

2007 Packaging Summer Programs at Christian Brothers University

S. Malasri¹, A. Ray², Y. Zhou³, J. Ventura⁴, P. Shiue⁵, A. Pourhashemi⁶

Abstract – Christian Brothers University (CBU) is one of 12 packaging programs in the United States. CBU started its packaging program with an elective course in spring 2001. Currently, it offers an undergraduate packaging certificate, a B.S. in engineering management with a packaging concentration, and an M.S. in engineering management with a packaging concentration. Most high school students have never considered packaging engineering as a career. Consequently, CBU has hosted packaging summer programs during the last four summers with support from the International Paper Foundation, Medtronic Foundation, and International Corrugated Packaging Foundation (ICPF). This paper describes two successful one-week summer programs hosted by CBU and funded by ICPF in June 2007: Introduction to Packaging Engineering and Introduction to Corrugated Packaging. In addition to the summer programs, ICPF also funded an after-school packaging workshop for high school students in November 2007. This paper also describes the workshop activities.

Keywords: High school programs, packaging engineering, recruiting, K-12

INTRODUCTION

Packaging engineering is an interdisciplinary field in which scientific and engineering principles are applied to develop and produce packages that contain, protect and preserve, transport, inform, and market products. The packaging industry is large and diverse and generates opportunities for engineering programs due to the required packaging concepts that need science, engineering, technology, and business management principles. In addition, a large percentage of the content of landfills is packaging material, and sustainability is an important issue in packaging. Packaging programs must include the design of packages that optimize the amount of material employed, employ material that are readily recycled, and use environmentally friendly materials. According to the International Corrugated Packaging Foundation's web site at www.icpfb.org, corrugated packaging is a \$25

¹ Department of Civil & Environmental Engineering, Christian Brothers University, 650 East Parkway South, Memphis, TN 38104, pong@cbu.edu

² Department of Chemical & Biochemical Engineering, Christian Brothers University, 650 East Parkway South, Memphis, TN 38104, aray@cbu.edu

³ FedEx Express, 2828 Business Park Drive, Building H, Suite 500, Memphis, TN 38118, yzhou@fedex.com

⁴ Department of Electrical & Computer Engineering, Christian Brothers University, 650 East Parkway South, Memphis, TN 38104, jventura@cbu.edu

⁵ Department of Mechanical Engineering, Christian Brothers University, 650 East Parkway South, Memphis, TN 38104, pshiue@cbu.edu

⁶ Department of Chemical & Biochemical Engineering, Christian Brothers University, 650 East Parkway South, Memphis, TN 38104, apourhas@cbu.edu

billion a year industry. Memphis is a perfect location for a packaging program since it has been a major distribution center with companies such as FedEx, International Paper, and several biomedical firms.

In fall 2000, Christian Brothers University was invited to attend a meeting with representatives of the Memphis-area packaging industry. They were interested in assisting in the development of a local packaging engineering program. In 2001, with support from various companies and foundations, CBU formulated a packaging program. It has become one of only 12 packaging schools according to the Institute of Packaging Professionals' website (www.iopp.org). A special topics course in packaging engineering was offered for the first time in spring 2001. In fall 2002, the course developed into ChE/ME 319 Principles of Packaging as part of the Packaging Engineering Certificate. A second course, ChE/ME 320 Distribution & Medical Device Packaging, was introduced in spring 2003. The Packaging Lab was established in 2003, with almost \$300,000 allocated for packaging equipment during the calendar years 2004 and 2005. In addition, almost \$400,000 was expended on related lab equipment in the Polymer Lab, Solid Mechanics Lab, and Manufacturing Lab. Two new degree programs with packaging concentration were announced in fall 2007: B.S. in Engineering Management and M.S. in Engineering Management [Malasri, 1]. Details of packaging activities at CBU from 2001 to 2006 are described in a recent publication [Malasri, 2].

Packaging career opportunities are not well known to most high school students, teachers, and counselors. Only a handful of universities in the U.S. offer packaging related programs [Kimmel, 3]. To expose students to packaging, CBU has been promoting packaging to high school students through summer programs, after-school workshops, and student packaging competitions for the past five years. Two one-week packaging summer programs and one after-school packaging workshop were offered in June and November 2007, respectively, under a grant from the International Corrugated Packaging Foundation (ICPF).

INTRODUCTION TO PACKAGING ENGINEERING SUMMER PROGRAM

The goal of this one-week summer program was to introduce students to packaging engineering. Twenty-eight students from 21 schools attended the program from June 18-22, 2007. Below is a list of topics covered in this program:

<u>Day</u>	<u>Session (Duration)</u>	<u>Topics</u>
1	Basic Mechanics (45 minutes)	Newton's laws of motion; equilibrium; stress-strain curves, elasticity, ductility, strength, and toughness; static versus dynamic loadings
	Basic Structures (50 minutes)	Forms and shapes; trusses; stability
	Hands-on Balsa Wood Crates (30 minutes)	Explanations of rules; pictures of crates from past competitions
	Field trip to Pratt Industries (180 minutes)	Corrugated board making; box design and manufacturing
2	Introduction to Packaging (100 minutes)	Packaging engineering; the system of packaging science; career opportunities; packaging industry; package test methods; packaging schools
	Hands-on Egg Cushion (50 minutes)	Explanations of rules; containers; cushioning materials
	Field trip to Schering-Plough (180 minutes)	Warehouse management; distribution system

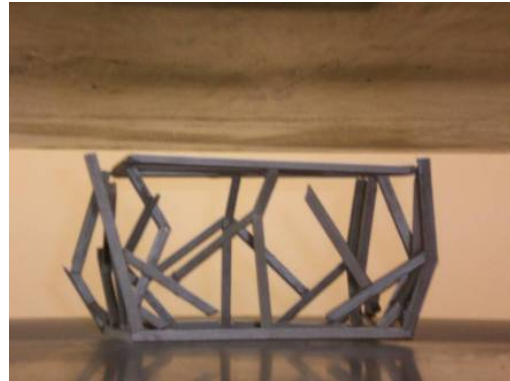
<u>Day</u>	<u>Session (Duration)</u>	<u>Topics</u>
3	Distribution Packaging (150 minutes)	Physical distribution environment and distribution hazards; mathematical model and theory of protective packaging system; product fragility and vibration sensitivity; cushioning materials and properties; compression issues; protective packaging development process; packaging for perishables and temperature sensitive products; packaging testing methods, standards, and systems
	Field Trip to Bryce Corporation (180 minutes)	Flexible packaging operations
4	Hands-on Egg Cushion (50 minutes)	Group work on egg cushion project
	Process Control (50 minutes)	Case studies: 1. Upgrade of the flaking packaging line; 2. autonomous robotics; 3. radio frequency identification in distribution packaging
	Hands-on Balsa Wood Crate (50 minutes)	Group work on balsa wood crate project
	Field Trip to Medtronic (180 minutes)	Medical device packaging operation
5	Recycling (50 minutes)	Ecosystem; types and causes of wastes; examples of various methods of waste reduction; roles and responsibilities of scientists and engineers
	Competitions (50 minutes)	Egg drop and balsa crate crush (See Figure 1 below)
	Keynote Address (30 minutes)	Lunch keynote address on “Why Packaging?” by Robert Larkin of ACH Food Company
	Information Searching (60 minutes)	Information development and flow; copyright and plagiarism; organizing information; academic disciplines; search techniques for finding books and articles; Internet; research project
	College Admissions (60 minutes)	College application process; admission requirements; financial aid; typical deadlines; campus visits

Feedback from students included:

- Most agreed that they had learned more about packaging engineering from this program. (4.6 from 5.0 scale where 5 is ‘strongly agree,’ 3 is ‘not sure,’ and 1 is ‘strongly disagree.’)
- Most still hesitated in choosing packaging as their future career. (2.6 from 5.0 scale)
- Most felt the program was appropriate for their level of education. (4.30 from 5.0 scale)
- Most liked the format of the program. (4.4 from 5.0 scale)
- Most liked field trips (4.7 from 5.0 scale) and hands-on projects (4.5 from 5.0 scale).



Egg Cushion Project



Balsa Crate Project

Figure 1. Hands-on Projects

INTRODUCTION TO CORRUGATED PACKAGING SUMMER PROGRAM

The goal of this one-week summer program was to introduce students to corrugated packaging. The previous program or similar program offered in previous summers is a prerequisite for the corrugated packaging program. Twenty-six students from 20 schools attended the program from June 25-29, 2007. Twenty-three of these students had attended the “Introduction to Packaging Engineering” the week before and three had attended a similar program in summer 2006. Below is a list of topics covered in this program:

<u>Day</u>	<u>Session (Duration)</u>	<u>Topics</u>
1	Introduction to Corrugated Packaging (45 minutes) Overview of CBU Packaging & Other Engineering Labs (100 minutes) Field Trip to Buckeyes	Paper and paperboard; paper types; paperboard cartons; corrugated packaging; different levels of packaging including use of corrugated box Lab tour; drop tester; shock machine; vibration table; compression table; sample table; temperature/humidity chamber; altitude chamber; universal testing machine; instrumentation; CNC machines; injection molding machine Paper pulp manufacturing; various lab tests
2	Corrugated Fiberboard (100 minutes) Hands-On Lab (50 minutes) Field Trip to Weyerhaeuser	Corrugated fiberboard; fiberboard components including flutes; fiberboard manufacture; properties; tests; carrier rules and regulations; box design variations Crush tester; altitude chamber; temperature/humidity chamber Corrugated board manufacture; box design and manufacture
3	Container Design (100 minutes) Hands-On Lab (50 minutes) Field Trip to FedEx	Corrugated fiberboard construction, grades, and adhesives; McKee formula; corrugated board properties and tests; Mullen burst test; edgewise compression test; box dimensions; loading orientation; flute direction, joints, selection; box styles and design variations; carrier rules/regulations and box certificate Container design software Containing testing

<u>Day</u>	<u>Session (Duration)</u>	<u>Topics</u>
4	Distribution Environment (50 minutes)	Warehouse and handling; package sorting and handling; manufacturer self operated distribution system; common carriers; third party logistics; transportation modes
	Hands-On Lab (50 minutes)	Compression test; shock test; drop test; vibration test; sample table (See Figure 2 below)
	Field Trip to Wurzburg	Packaging suppliers; special applications of corrugated boards
5	Materials (100 minutes)	History of evolution of packaging materials; modern materials; glass and metals; paperboard and corrugated fiberboard; plastics
	College Study Options (50 minutes)	Various packaging related options; various engineering and related disciplines
	Keynote Address (30 minutes)	Keynote address on “Sustainability” by Greg Ketron of Pratt Industries
	Career Opportunities (90 minutes)	Panel discussions with industry representatives

Feedback from students included:

- Most agreed that they had learned more about corrugated packaging from this program. (4.2 from 5.0 scale where 5 is ‘strongly agree,’ 3 is ‘not sure,’ and 1 is ‘strongly disagree.’)
- Most did not want to choose corrugated packaging as their future career. (1.6 from 5.0 scale)
- Most felt the program was appropriate for their level of education. (4.1 from 5.0 scale)
- Most liked the format of the program. (4.1 from 5.0 scale)
- Most liked field trips (4.5 from 5.0 scale) and hands-on activities (4.6 from 5.0 scale).



Figure 2. Hands-on Activities

PACKAGING WORKSHOP

Due to the success of the two summer programs above and the need for a shorter workshop for high school students who do not have time for a summer program, an after-school corrugated packaging workshop was offered on November 6, 2007. There were 30 students from five schools at the workshop. The program was at its capacity due to popularity of the summer programs; thus another workshop was offered on January 24, 2008, for another 30 students.

The program includes

- Corrugated box design using ArtiosCAD
- Corrugated box preparation using Kongsburg sample table
- Corrugated box testing including drop, vibration, shock, and compression tests
- Career opportunities – industry panel discussion

The workshop was well received based on student feedback. Figure 3 shows some of the activities at the workshop.



CAD Session



Drop Test

Figure 3. Package Design & Test

CONCLUSIONS

Christian Brothers University has increased the awareness of packaging opportunities to high school students in the past five years through summer programs, after school workshop, and hands-on competitions. The attendance by students of these activities has increased, and more high school students have become aware of such packaging opportunities. The packaging industry has also been supportive in these activities through grants, field trips, and speakers. For more information about future packaging activities for high school students, please check the CBU packaging web site at <http://www.cbu.edu/engineering/packaging>.

REFERENCES

- [1] S. Malasri, N. Jackson, and J. Olabe, "M.S. Engineering Management with Packaging Concentration," *Proceedings of the 2008 ASEE Southeast Section Conference*, Memphis, TN, April 6-8, 2008.
- [2] Siripong Malasri, Asit Ray, and Yongquan Zhou, "Packaging Engineering: Responding to Industry Needs & Market Change," *Proceedings of the 27th Annual National Conference of the American Society for Engineering Management*, Huntsville, AL, October 25-28, 2006.
- [3] Robert M. Kimmel, "Undergraduate Labs in Applied Polymer Science – A Case Study," *Proceedings of the 2002 American Society for Engineering Education Annual Conference & Exposition, American Society for Engineering Education*, Montreal, Quebec, Canada, June 16-19, 2002

Siripong Malasri, Ph.D., P.E.

Dr. Malasri is a professor of civil and environmental engineering. He received his Ph.D. from Texas A&M University. His background includes construction management, structural engineering, solid mechanics, material testing, artificial intelligence, and optimization. He was instrumental to the establishment of the packaging engineering program at CBU during his term as engineering dean from 1999-2005. Currently, he serves as packaging activities coordinator. He was on editorial boards for *International Journal of Engineering Education* and *Journal of Professional Issues in Engineering Education and Practice*. His recognitions include Outstanding Engineer of the Year (Tennessee Society of Professional Engineers), Award of Excellence (Memphis-Area Joint Engineers Council), Distinguished Lasallian Educator (CBU), and Douglass J. Thomas Chair in Engineering (CBU).

Asit Ray, Ph.D.

Dr. Ray is a professor of chemical engineering at CBU. He earned his Ph.D. from Lehigh University and has over 20 years of teaching/research experience at Auburn and CBU. Dr. Ray spent seven years in the polymer industry, and was four times a NASA/ASEE Summer Faculty Fellow engaging in polymer research at NASA Kennedy Space Center and Langley Research Center. He is actively engaged in laboratory research in polymeric and biomaterials in collaboration with professors from the University of Memphis and Rhodes College and has published over fifteen refereed papers. Dr. Ray co-teaches packaging classes with Mr. Yongquan Zhou. He also serves as the Coordinator of the Packaging Engineering Certificate and Lab at CBU. He was recognized as the 2003 Featured Engineering Faculty by the School of Engineering at CBU.

Yongquan Zhou, CPP

Mr. Zhou is a project engineer in Packaging Design and Development at FedEx Corp. and is an adjunct faculty for the School of Engineering at CBU. He received his B.E. in packaging engineering and M.E. in mechanical engineering from the Wuxi Institute of Light Industry in China, and his M.S. in packaging science from the Rochester Institute of Technology. He is currently working on his Ph.D. at Mississippi State University. Mr. Zhou is a Certified Packaging Professional (CPP) with more than 20 years of experience in the packaging industry, academic classrooms, and research and testing laboratories. Mr. Zhou serves on various IoPP, ASTM, and ISTA technical committees, and was an IoPP AmeriStar Packaging Competition judge from 1997 to 2001. He has published articles in *Packaging Technology and Engineering* and other magazines.

John Ventura, Ph.D., P.E.

Dr. Ventura is an associate professor and Chair of Electrical and Computer Engineering Department at CBU. He is a senior member of IEEE and a professional registered engineer in Mississippi. He received a Bachelor of Science in Electrical Engineering from Christian Brothers College, a Master of Engineering from the University of Florida, and a Ph.D. at the Graduate School of Computer and Information Sciences at Nova Southeastern University in Fort Lauderdale, FL. Dr. John Ventura designed and built a manufacturing facility for Mebane Packaging Corporation, a manufacturer of folding cartons, in Greenville, MS. IEEE and CBU recognized John as the 2006 Featured Engineer of the Year, and the Tennessee Society of Engineers recognized him with the chapter-level and state-level 2006 TSPE Distinguished Service Awards.

Paul Shiue, Ph.D.

Dr. Shiue is a professor and chair of Mechanical Engineering Department at CBU. He received his B.S. from Tatung University in Taiwan and his M.S. and Ph.D. degrees from the University of Memphis. He is an associate member of the American Society of Mechanical Engineers and a professional member of the American Society for Engineering Education. Dr. Shiue is also a member of editorial advisory board of the *International Journal of Engineering Education* and served as guest editor of a special issue in manufacturing engineering education. He was five times a NASA/ASEE Summer Faculty Fellow at Marshall Space Flight Center. Currently, he is focusing on concurrent engineering and design through manufacturing and product realization processes.

Ali Pourhashemi, Ph.D.

Dr. Ali Pourhashemi is an associate professor and chair of Chemical and Biochemical Engineering Department at Christian Brothers University (CBU) in Memphis, TN. He earned his B.S and M.S. degrees from Howard University and Ph.D. from University of Maryland, College Park. He has taught various courses including process design and developed laboratory experiments in chemical engineering. He has authored and co-authored various publications in the areas of heat and mass transfer. He has served as a technical committee member and session moderator at technical conferences. Dr. Pourhashemi is a member of AIChE, and he was recognized as the 2003-Featured Engineer by the Memphis Joint Engineers' Council (MJEC).