission of the center is to assist firms in the forest products industry to improve the management of their operations and the marketing of their products.

The center's annual meeting held on March 15th, was the highlight of the year. Rick Lovorn, plant manager at Merillat Industries in Atkins, VA, was the keynote speaker. The annual meeting gave the steering committee a chance to meet again to discuss where the focus of the center should be placed. Using a new Nominal Group Technique format of discussion led by Dan Cumbo, the group focused on the key question of "What significant challenges will your company or firm face in the next five years?" Through this discussion, the following topics were identified as areas that the center should focus on: system level improvements; improved supplier-consumer relations; employee recruiting training and human resource development; issues relating to global competition of imports and exports; and wood raw material utilization. As such, these topics have played an increasingly prominent role in the center's research and research-related publications.

Report of Activities – 2004

At the annual meeting, the center awarded nearly $22,000 in scholarships to undergraduate and graduate students. All of these scholarships were donated by members of the center. Scholarships ranged between $500 and $2,000, and were awarded to those students who showed that they have the aptitude to be the future leaders in the forest products industry. Students receiving scholarships included: Whitney Donithan, Patrick Rappold, Isaac Rickman, Joshua Hartzog, Chris Gabrielli, Sam Street, Joseph Ciucci, Andrew Fitch, Hunter Pusey, William Edwards, Jeremy Wooton, Braden White, Garrett Norman, and Jonathon Frey. Member organizations sponsoring scholarships included:

- Frank Miller Lumber Co.
- Hardwood Publishing Inc.
- Morgan Lumber Co.
- Snavely Forest Products
- Coastal Lumber Co.
- Virginia Forest Products Association
- Anderson-Tully Lumber Co.
- Appalachian Hardwood Manufacturers Association
- Boehm-Madison Lumber Co.
- Danzer Group
- Fitzpatrick and Weller Inc.
- Jeld-Wen Corporation
- Southeastern Dry Kiln Club
- J.T. Shannon Lumber
- Wood Components Manufacturers Association

The center thanks these organizations for their support of our students.

For information about the Center for Forest Products Marketing and Management, please contact Ms. Joanne Buckner at (540) 231-5876 or by email at ctrfpmjo@vt.edu.

Center for Unit Load Design

Director: Dr. Marshall S. White
Managing Director of Member Services and Marketing: Bonnie Maccubbin
Research Associates: Peter Hamner, John A. McLeod, III, and Ralph Rupert
Senior Secretary: Sharon Daley
www.unitload.vt.edu

Formed in 1996, the Center for Unit Load Design develops information and technologies to optimize the relationship between the design and performance of unit loads, and to maximize the efficiency of unit load material handling systems. The center focuses on system optimization in studying the mechanical interactions between containers, pallets, and unit load material handling equipment. Facilities include the William H. Sardo Jr. Pallet and Container Laboratory and the Unit Load Testing Laboratory, which feature a comprehensive packaging testing laboratory and automated material handling equipment typically found in many automated warehouses. The center's team includes experts in packaging, palletization, material handling, and unit load design.

Starting fall 2004, undergraduate students gained a new educational study option in packaging science. Students will work closely with the center to identify significant opportunities to improve the efficiency and safety of the global unit load logistics system for product storage and distribution by understanding how critical components in the system interact during use. Interdisciplinary education and research will include all components of the unit load logistics system, including packaging design, pallet design, unit load stabilization, dunnage, blocking, and bracing, unit load handling equipment design, and associated interactions and includes courses in wood science and forest products, industrial and systems engineering, and graphic arts. The first program graduates, anticipated in spring of 2006, can expect employment in a variety of industry groups including box plants, wood pallet and container manufacturers, folding

Report of Activities – 2004

carton suppliers, and corporate packaging, warehouse, shipping, and logistics departments. Graduates of the new packaging science program will be unique in the industry with an understanding of transport packaging and unit load systems-based design technologies which include the interactions of packaging, pallets, and unit load material handling equipment. Future plans also include a proposed graduate program in packaging and logistics science.

Dr. Jongkoo Han, assistant professor for the new packaging science option, joined the department this September and will develop and teach packaging related courses including "Principles of Packaging," "Paper and Paperboard Packaging," and "Distribution Packaging Dynamics." His background is in chemical engineering with an emphasis on materials application to packaging. Dr. Han received his Ph.D. degree in packaging from the Michigan State University. Prior to joining the department, he served as a visiting assistant professor at the Indiana State University and instructor at the Michigan State University. He was a packaging research scientist in the Korea Design and Packaging Center for 15 years.

Also of great significance is the formation of the interdisciplinary Supply Chain Systems Development Group on campus, which met for the first time in September under the direction of center director, Marshall White. The mission of this working group is through interdisciplinary research and instructional programming to develop and implement systems-based design principles and technologies with a goal of improving the efficiency of material and product manufacture, storage, and distribution. Participants represent expertise in most components of the global product supply chain: packaging, unitization and warehousing, transportation, and supply chain, layout, location, and design. Virginia Tech departments, in addition to Wood Science and Forest Products, include Mechanical Engineering, Food Science and Technology, Industrial and Systems Engineering, and Aerospace and Ocean Engineering.

Center research for 2004 included PHASE II of the Vacuum Technology Project conducted by Dr. Zhangjing Chen, Dr. Marshall (Mark) White, and Dr. William H. Robinson. Dr. Chen has been working in the wood and moisture relation under the vacuum, especially in the field of vacuum drying. Dr. Robinson is an entomologist who has extensive knowledge on wood insects. The objective of this phase of project is to demonstrate that the low-pressure control method for insects in solid wood packaging material can be commercialized and become one of the accepted treatments in the International Standards for Phytosanitary Measures.

John McLeod led another research project to determine the effect of moisture content on the mechanical properties of hardwood components manufactured green but dried before use. In addition, the difference in creep performance between green pallets, pallets assembled green and then dried, and pallets assembled from dry components were studied. The results of this research will be incorporated in a new version of *The Pallet Design System*©.

Topographical mapping, a procedure using pressure sensitive films to map the distribution of dynamic and static stresses on pallets during use, was also studied by the center. It is hoped that the results of this research will assist package designers to understand the stresses that are imposed by the pallet on the package in order to improve package efficiency. In addition, understanding the distribution of impacts on pallets during unit load materials handling will help designers determine the best location for applying labels or Radio Frequency Identification (RFID) tags to pallets.

Many projects with corporate clients were completed during 2004, including work with new center members: BCI (Division of the Newark Group), Bison Pallet (Miller Dowel), Cooper Tire, Dupont Surfaces, Fastec, Great Salt Lake Minerals, Hewlett Packard, Multi-Wall Packaging, Inc., National Nail Corporation, Optilogistics, Protective Pallets, Smurfit-Stone Container Corporation, TriEnda/Creative Packaging, and W.W. Henry. Two innovative new products were evaluated at the center this past year. Armacel, an Australian company, has developed a process to encapsulate a skid in a polyester film using a vacuum and heat system. This works very well with paper-based pallet designs, as the film provides a water and moisture barrier. The second new product is a simple plastic ledge that fits under the edge of a rigid unit load. The ledge, called the Optiledge and produced by the Optilogistics Company, was evaluated on load capacity and unit load types before its introduction to the market.

Report of Activities – 2004

During 2004, the center offered short courses in unit load design and introductory and advanced courses on pallet design. Center activities also included a new version release of *The Pallet Design System*© and exhibits at NA2004 (a material handling and logistics tradeshow), PackExpo 2004 (a packaging tradeshow), and the Richmond Expo.

For information about the Center for Unit Load Design please, contact Ms. Bonnie Maccubbin at (540) 231-5370 or by email at bjmac@vt.edu.

Unit Load Testing Laboratory at the Brooks Forest Products Center.

Wood-Based Composites Center

Director: Dr. Charles Frazier
Managing Director: Ms. Linda Caudill
Participating Virginia Tech Faculty:
Dr. Wolfgang Glasser, Dr. Daniel Hindman,
Dr. Joseph Loferski, Dr. Maren Roman,
and Dr. Robert Smith
Senior Secretary: Angela Riegel
www.wbc.vt.edu

Wood-based composites play an ever-increasing role in the wood products industry. In order to support the needs of the industry today and in the future, the Wood-Based Composites Center was established in 1999. The center is a cooperative effort between the Department of Wood Science and Forest Products at Virginia Tech, its member companies, and several partner universities, including Mississippi State, Oregon State, and the University of Minnesota. Its activities are focused on meeting the educational and research needs of the North American wood and fiber-based composites, and related industries.

Eleven corporations supported the activities of the WBC Center in 2004, including Bayer MaterialScience, Boise, Borden Chemical, Columbia Forest Products, Dynea, Georgia-Pacific Resins, Grant Forest Products, Huber Engineered Woods, Huntsman Polyurethanes, National Starch and Chemical, and Weyerhaeuser Company. Gifts from these corporations totaled $166,500.

During 2004, the center supported seven graduate fellows, at three of its four universities. In July, Borden Chemical Fellow Jeffrey Smith completed his M.S. program at Virginia Tech. Undergraduate scholarships totaling $20,000 were awarded to eleven students at the four center universities in 2004. Several students successfully completed internships at participating company facilities during the summer.

The WBC Center offered three short courses during the year, with a total of 66 participants from 20 companies and organizations. The 6th Annual Wood Adhesion Short Course was held at Virginia Tech in May. A customized short course, The Marketing Professional's Guide to Wood Adhesion, Structure, and Properties, was presented for Huber Engineered Woods in August in North Carolina. This year's Wood Adhesion Problem Solving Course, which focused on

Report of Activities – 2004

isocyanate adhesives, was held in Blacksburg in November. Additional courses, including a new Wood Adhesion Problem Solving Short Course focusing on adhesives used in the furniture industry, are planned for 2005.

The WBC Center Industry Advisory Board met twice in 2004. The spring meeting was held at the University of Minnesota in St. Paul in April, and included a Technical Forum and Student Reception that was well attended by faculty and students. In September, Virginia Tech hosted the fall meeting and Technical Forum. Nineteen students and faculty members presented posters and talks at the meeting, highlighted by overviews from each of the four partner universities on the composites-related research underway in their individual departments. The Advisory Board plans to meet at Oregon State University in Corvallis in the spring of 2005.

The Wood-Based Composites Center was represented at several professional meetings throughout the year, including the Annual Meeting of the Society of Wood Science and Technology, the 58th Annual Meeting of the Forest Products Society, both held in Grand Rapids, Michigan, the Virginia Tech 2004 MACRO Conference and Review in Blacksburg, Virginia, the Annual Meeting of the Society for Engineering in Agriculture, Food and Biological Systems, Ottawa, Canada, the University of Potsdam's POLYDAYS 2004 in Potsdam, Germany, the SBA's OSB World Symposium in Niagra Falls, and the Annual Info Fair of the Engineered Wood Research Foundation, Naples, Florida.

For information about the Wood-Based Composites Center, tours, or research opportunities, please contact Ms. Linda Caudill at (540) 231-7092 or by email at lcaudill@vt.edu.

Instructors and students of the Wood Adhesion Problem Solving Short Course, November 2004.

Wood Magic at Virginia Tech

Program Coordinator:
Dr. Audrey Zink-Sharp
www.woodmagic.vt.edu

Wood Magic at Virginia Tech is a youth education program centered on teaching the role of wood utilization in a sustainable natural resources future. Components of Wood Magic at VT include an annual on-campus program for regional school classes, an informative website that includes an extensive activities section, and a traveling classroom. Through Wood Magic we interact with youth, educators, the public, and industry partners to raise awareness of wood and wood science's role in efficient utilization and renewal of our forests. We often remark that wood science suffers from an awareness problem. Programs like Wood Magic are effective ways to meet the challenge of raising awareness, clarifying misperceptions, and looking toward the future.

We are gaining awards and international recognition with Wood Magic. For example, in 2004 we won the first College of Natural Resources Award for Outreach Excellence, and we were featured in a Korean newspaper as a model program to duplicate. Our website extends the reach of Wood Magic around the globe. In 2004, we completed a comprehensive website overhaul (*www.woodmagic.vt.edu*) and received numerous requests for assistance in science fair projects and youth and environmental science curricula design.

Wood Magic is very popular with educators. Just over 9,000 students and teachers have participated since the first program in 1998, either on-campus or through traveling classroom programs. Wood Magic 7 (October 2004, Blacksburg campus) was well attended by 379 young students (4th and 5th grades), 43 teachers, in 22 classes, from 8 schools. Faculty, staff, and students from all four departments in our College helped create a successful program in 2004. Letters from the youth indicate their favorite activity is making paper, because they get to craft their own sheet of paper with their own hands and take it home. They also like lunch and snack, as might be expected, but their letters indicate that they had a great time learning about wood science basics, creating wood and fiber products, recycling wood, and breaking wood. We strive to make our activities fun AND informative because having fun is crucial

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to learning and retention of new knowledge at the educational stage of our young participants.

In 2004, a successful partnership was initiated with Virginia Cooperative Extension in curriculum design, training workshops, and the 4-H Educational Centers. Several hundred students learned from the traveling classroom at the Holiday Lake 4-H Educational Center near Appomattox, Virginia. We delivered a training workshop for 4-H youth educators as part of their In-Service Training held on campus, and a new curriculum area in Wood Science was created. A Wood Magic Leaders' Guide is in print that will soon be available to all 4-H youth educators across the country. Because our Leaders' Guide puts wood science and forest products activities in the hands of hundreds of extension and youth educators, we can expect tremendous returns in increased awareness and interest in wood science. Look for Virginia Cooperative Extension publication #388-807 in early 2005.

Wood Magic attendees making paper.

Wood Magic has been so highly regarded by elementary school educators, we are developing a national curriculum for high school classes with anticipated completion summer 2005. We have also begun production of an instructional DVD for distribution to anyone interested in creating their own version of Wood Magic. The first day of Wood Magic 8 (October 2005) is already full with classes from Pulaski, Virginia, and we have new activities planned for them. Wood Magic at Virginia Tech works because of the dedication of the many volunteers that put their time and energy into the on-campus program, and also because we have dedicated industry, association, and foundation partners that donate materials, funds, and ideas, for which we are extremely grateful.

For information about Wood Magic at Virginia Tech, please contact Dr. Audrey Zink-Sharp at (540) 231-8820 or by email at agzink@vt.edu.

Quantitative Wood Anatomy Laboratory

Program Coordinator:
Dr. Audrey Zink-Sharp

Research results, interaction with students, and industry connections were accomplished in the first year of our Quantitative Wood Anatomy (QWA) Laboratory. Research primarily focused on determining the crushing strength of several hundred small wood columns using the new micromechanics test system developed specifically for our lab. This research and the micro test system are part of on-going efforts of the Sustainable Engineered Materials Institute (SEMI) at Virginia Tech. SEMI is a collaborative effort focused on ensuring an economic and environmentally sustainable supply of renewable resources to match future demand for building construction materials and allied products. Our efforts in micro testing protocols for wood are receiving recognition. For example, we were invited to present results at a European conference held in September 2004. The company that manufactures the test system software is featuring our application in their technical literature, and other building material journals have picked up this literature for reprinting.

Many undergraduate and graduate laboratory classes took place in our lab this year. Students from all majors in our college were given the opportunity to examine two pieces of wood, first with a hand lens, then through optical microscopy, and finally with the Scanning Electron Microscope (SEM). Almost without exception, the first comment was "Wow, I didn't know wood was so complicated. I thought they were all alike." Graduate and undergraduate labs benefited from having the ability to macerate wood into its constituent cells and also to make their own microscope sections from wood surfaces. The students could then examine the cells and slides themselves rather than rely on prints from someone else's work.

We are working with an industry partner through the Wood-Based Composites Center to help solve a problem in veneer surface quality. In another industrial-related research project, we are determining the wood cell structure after heavy densification through compaction.

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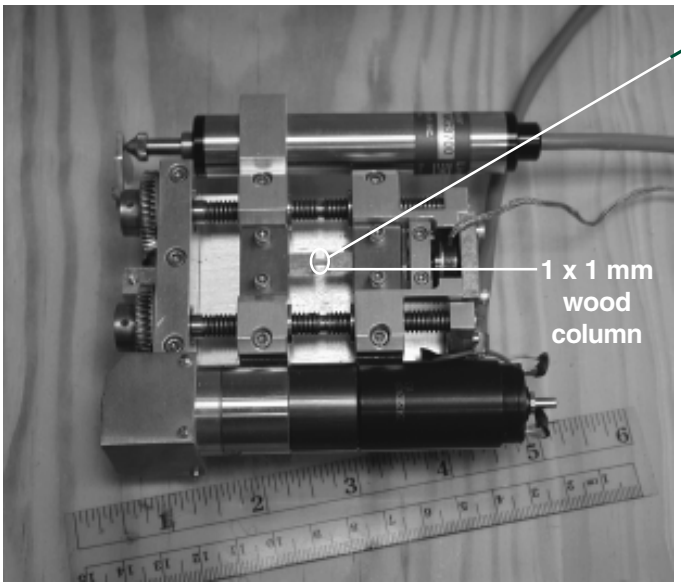
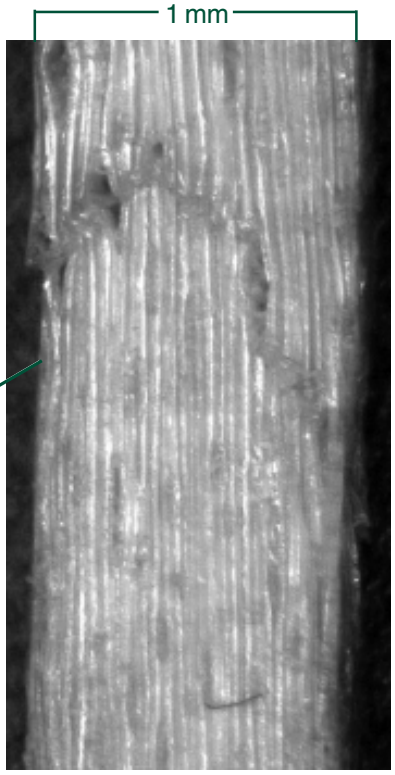
The future for our QWA Laboratory looks promising. We will continue intensive and comprehensive determination of intra-ring mechanical properties of low density hardwoods. We will establish testing protocols for tension and bending tests of small wood specimens. In addition, there are four research proposals to be submitted in 2005 that rely on our QWA for its analytical capabilities, and one proposal to enhance the instrumentation on the SEM.

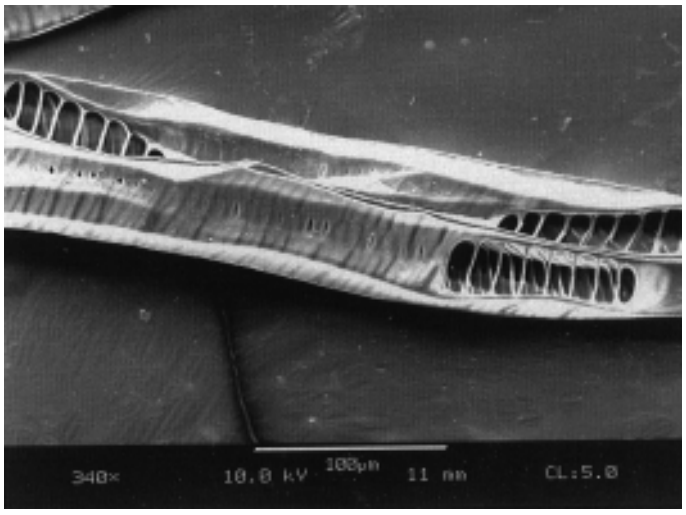
For information about the Quantitative Wood Anatomy Laboratory, tours, or research opportunities, please contact Dr. Audrey Zink-Sharp at (540) 231-8820 or by email at agzink@vt.edu.



▲ The micromechanics test frame is uniquely capable of measuring tension, compression, bending, and cyclic properties.



▲ An example of the failures created in a wood column (The specimen is 1 x 1 mm in cross section and 4 mm long. Image is enlarged 43x).



Two vessel elements from a magnolia tree (*Magnolia accuminata*) just outside Cheatham Hall as seen in our SEM. Notice the intricate openings at each end of the cells and the spiral thickening around the cavity of the cells. (Micrograph courtesy of Carlile Price). ▶

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Thermal Analysis Laboratory

Coordinator: Dr. Charles Frazier

The Thermal Analysis Laboratory is housed in Room 225 of Cheatham Hall. A 600 sq. ft. facility, the Thermal Analysis Laboratory contains the latest equipment for conducting a complete range of polymer analyses. This facility supports the research needs of the Wood-Based Composites Center, the Sustainable Engineered Materials Institute, the Wood Adhesion research group, and the Advanced Biopolymer Materials research group. The Thermal Analysis Laboratory is equipped with the following analytical instruments:

- Two stress-controlled advanced rheometers for the complete rheological analysis of polymeric materials (solutions, melts, and glasses).
- Two modulated differential scanning calorimeters for the analysis of primary and secondary thermal transitions in polymeric materials.
- Two stress-controlled dynamic mechanical analyzers for the complete viscoelastic analysis of polymeric materials.
- One high resolution thermogravimetric analyzer for evaluating the thermal stability and thermal decomposition kinetics of polymeric materials.
- One thermomechanical analyzer for measuring the thermal softening of polymeric materials.
- One sessile/pendant drop surface analyzer with high speed video capture for measuring surface chemistry.
- One size exclusion chromatograph with triple detection (differential viscometry, low-angle laser light scattering, and refractive index) for determining polymer molecular weights.

The Thermal Analysis Laboratory supports a broad range of research. Recent activities include the rheological analysis of adhesive-treated wood to identify wood/adhesive interactions that influence wood-based composite durability, the rheology of novel emulsified thermosetting structural adhesives, and the surface chemistry of eastern hardwoods as this is affected by silvicultural practices.

For information about the Thermal Analysis Laboratory, tours, or research opportunities, please contact, Dr. Charles Frazier at (540) 231-8318 or by email at cfrazier@vt.edu.

The Thermal Analysis Laboratory supports the research needs of the Wood-Based Composites Center, the Sustainable Engineered Materials Institute, the Wood Adhesion group, and the Advanced Biopolymer Materials research group.

Report of Activities – 2004

Unit Load Testing Laboratory
William H. Sardo, Jr., Pallet and Container Research Laboratory
The Center for Unit Load Design

Coordinator: Dr. Marshall White
Lab Manager: Ralph L. Rupert

The Center for Unit Load Design, located at the Thomas M. Brooks Forest Products Center, includes the William H. Sardo Jr. Pallet and Container Research Laboratory (Sardo Pallet Lab) and the Unit Load Testing Laboratory. The research focus of the center includes understanding how packaging, pallets, and distribution equipment interact. The results of this research are methods for optimizing unit load storage and distribution system design.

The Sardo Pallet Lab covers 7,200 square feet that provide space for standardized and specialized testing equipment and environmental exposure and conditioning chambers, faculty, staff, and student offices. Adjacent to the Sardo Pallet Lab is the 2,000 square foot office and high bay Unit Load Testing Laboratory, which features a comprehensive packaging testing laboratory and automated material handling equipment typically found in modern manufacturing and warehouses, such as a dynamic storage rack, roller conveyors, chain conveyors. The center's laboratories include standard as well as uniquely computerized, mechanical, and hydraulic instrumentation:

- Custom pallet tester with pneumatic load applicator, 12,000 pound capacity.
- Tinius Olsen compression tester, 20,000 pound capacity.
- MTI/LAB hydraulic vibration table–1500 pound, sine and random vibration capacity.
- Inclined impact tester with modified fork tine impact hazard.
- Clarke electric forklift.
- Clarke electric pallet jack.
- Mibant nail tester.
- LAB package drop tester.

For information about the Center for Unit Load Design laboratory or the Sardo Pallet and Container Laboratory, tours, or research opportunities, please contact Dr. Marshall White at (540) 231-7134 or by email at mswhite@vt.edu.

Sardo Pallet Laboratory.

Wood-Based Composites Laboratory

Coordinator: Ms. Linda Caudill

The Wood-Based Composites Laboratory services the Sustainable Engineered Materials Institute and the Wood-Based Composites Center. This 4,000 square foot facility houses a pilot plant for the manufacture of flat-pressed composites, wet-lab, raw material preparation, and material testing.

Equipment in this laboratory includes:

- Hot-press (Clifton), 24-inch x 24-inch, 300-ton, oil-heated, computer controlled, steam injection capability, multiple temperature and gas pressure probes.
- Disk flaker (CAE), 36-inch.
- Knife-ring flaker (Pallmann), 36-inch.
- Blender, 6-foot diameter with spinning disk atomization.
- Blender, 4-foot diameter with air atomization.

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- Particle size separator, Ro-Tap.
- Tray dryer for strands, veneer, particles, and flakes; forced air, 140 ft³ and 18 ft³.
- Roll coater, 24-inch width.
- Environment control chambers, 5 ft.² and 10 ft.².
- Vacuum pressure soak tanks (2), 12-inch diameter by 36-inch length.
- Universal testing machine (Universal Testing Systems) for small specimen bending, IB, shear, tension, compression, and mode-I fracture.
- Vertical density profiler (Quintek Measurement Systems).
- Load and displacement testing machine, Rheometric Scientific, MiniMat 2000, 5 lb. and 225 lb. capacity.
- Uniform load tester for 4-foot x 8-foot panels.

For information about the Wood Composites Laboratory, tours, or research opportunities, please contact Ms. Linda Caudill at (540) 231-7092 or by email at lcaudill@vt.edu.

Wood-Based Composites Laboratory.

Wood Drying Laboratory

Coordinator: Dr. Brian H. Bond

A Wood Drying Laboratory has been established in Room 110 of the Brooks Forest Products Center for the purpose of discovering ways to improve wood drying methods and incorporate newly developed concepts into industrial practice. Improvements in the science of drying are required to meet the changing demands of customers and maintain manufacturing objectives as the quality of raw material continually changes. The resources contained in the lab will allow us to advance state of the art drying technology and methods.

This 645 sq. ft. lab contains a dry kiln, ovens, balances, and other monitoring equipment; a 110 sq. ft. office space housing staff and computer equipment; and 335 sq. ft. under roof equipment and storage space. The drying lab consists of two experimental dry kilns, a 750 board foot Southeastern Installations Incorporation (SII) conventional steam dry kiln and a 1000 board foot Irvington Moore kiln. The new SII kiln has PLC controls and is capable of drying with the SAMPLE WATCH weight based kiln control system. The kiln has frequency controlled fan drives, which allows airflows of up to 1000 ft/min. through the lumber. The kiln is being used for research, teaching, and industrial assistance programs. The lab also contains resistance moisture content measurement devices, weight based kiln control, thermocouple temperature sensors, airflow meters required to conduct state of the art drying experiments.

Several projects were underway this year in the lab. The lab was used to help provide the General Assembly with new gavels this past session. Wood blocks cut from the Capital Square tree, which had resided near the Virginia General Assembly until Hurricane Isabel brought it down, were dried in the kiln and used to produce a commemorative gavel for each senator and delegate of the Commonwealth of Virginia.

A study comparing the effect of two different drying schedules on lumber quality and moisture content distribution for two white pine timbers was undertaken as part of an industrial extension program for a Virginia log home manufacturer. The calling up of an Army National Guard unit, delayed the completion of an experiment to determine the effect of sticker placement on low grade

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lumber. The main contact for the industrial partner was called to duty amid the experiment. We look forward to his safe return.

An experiment comparing the effectiveness of various end coating products to prevent end grain moisture flow during drying was also carried out. Two loads of lumber, yellow-poplar and white oak, were dried for students learning about lumber drying in WOOD 4524 and WOOD 3534 Lumber Manufacturing and Drying. The students had the opportunity to control the drying process and measure the quality of the finished product as part of their coursework.

For information about the Wood Drying Laboratory, tours or research opportunities, please contact, Dr. Brian Bond at (540) 231-8752 or by email at bbond@vt.edu.

Students in WOOD 4524 operate the kiln in the Wood Drying Laboratory.

Steam Explosion Pilot Plant

Pilot Plant Manager: Bob Wright

In 2004, the steam explosion pilot plant has primarily provided technical support toward the production of research material necessary for two very distinct and different research efforts. In the one case, the smallest of our three steam explosion reaction vessels provided material involving the co-steam explosion of wood and thermoplastic polymers. This has been on-going work over several years and, in fact, was referenced in last year's "Creative Achievements." This year the work culminated in the completion of two graduate degrees. Scott Renneckar successfully defended his dissertation titled "Modification of Wood Fiber with Thermoplastics by Reactive Steam-Explosion Processing" and Richard Johnson successfully defended his master's thesis titled "Mechanical and Sorption Characteristics of Cellulose Fiber-Reinforced Thermoplastic Composites." Both students had utilized the small stirred batch steam explosion reactor extensively.

In the second case Dr. Foster Agblevor continued his work to further develop the empirical knowledge base for the optimization of steam explosion as a treatment step for the utilization of cotton gin waste material as a source of fuel ethanol. The steam explosion process provides essential chemical modification to the waste material and renders it into a more homogeneous mixture of particle sizes. The homogeneity facilitates each subsequent process step in the production of ethanol. Dr. Agblevor is a faculty member in the Department of Biological Systems Engineering, and is making a significant investigation into the utilization of two other agricultural products as a source for enzymatic conversion of cellulose via steam explosion.

The steam explosion laboratory is equipped with three different process vessels and several pieces of ancillary equipment. The process vessels, in size order from large to small, begin with our Stake Technologies Ltd. continuous steam explosion reactor with co-axial feeder assembly. This is a stainless steel pressure vessel with agitation and measures 2 ft. diameter x 24 ft. long (70 ft^3 volume). Material can be processed at pressures up to and including 450 psig working steam pressure and 500°F. The coaxial, mechanical feeder attached has a 6 in. diameter bore and a

Report of Activities – 2004

capacity of 1,750 lbs/hr (oven dry basis) ¾" pulpwood chips. We also have the capability to work with properly sized agricultural residues of any type, properly sized paper products for re-pulping, food waste blended with ligno-cellulose waste materials, thin film plastic waste blended with ligno-cellulose materials, and many other materials including reaction catalysts.

The next size smaller piece of steam explosion equipment is our 0.9 ft.^{3} (20 liter) volume, stainless steel, non-stirred, batch steam explosion vessel capable of 450 psig and 500 °F. The mass capacity depends upon the bulk density of the material being tested. Typically for green wood chips it would be a maximum of 5 lbs., dry basis.

The smallest steam explosion vessel is a stirred batch reactor. It has a volume of 0.13 ft.^{3}, is made of extra-heavy wall stainless steel with a working pressure capability in excess of 1,000 psig, and is configured in a manner that permits *in situ* addition of catalysts and alternate reaction atmospheres.

For information about the Steam Explosion Pilot Plant, tours, or research opportunities, please contact Bob Wright at (540) 231-8838 or by email at rswright@vt.edu.

◀ Richard Johnson and Scott Renneckar at the steam explosion pilot plant.

Richard Johnson adjacent to the 20 liter batchs steam explosion reaction vessel. This equipment was used to provide some of the material required for Richard's graduate research project. ▶

Wood Machining Laboratory

Woodshop Laboratory Manager: David Jones

A 900 square foot woodshop laboratory is maintained at the Thomas M. Brooks Forest Products Center to support teaching, research, and outreach activities of the department. This facility is fully stocked with heavy-duty stationary machinery: 10" Powermatic table saw, 20" Laguna band saw, 14" Powermatic band saw, 800 Maggi Engineering radial arm saw, 12" Makita sliding-compound miter saw, Milwaukee 8" panel saw, 8" Powermatic jointer, 18" Powermatic planer, 13" Delta planer, Craftsman floor drill press and 6" belt/12" disc Delta sanding machine. Additionally, two dry kilns are available for the drying of lumber and other materials. Students in our program receive some training on the operation and use of equipment in the laboratory.

Logs are processed on a Timber King B-16 portable band saw mill. This saw has a cutting capacity of 27 inches, is powered by a 25 horsepower gasoline engine and is equipped with hydraulic log loaders and turners. The mill is used in teaching Lumber Manufacturing and Drying (WOOD 3534) and for custom cutting of lumber for lumber drying research. Once dried, the lumber is used by the department for research and renovation projects.

During 2004, the wood processing facilities at the Brooks center provided a wide range of services.

Teaching

Nearly all courses taught require some type of wood specimens. With the department's focus on student involvement in the learning process many courses provide opportunities for the students to actually work with wood in making specimens for demonstration and testing. In WOOD 4534: Lumber Manufacturing and Machining students followed twenty logs through grading, milling, lumber grading, and calculating lumber yields. In WOOD 4524: Wood Drying and Durability students gained actual dry kiln operation experience by drying the lumber produced in Lumber Manufacturing. In WOOD 4315: Mechanical Properties of Wood, WOOD 4554: Wood-Based Composite

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Materials and WOOD 5314: Physical and Mechanical Behavior of Wood students use the wood shop to mill test specimens for testing in laboratory exercises.

Any student using the wood processing facility is required to participate in a shop safety orientation. This program introduces the students to safe shop practices and actual use of the wood working equipment.

Research

The wood processing facility is utilized extensively in the department's research efforts. Nearly all research requires the processing of wood from cutting rough moisture samples from pallets to exacting adhesion specimens with tolerances within millimeters. During 2004 nine graduate students used the shop to conduct their research projects.

Outreach

The wood processing facility also contributes to the department's outreach mission. The various materials from bending specimens to one inch cube keepsakes are made for Wood Magic. Short course material is also produced in wood shop. During 2004, dry and green moisture samples were made for lumber drying short courses; specimens were machined for visual aids to display actual wood radial, tangential, and end-grain faces for a wood properties short course; wood stands and veneer pieces were cut for short course attendees to make veneer barometers: narrow strips of wood machined in opposite grain directions and glued together to demonstrate differences in tangential and radial shrinkage.

Renovations

During 2004 the wood processing facility was used to produce cabinetry and fixtures needed in the department. Before the Brooks computer lab was updated with eight new computers, the room was renovated with fresh paint, new computer desks and natural wood trim. Currently a project is underway to provide a central location for the printed material resources for our students. In the near future, a wall of bookshelves will be installed for the storage of theses and other pertinent information.

For information about the Wood Machining Laboratory, tours, demonstration of equipment, or research opportunities, please contact David Jones at (540) 231-7342 or by email at dajones@vt.edu.

Dr. Jim Fuller using the bandsaw.

Wood Engineering Laboratory

Engineering Laboratory Manager: Rick Caudill

The Wood Engineering Laboratory located at the Thomas M. Brooks Forest Products Center is a 2,600 square foot high-bay laboratory. Equipment in the laboratory includes a MTS (model 826.75) 50,000 lbs servo hydraulic test system, a MTS (model OME) 20,000 lbs servo hydraulic test system, a MTS (model GL-10) 10,000 lbs screw driven test system, a Endure Tec 50,000 lbs shear wall hydraulic test system, a Environmental Specialists (model CER9-17) walk-in conditioning chamber and a Parameter Generation (model AA-5460A) portable conditioning unit. The Wood Engineering laboratory functions as a flexible testing laboratory and is used by faculty and students for research, graduate student research, demonstrations, and short courses.

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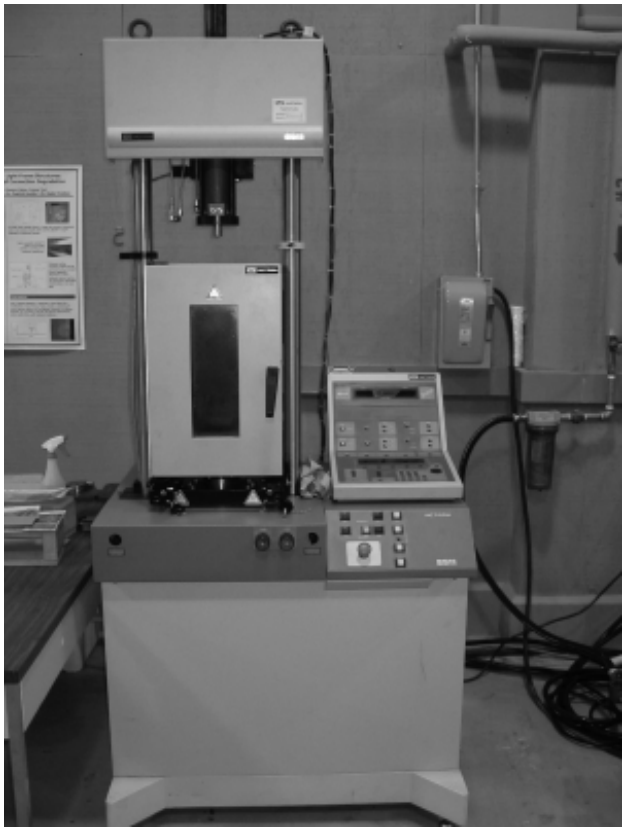
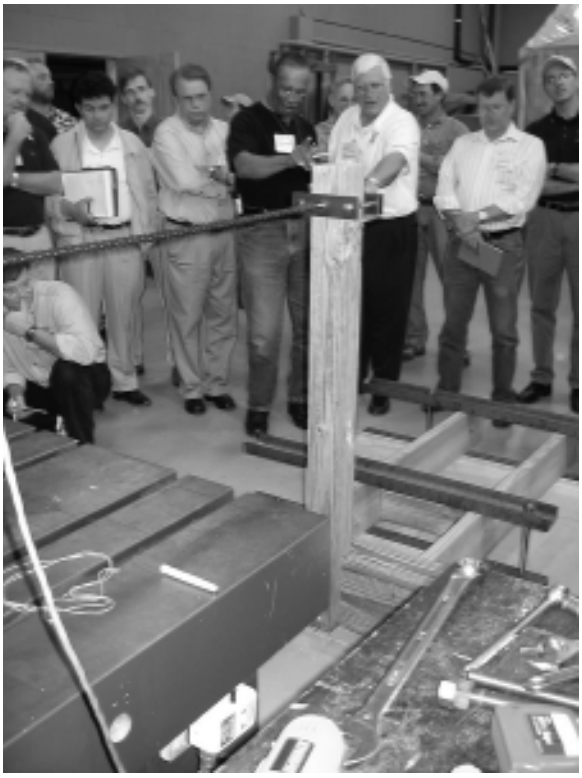
In August 2004, an Instron (Model 8511) 20,000 lbs servo hydraulic test system was donated to the lab by National Starch and Chemical Company. The donation was coordinated by Dr. Charles Paul and Mr. Mike Gefri of National Starch. The test system is equipped with a sample oven capable of testing specimens at temperatures up to 250 degrees C°. The unit includes 50 and 1,000 lbs load cells, with ram travel capability of six inches.



Instron 8511 test system donated by National Starch and Chemical Company.

Use of laboratory equipment has been ongoing throughout the year. Work has included the testing of bamboo plywood, pressure sensitive tape used in the manufacture of pallets, larch hardwood flooring, door panels, wooden decks and guard rails, and various composite products. Drs. Marshall White, Fred Kamke, Joseph Loferski, Brian Bond, and Daniel Hindman have all used laboratory facilities during the year, in additional to several staff members and graduate students. The laboratory was also host to 40 home inspectors as they studied deck connections and guard rail performance during a short course in April.



Home inspectors study deck connections and guard rail performance during a short course in April.

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Academic courses using the lab in 2004 included WOOD 5314: Physical and Mechanical Behavior of Wood, WOOD 4316: Mechanical Properties of Wood, NR 1114: Introduction to Renewable Natural Resources, and CE 5944: Civil Engineering Seminar. The on-campus Wood Magic show used the laboratory for demonstrations and in conducting the *Rock Stars* learning module.

For information about the Wood Engineering Laboratory, tours, demonstration of equipment, or research opportunities, please contact Wood Engineering Laboratory Manager Rick Caudill at (540) 231-7453 or by email at rcaudill@vt.edu.

Metals Machining Laboratory

Machine Shop Laboratory Manager: Kenny Albert

The department maintains a Metals Machine Laboratory for the purpose of fabricating jigs, fixtures, and test equipment used in our wood research, teaching and outreach programs. The metals machining laboratory is located at the Thomas M. Brooks Forest Products Center. The laboratory is approximately 600 square feet of working space. Equipment contained in the Metals Machining Laboratory includes a Miller Matic Challenger 172 welder and a Craftsman 250 amp AC/DC welder. We have cutting capabilities of a Harris Welding torch to burn and cut metal. The Lagun FTV3 milling machine is used for all of our small drilling and cutting needs. A Sigma lathe SN45B has the ability to cut round and some square stock. There are two metal cutting band saws–a vertical Kalamazoo and a horizontal Jet cutting band saw.

Some of the projects that were supported by machining and fabrication in the Metals Machining Laboratory in the past year include fabrication of a drum blender for the wood composites program, and parts for the high temperature/high pressure vessel (wood bomb reactor) for Dr. Fred Kamke.

Also made and modified were testing fixtures for Dr. Daniel Hindman for torque loading of composite structural I-joints and beams. Also, testing equipment for Dr. Loferski's students for testing wood joint connections for decks were fabricated. Creep testing equipment and an incline fork truck impact tester were made for Dr. Marshall White and the Center for Unit Load Design.

The machine shop plays a significant part in all aspects of the Brooks Center testing. Before any testing is done, the fixture and testing equipment is designed, working drawings are prepared, and then the equipment is fabricated.

For information about the Metals Machining Laboratory, tours, demonstration of equipment, or research opportunities, please contact Metals Machining Laboratory Manager Kenny Albert at (540) 231-8323 or by email at albertk@vt.edu.

Metals Machining Laboratory at the Brooks Forest Products Center.

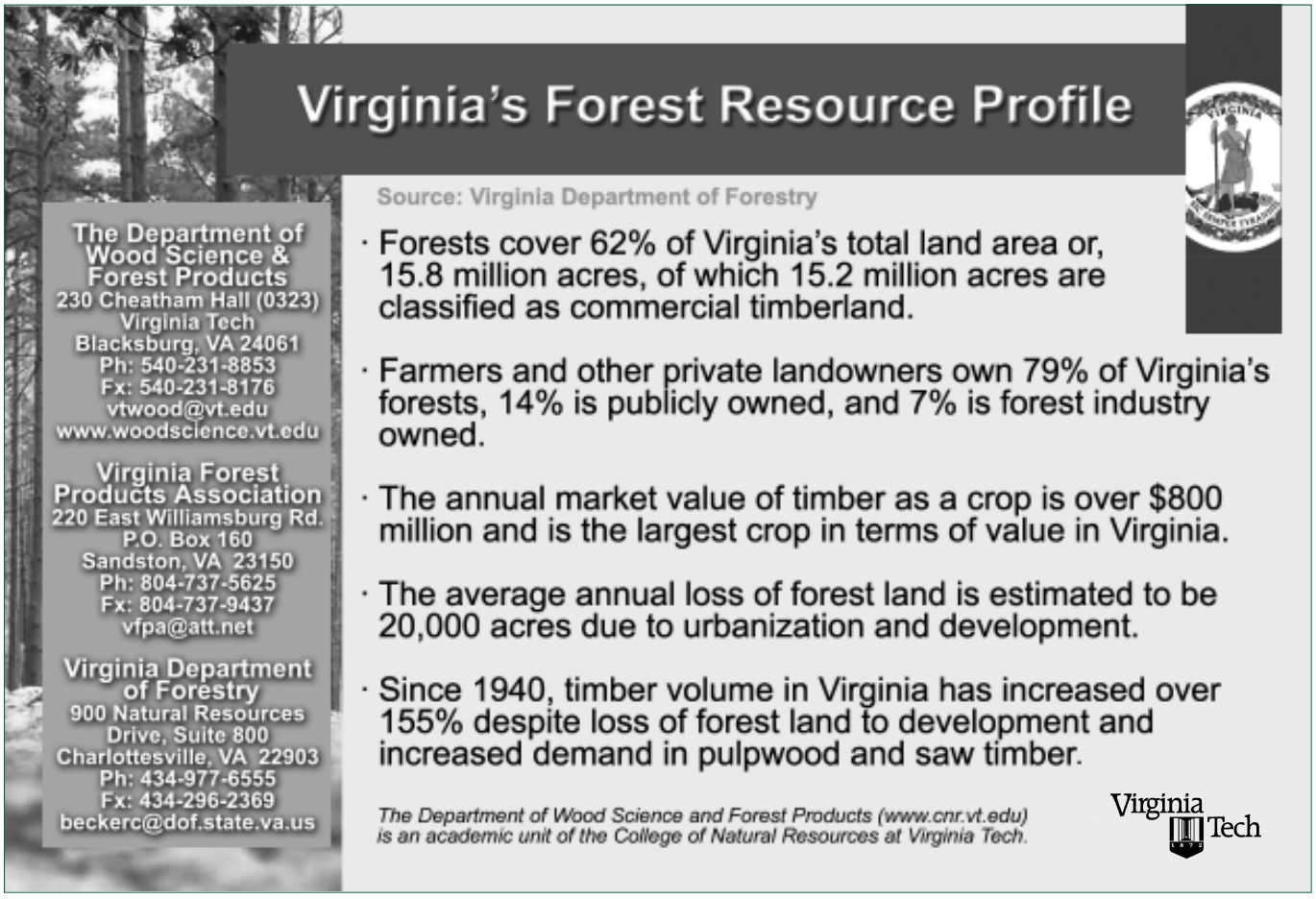
Virginia Forest Products Industry
Economic Profile Information

This is a preprinted postcard. Copies are available from the Department of Wood Science and Forest Products upon request.

U.S. Forest Products Industry
Economic Profile Information

This is a preprinted postcard. Copies are available from the Department of Wood Science and Forest Products upon request.

Virginia Forest Resource Profile Information



This is a preprinted postcard. Copies are available from the Department of Wood Science and Forest Products upon request.

U.S. Forest Resource Profile Information

This is a preprinted postcard. Copies are available from the Department of Wood Science and Forest Products upon request.

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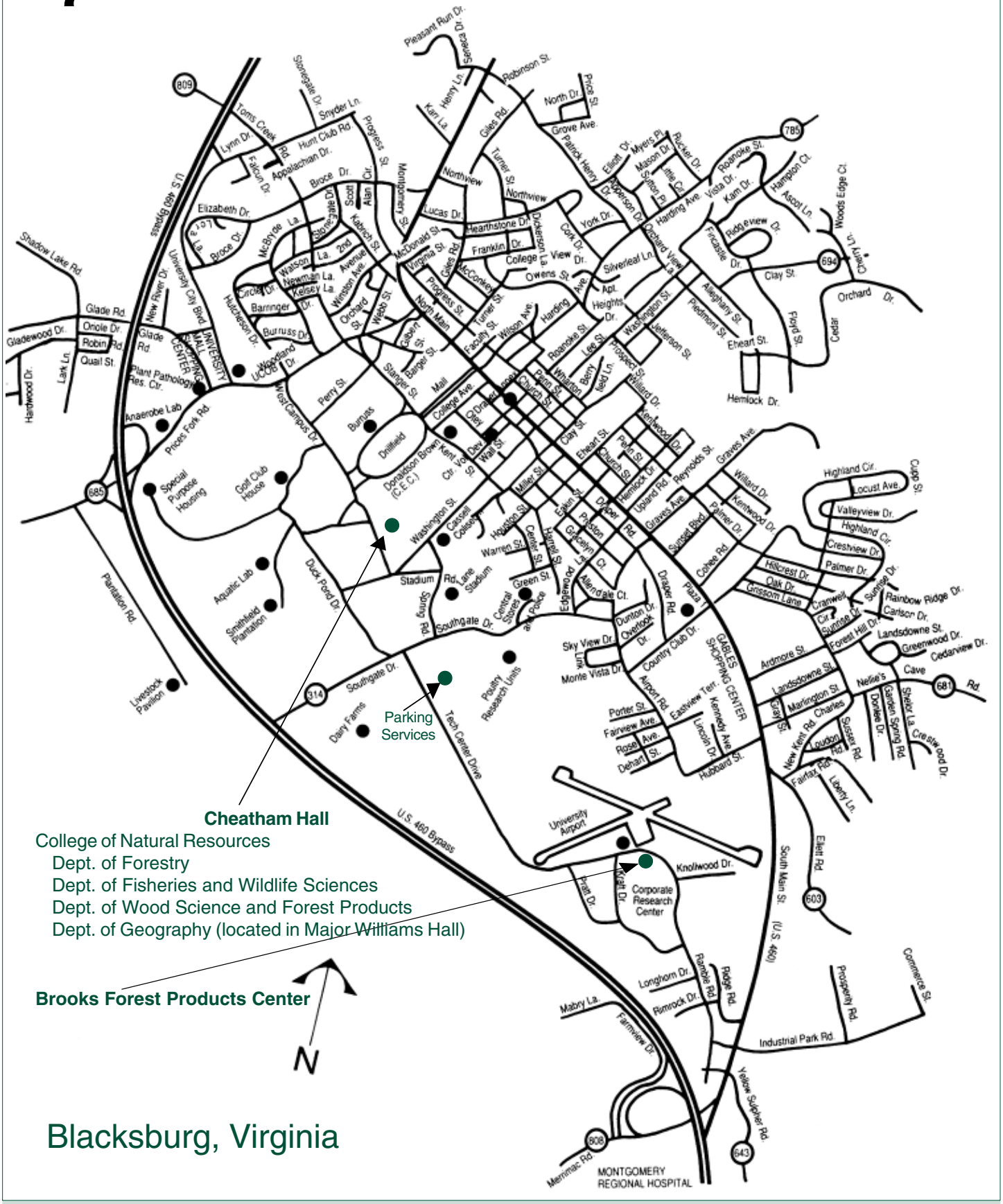
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Acknowledgments

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