



# Thermofforming

## Quarterly®

A JOURNAL OF THE THERMOFORMING DIVISION OF THE SOCIETY OF PLASTIC ENGINEERS

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*The Sky's The Limit*

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Scholarship Winners

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## Thermoforming Quarterly®

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**A**s we close out the summer, we forge ahead with renewed interest in the growth and anticipation of business success. On behalf of SPE, I would like to welcome you to our annual conference in Milwaukee, Wisconsin, September 18th through September 21st. More than ever, this conference is provided as an opportunity to help and inspire you to continue developing your strategies. As you canvass the exhibit hall and participate in the high quality technical programs, I want to encourage you to find new ideas and new opportunities. The participating vendors and experts are here to both educate and inspire you and your company with new innovative concepts such as energy saving devices and process-enhanced capabilities.

The conference, sponsored by your SPE Thermoforming Division, provides a single location in which will be showcased the latest innovations in material science and process techniques, as well as machinery developments and tooling disciplines. We encourage you to bring your ideas and your questions to the conference. Within the walls of the conference center, the Thermoforming Division has a mass array of innovation briefs. It is here that your networking skills will be amplified

as many of the best connections and conversations are made in the hallways.

In the days and weeks following the conference, I encourage you to grow your business with the same enthusiasm you experienced during the conference. In and around your plant, meet with all of your co-workers. Provide them with the details and innovations you have learned while in Milwaukee. Chances are this interaction will spark dialog on new grounds of process improvements. More importantly, a challenge to your co-workers will get them involved with ideas and possible innovations. Next year, they too may attend the conference and experience firsthand the excitement of this great event!

So how is your business doing? Indications show that some areas of the country are feeling a slight increase in traffic in new product development. Other areas are still struggling. Throughout my discussions with many thermoformers, all agree that there is still uncertainty in our future. However, even with this uncertainty, some are very blessed with current levels of production.

Our work is still not done! We need to educate our audiences that thermoforming is the process of choice. We need to increase our education practices for customers on new materials that we can offer and the effects on part performances. Our websites should explain that our process is repeatable. If the product is designed with thermoforming in mind, it can and will meet the client's requirements, but in most cases, it will exceed their requirements while decreasing the time to market.

While keeping the doors of your business opened, there is still another challenge out there. Each of us needs to keep current with political issues on the local, state and of course the federal levels. Keeping the doors open and production lines flowing effortlessly may be the

easy part compared with staying current on political issues these days. Our government has new taxation looming around the corner while telling businesses how they should operate. New laws and government involvement will impact all manufacturing sectors. I ask you to stay politically current as you focus on your core business. Strive to develop new process techniques and business relationships. This will not only improve your bottom line but also may help save a little green outside! Be aware of what our elected officials are saying and doing.

Moving past politics, there is some positive news to report. This past year your SPE Thermoforming Division was selected to receive the Gold Pinnacle Award as recognition for creating outstanding member value within SPE. It is a true testament of the hard work that this organization has compiled these past years. Way to go! We also thank all our members for their help and support making this award possible.

With this quarterly issue also comes sad news. As Chairman, it is my duty to inform you of the passing of two fellow members from our thermoforming industry: William K. McConnell on June 5th and David M. Bestwick on July 18th. Both were a true inspiration to our industry and will be greatly missed. The SPE Thermoforming Division and associated industries would like to extend our thoughts and prayers to their families.

Thank you for your continued support and get the word out: Do Thermoforming!

If you have any view points or comments please feel free to contact me. I would like to hear from you. |

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# Thermoforming in the News

## Plastics Packaging: Sonoco requires APT, leading CPET tray thermoformer

By Matt Defosse, [PlasticsToday.com](http://PlasticsToday.com)  
Published: June 30th, 2010

Associated Packaging Technologies Inc., which claims to be the world's leading processor of crystallized polyethylene terephthalate (CPET) trays, has been scooped up by Sonoco, one of the world's largest packaging processors. Sonoco paid about \$120 million all-cash for APT, a price that includes the cost of paying off various obligations of APT.

Why APT? In a statement, Harris DeLoach Jr., president and CEO at Sonoco, explained, "With this acquisition, Sonoco has significantly expanded its existing thermoforming plastic container capabilities into the growing global frozen, chilled and ready-to-eat food markets. While APT is today the leading global supplier of CPET containers, we believe its proprietary material formulations and rotary thermoforming technology provide a strong platform for significant product development and growth. In addition, this acquisition will help accelerate Sonoco's current development of multilayer barrier polypropylene food containers."

Sonoco expects the acquisition to be modestly accretive this year and is expected to generate annualized sales of approximately \$150 million. APT was previously

majority owned by investment funds controlled by Castle Harlan Inc.

APT runs thermoforming facilities in Ontario, Canada; at two sites (Chillicothe, MO and Waynesville, NC) in the U.S.; and at Carrickmacross, Ireland, and employs more than 400 workers. CPET trays are dual-ovenable (conventional and microwave) and see use primarily in packaging of ready-to-eat frozen meals. APT's capacity is enough to process some 3 billion CPET

containers annually; it standardizes on extrusion machinery from Davis-Standard and thermoformers from Lyle.

Last year, APT announced it was adding polypropylene and multi-layer film extrusion and thermoforming capacity to its Cambridge, ON facility, raising capacity there by about 8 million lbs./year. It also was the first processor in the U.S. to thermoform frozen meal trays incorporating post-consumer recycled plastic. |

## Thermoforming Division Receives Gold Pinnacle Award

The Pinnacle Award recognizes achievements by SPE Sections and Divisions that successfully create and deliver member value in four categories: Organization, Technical Programming, Membership, and Communication. Two levels of the award are available – Silver and Gold – and the Thermoforming Division received a Gold Pinnacle Award this year.



*Pictured are Roger Kipp, Councilor (left) receiving the award from Paul Anderson, 2009-2010 SPE President, at the Leadership Awards Luncheon at ANTEC in Orlando, Florida this past May.*

# In Memoriam

## William Keller McConnell, Jr.

The Thermoforming Industry has suffered a great loss with the passing of William "Bill" K. McConnell, Jr. If one individual could be identified as a major contributor to the technical growth of our industry, it would surely be Bill. Founder and President of the McConnell Company, Inc., Bill died on June 5, 2010 after a very short illness. Over the years, as a consultant to the plastics industry, Bill became a colleague, a mentor, an instructor and a good friend to countless people in our industry and those associated with it.

Active in the thermoforming industry since 1948, Bill McConnell was a dedicated alumnus of Texas A&M University where he majored in Aeronautical Engineering. He spent the WWII years teaching aerial navigation for the Navy. In the post-war years, he started and operated a non-scheduled airline for two years. His personal life, as well as his business life, represented a full palate of activities. He and his wife Pat raised three sons: Sandy, Steve and Scott. With the support and care of his family, Bill found time for camping, traveling and consulting. Until her death in 2001, Pat was a major support in all phases of his professional career.

In India, the most revered individuals in society are the teachers who share their knowledge to improve the lives of others. This status can most certainly be applied to Bill. It would be impossible to count the number of people in our profession that were taught and influenced by Bill McConnell. He was a person who gained and held the respect of countless individuals due to his dedication and caring attitude. Much of his consulting work was done in manufacturing analysis, assistance in product development, process troubleshooting, in-house training seminars and development of processing specifications. He was regularly asked to be an expert witness and consultant to the legal fields on plastics-related projects. Bill's pioneering contributions to the plastic industry are well recognized. He was one of the innovators in thermoforming and plastic processing for the industrial and aerospace industries.

In his early years in plastics, Bill McConnell gained 14 years of invaluable experience in thermoforming, injection molding and blow molding as vice-president and General Manager of Texstar Plastics, a custom processor and thermoplastic sheet laminator. Using his knowledge, he organized a



manufacturer's representative business dealing in plastic sheet, film and equipment. After 20 years, he sold this business to a long-time employee and founded AAA Plastic Equipment, Inc., a manufacturer of shuttle and rotary thermoforming equipment, where he served as CEO and General Manager. In 1966, AAA Plastic Equipment joined the SPI. Bill was active on the Machinery Division Safety Committee until 1976.

In 1960, Bill founded McConnell Company, Inc., and served as President and Owner until his death. What started as a sales representative business became internationally recognized as one of the premier thermoforming consultant companies in the world. Excelling in offering technical advice and services, Bill enjoyed bringing all of his experience together to help companies succeed. His associate partners will endeavor to carry on his work and legacy.

Since his early career, Bill McConnell has earned many awards. He received the first annual "Thermoformer of the Year" award from the Thermoforming Division of the Society of Plastics Engineers. He was also one of the 136 Fellows of the Society, out of 36,000 members. In 1997, he was honored

with a "Lifetime Achievement Award" at the Thermoforming Conference and also inducted into the Plastics Pioneers Association that same year. He was the first Thermoformer for this group. Bill has been a member of SPE since 1953 and has served as an International Membership Chairman, Education Chairman and President of the North Texas Section. He was one of the founding members of this Division and was a former chairman. Since 1972, he conducted two-, three- and four-day thermoforming seminars for the SPE. Bill has also taught international seminars in England (Rubber & Plastic Institute), Belgium, Denmark, Australia, South Africa, Canada, and Mexico. He served on the Board of Directors of the Thermoforming Division until his passing this year.

As well as seminars and lectures, Bill wrote many articles on all phases of thermoforming, including contributions to textbooks and publications including the *Modern Plastics Encyclopedia*. He wrote the thermoforming chapter for the "Handbook of Plastic Materials and Technology" by Irvin Rubin. His textbook, "Thermoforming Technology," is used as the manual in his seminars. Bill also created a special training course for designers and engineers on what can and cannot be done in thermoforming.

Anyone who has had the privilege of meeting and learning from Bill McConnell understands that his joy of people and his dedication to helping them achieve success was his goal in business and in his personal life. He will be remembered for many different attributes which include his colorful airplane ties and for his special motto "If you can't measure it, you can't control it."

Our thoughts and prayers are with Bill's family. His memory will continue to serve as an inspiration for the many people that knew him, and for those who will benefit from his pioneering spirit. |



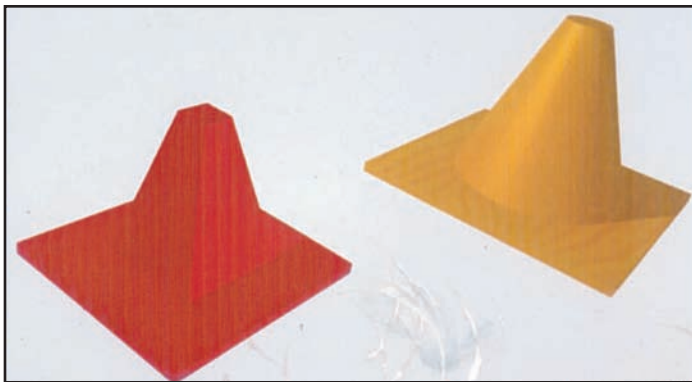
Lifetime Achievement Award



# Undercuts & Tooling Design for Heavy-Gauge Thermoforming

Art Buckel, Associate Consultant, McConnell Co., Inc.

When I first found vacuum forming in the late 1960s as a way to manufacture plastic parts for my customer's needs, I was advised by the "old pro" that vacuum form molds were all truncated pyramids or cones [see *Illustration 1*]. In other words,



**Illustration #1.**

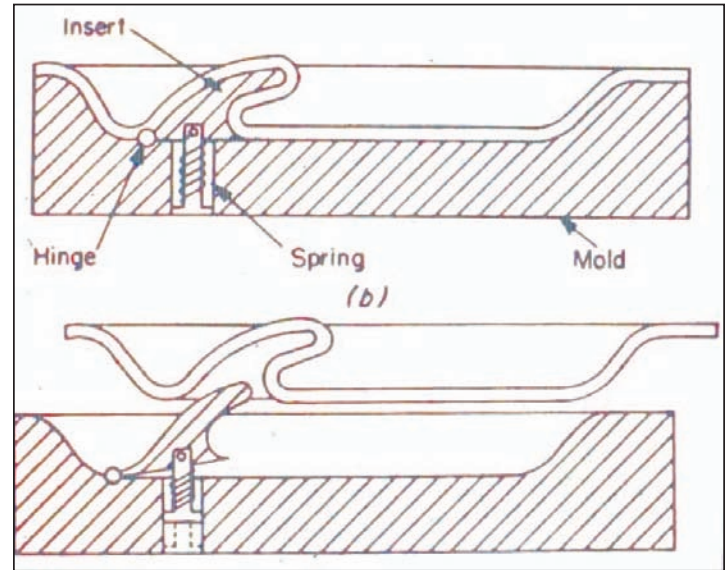
parts with no pointy tops and very heavy draft on all sides. When I suggested that it would be extremely difficult to sell these shapes to all customers without considerable modifications, he agreed and said "of course you can lengthen the parts, and widen them, and use various different heights, and add rounded corners – but always retain the original thought."

My great pleasure of the last 40 years has been to design molds for every conceivable market and application: parts with sides with no draft or reverse draft; undercuts in one or more locations; some that have undercuts around the entire base. However, I have always retained that original thought: "Design the mold to give the customer exactly what he needs while ensuring that the formed part releases as easily as possible." Put another way – design for ease of manufacture.

In this article, we are going to look at a number of vacuum formed and pressure formed parts with undercuts ranging from quite simple to very complex and how the mold was designed to meet the customer's need.

## Keeping it Simple

One of the simpler things to achieve in a vacuum formed part is a handle on the front panel of a cabinet or a drawer front. You should design the part with a scooped-out section as long as you wish the handle to be, usually about 5-6" in length, with the hand-grab in the center [see *Illustration 2*]. With the profile of the hand-grab flowing into the ends of the scooped area (where



**Illustration #2.**

the undercut section is a separate piece) the hot plastic material will flow down into the recess, over the shape, and back up the other side of the scoop. Since the loose section is hinged at the top edge with a coil spring under the other edge, the loose section will rise at the undercut edge when the cooled part begins to release from the mold. It will then lift up until the formed part clears the overlaying section. At this time the part is free of the mold and the handle section snaps back into place ready for the next hot sheet to form. With the proper design and fabrication of the mold, this action will repeat thousands of times with little or no problems. It is perfect for use on high volume production on a rotary machine.

Another good way to create an undercut handle is with a loose part to create the hand-grab. This technique is typically for use on smaller part quantities run on a single-station machine. For example, a section of heavy-walled PVC or ABS pipe about one half inch in diameter is used. Design the mold with the same scooped-out area and a wall running the length of the cavity one half inch lower than the face of the panel. At both ends of the cavity, build stops that create areas that contain small steps on the sides for the pipe to butt up against and to retain the pipe when it is inserted [see *Illustration 3*]. When the hot sheet forms over the pipe section it will create the undercut hand-grabs and carry the loose part away.

*Illustration 4* shows a mold for forming a display rack of greeting cards with an undercut riser in the front to prevent the cards from slipping out of their proper display space. The moving section of the mold is a flat piece of aluminum stock with two pivot hinges at the rear corners, and a return spring under the part. As the hand in the photo shows, when the formed sheet is cooled and begins to





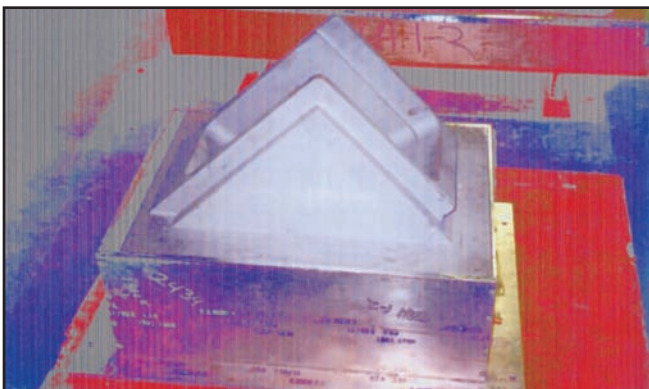
**Illustration #3.**



**Illustration #4.**

release from the mold, the undercut section lifts the flap until it is clear. The mold section then snaps back into place, ready for the next hot sheet. This mold is about 45" x 27" with many hinged sections.

Some undercuts shown in preliminary drawings of the required plastic part appear to be a real problem as the part design does not lend itself to a moving section in the mold [see *Illustration 5*]. On the right edge of the part is a severe undercut. For the mold



**Illustration #5.**

design solution [see *Illustration 6*], where the mold platen surface is separate from the platen box, there are two pins in the walls of the box which create two pivot points. Note that the pivot points are not in the center of the mold. The platen surface rests on a ledge inside the platen box, on the undercut side only. When the hot sheet



**Illustration #6.**

has formed and cooled it begins to dismount the mold, lifting the undercut end of the mold until it clears the undercut allowing the mold to drop back to its forming position ready for the next hot sheet.

Products that have been in great demand for a number of years are "work in process containers" that will stack using projecting sections on the outside of the containers [see *Illustration 7*].



**Illustration #7.**

A two-up mold to form this type of product is shown with the moving sections along both sides and around the corners onto the ends, which are made up of four sections. At the bottom of the molds are steps that form a "step surface" inside the plastic part where the projecting section can rest and be contained on the sides for good stacking. The design of the four moving sections is achieved by using pivot pins at the extreme ends of the short sections. When the ends of the long side sections are pulled into the mold, they cause the loose sections to move entirely within the mold [see *Illustration 8 on page 10*] allowing the formed and cooled material to dismount the mold. The movement of the sections can be induced by pneumatic or hydraulic cylinders or electric motors, pushing and pulling the sections.

## TPO Front Facia Example

The next part we will examine is a TPO front facia required by the French auto manufacturer Renault for limited production in South America. Because the part swept around the complete front of the auto, and then turned in at the front wheel openings on both sides, it created a severe undercut at each end of the mold. There were two important customer requirements that were critical to this project:

*(continued on next page)*



**Illustration #8.**

1. Absolutely no mark on the outside indicating any separate mold sections.
2. Uniform material thickness over the entire plastic part.

The design answer was to build loose undercut parts that would slide up inclined ramps on the main body of the mold [see *Illustration 9*]. However, the most important requirement of the



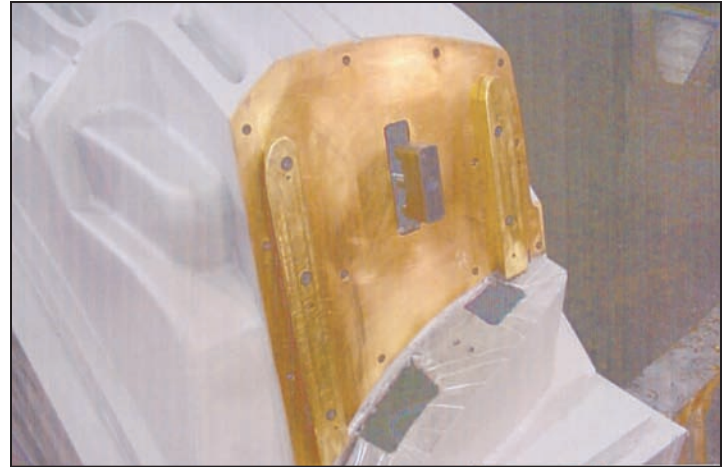
**Illustration #9.**

mold design was to guarantee the “no mold mark” on the finished parts over large production runs. An additional challenge was how to get the two heavy moving sections easily up the slide until the plastic part was freed, and then how to “gently” get the mold sections back down the ramp without slamming the bottom rests.

#### ***Achieving the “No Mark” Requirement***

The two end sections were cast of aluminum as was the main body of the mold. They had cooling lines cast in them, connected to the lines in the main body of the mold with flexible woven steel tubes [see *Illustration 10*]. It was important that the aluminum behind the bronze plates, on which the two moving sections slid, were temperature-controlled with cooling lines. (*Author’s Note: NEVER build a mold with sliding sections moving on similar metals. They will cause galling of the aluminum surfaces and metal pieces will come off of the contact area, which will soon lead to binding.*)

Notice in *Illustration 10* how the two guides are built in to control the positioning of the sliding part. Also, the pivoting lock in the center of the bronze plate that secures the end section when it is down in the forming position is turned by an electric motor: one direction to lock, and reverse to unlock when the part is formed and cooled. It is critical to remember not to use the hollow of the



**Illustration #10.**

mold as a vacuum chamber! When the vacuum comes on, and the ambient air pushes the hot sheet onto the mold, it will tend to move any loose part no matter how tightly it is locked in place, because there is no equal pressure pushing back.

When designing a mold with loose sections that must not leave a mark, you will be amazed at how well it will work if you run a vacuum manifold through the mold and run flexible tubes from the manifold to the inside surface of the mold at all of the vacuum holes. During forming, the inside of the mold has the same ambient air pressure as the room in which it is being formed and the inside of the mold is pushing back against the pressure caused by the vacuum forming of the sheet. Thus the loose section will not move during the vacuum forming period.

To handle the weight of the two moving end sections, each one has a steel cable fastened to it that runs through a hole in the bronze plate, over a pulley, and is secured to a counterweight within the body of the mold. The counterweight hangs in a tube, and as the part begins to dismount the mold, the ends moved up the slides quite easily due to the falling weight inside the mold. When the formed plastic part undercuts have cleared the moving mold sections, they slide down the ramps slowly due to the resistance of the weights. Each counterweight reduces the sliding section of the mold from a true 34 pounds to a lifting and falling weight of only 4 pounds.

What is probably the most common undercut in today’s thermoforming industry is the pressure formed housing with a return at the base (either partial or completely around the base.) Since the pressure formed housing is formed into a cavity mold, the return is formed with an over-hanging aluminum section at the top of the mold [see *Illustration 11* – the brown section at the bottom of the mold is a piece of a formed part that protects the molds textured surface when it is not in use].

I have selected this particular example because of the complexity of the total design, Notice the severity of the undercuts in the four corners, each more than 1" deep [see *Illustration 12*]. In order to form these corners with adequate material thickness, I designed four articulating pushers in the corners of the plug. These pushers were pieces of aluminum stock with wooden shapes on the forming ends. The aluminum was shaped to fit into the plug where it had a pivot point, and the other end extended out of the side of the plug where it rested on the top surface of the hot sheet as the plug pushed the material down into the cavity of the mold [see *Illustration 13*





**Illustration #11.**



**Illustration #12.**



**Illustration #13.**

*showing fingers pushing the extended ends of two of the pushers, which cause the wooden sections to move out into the undercut section of the mold]. As the plug moves down into the bottom of the mold, the hot forming sheet laying over the top of the overcut sections of the mold, pushes the aluminum ends up and into the plug, pivoting the pushers out and pushing the hot sheet back into the deep corners. This design produced large quantities of pressure formed parts.*

There are a number of ways to design this overhang in the cavity mold that produces the undercut. The first and simplest way is to use one or more loose tooling sections that fit into a special opening at the mold's upper edge and come out in the formed plastic part, as shown in the previous example. The loose parts are then removed from the formed part, and placed back on the mold while the next sheet is heating. With 2 or more loose sections on adjoining sides, the corners will usually meet at 45° angles.

Other ways to move the over-hanging mold sections away from the main mold cavity during part removal include:

1. Hinge the loose sections at the rear lower edge, so that the sections swivel up and back as the part dismounts the mold until it clears the undercut area of the plastic parts which then drop back into the forming position.
2. Move the loose sections horizontally back into the mold body to clear the formed plastic part during its removal from the mold. Then move the loose sections back into the forming position.
3. The movement of the mold sections can be caused by the use of pneumatic or hydraulic cylinders, or electric motors. A ring gear and pinion is often used to move large, heavy sections.

This article is offered to not only assure the readers that you can create molds with undercuts, but also to emphasize that it is most important to create good designs of the critical mold sections. It is always a good idea to cut out a cardboard of the moving section, to scale, and pin it over the drawing to proof the design and determine that there is no interference. |

## SPE Veteran Recognized by Western Plastics Pioneers



**Art Buckel was recently recognized by the Western Plastics Pioneers Association and was conferred with their Hall of Fame Award for his outstanding achievements to the plastics industry.**

**The objectives of the Plastics Pioneers Association shall be to recognize achievement in the field of plastics/polymer science, engineering, technology and management; to support industry-wide educational programs; and to promote the study and improvement of plastics, science engineering and technology.**



# Texture in the Digital Age

Chris Spellman, Sales Engineer, Mold-Tech, Carol Stream, IL

The process of texturing molds has always been recognized as an artistic and as a craft-based process. A look inside the texturing process will reveal the technician applying his tools using the smallest of fine-tip paintbrushes and X-acto knives, all being done under the highest magnification possible. As mold-making has moved squarely into the CAD/CAM world, texturing, like mold polishing, has remained an art form. While this remains true today, there are new technical developments that are having a significant impact on quality and cost.

Texturing is achieved through a controlled corrosion process. Areas of the mold that are not to be textured are protected with tapes, paints, and waxes. These are also called “resists” as they prevent the etchant from etching the mold. Once the areas of the mold to be textured are defined by the masking process, the next step is to apply the pattern resist to the mold surface. In most cases this pattern is a wax resist and it has the appearance of a leather grain or a wood grain. These patterns have traditionally been achieved by producing a master plate that allows the wax pattern to transfer from the plate onto a tissue paper or transfer sheet. The transfer sheet is then “wallpapered” on to the mold surface.

The master plate process has some limitations, the first of which is size. Current uses are limited to 24" x 36" which requires that multiple sheets of wallpaper be patched on larger areas. The seams between these sheets require skillful and detailed hand work to make a seamless transition. This is very time consuming and results are based on the technician’s skill, the time allotted to the task and the ability of the touch-up resist to last through the etching process.

This is an area where MoldTech has advanced into the digital age. New digital transfer technology can produce pattern sheets that are 48" x 72", giving the mold surface a seamless pattern. This eliminates time and the possible breakdown of the hand-painted

seams. The result is greater efficiency, lower costs, less risk, and a more consistent pattern application.

Digital Transfer Technology also allows for rapid pattern development capabilities. Whether creating new patterns or manipulating existing patterns, Digital Transfer Technology has greatly reduced the task time, while the design options have exploded. Brand new options include new “morphing” textures, where one texture pattern can blend into another with seamless transition. Geometric patterns, like a diamond grid, can now morph into a leather pattern. Traditionally, there have been break lines between grains of different styles. These are no longer required. Additional advances include the ability to take the file of a specific mold surface and design a grain to conform to the contours of that surface. This can result in a texture that changes or morphs from one pattern to another along the contour or profile change on a mold surface. Geometric textures (those that have patterns laid out in rows) can also be developed to “wrap” the complex curves of a tool surface. This is another advance that saves time, lowers costs and reduces risk while reducing manual touch-ups as well as eliminating distortion that can occur with geometric patterns on complex curves. Given the new popularity of geometric textures, this new technology is producing results never before seen.

Another design advantage of the digital process is the ability to incorporate corporate logos into the texture. By taking the artwork of a company logo and developing a texture pattern that includes it, textures can now be created that are both decorative and that reinforce brand identification.

The chemistry used to etch these patterns into machined and cast aluminum molds is another area of development. The texturing industry has for years strived to produce the sharp, well-defined grain profiles that were available with steel tooling. Recent breakthroughs have produced an aluminum etchant that does now provide texture profiles similar to those achieved in steel.



**Figure 1: Example of textured logo to enhance brand.**

Textured surfaces often include the design intent of gloss management. This is best achieved with sharper texture profiles. Lower gloss matte finishes and stipples, more realistic looking woodgrains, and leather grains that display natural creases, wrinkles, and pore patterns all benefit from a sharper etch profile. This new chemistry also has the advantage of better texture depth control and enhanced repair results. High appearance parts that previously required injection molding from steel tooling may now be considered for thermoformed parts. |

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# Eddyline Kayak

Tom Derrer, Eddyline Kayak

*[Editor's Note: We wish to thank Tom Derrer of Eddyline Kayak for contributing this highly original piece to THERMOFORMING QUARTERLY. It is just another example of how thermoforming as a process is being used in new, innovative ways.]*

The City of Bend, Oregon and several other local area businesses sponsor an “Art in the Park” program. Each year they solicit entries from numerous artists for project ideas. They have a selection board made up of commissioners and citizens and they make a selection which is funded by the city and sponsors. This year, Troy Pillow ([www.pillowstudios.com](http://www.pillowstudios.com)), a Seattle artist, submitted a proposal and rendering of the kayak “flower” sculpture. It was voted in unanimously by the group. Troy then researched various kayak manufacturers and methods of construction and approached Eddyline. After several meetings discussing the merits of various materials and looking at different kayaks, Troy decided to use our Merlin LT model. Eddyline put nine boats and nine paddles into production to meet his needs, three of each color: red, orange and yellow. The paddles (the stamen of the flowers) are all black. Troy had engineering help to design the structure, which he says has been tested to winds of 85 mph. It was erected on May 5th and 6th, 2010.



*Close-up of the “stem” of the kayak structure.*



*Tom Derrer and his wife, Lisa, photographed beside the sculpture in Bend, OR.*





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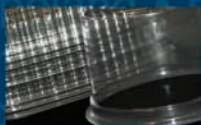
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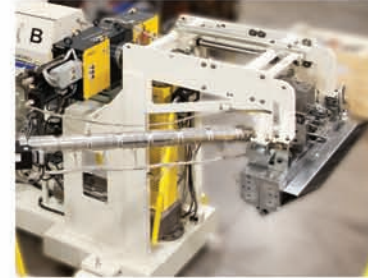
**Typical Application:**  
PP homo- & Co-polymers  
2,200+ pph (1,100 kg/hr)  
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Optimal Die Approach



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# Thermoforming Optimization: Improving Process Efficiency and Lowering Energy Consumption

William Karszes, PhD, OCTAL, Roswell, GA  
 Mohammed Razeem, OCTAL, Dallas, TX  
 Jerome Romkey, GN, Chester, Nova Scotia

*[Editor's Note: We are grateful to the authors for providing such a comprehensive article that includes cost and energy savings models. We believe it is important to point out that the models and subsequent data are presented in THERMOFORMING QUARTERLY as illustrative examples of how processors might examine their own operational performance. Equipment type and processing parameters will vary across the industry.]*

## SUMMARY

This paper was written to explore the effects of material and machine choice on the thermoforming process. The data and findings related to production costs, energy consumption and process optimization. Within this paper we explore two different types of machines. One is distinguished by the heating of the plastic by conduction of heat into the plastic from a heated platen. This process is defined as contact heat method (GN-DX series). The second process is where the heat is introduced into the sheet by electromagnetic waves or radiant heat called the radiant heat method. The source of the radiant heat may be varied and the control scheme is varied between the two processes. GN machines are based on the contact heat method. This paper will not go into the technical details of each process, but is written to compare the economics of the two processes. Also within this study we examine the effects of a specific material DPET™ (OCTAL) on the economics of the process.

## INTRODUCTION

A new-patented process has been developed by OCTAL Petrochemical to produce APET sheet. The new process has been created to produce a new sheet specifically for the thermoformer. The new product trade named DPET™ was tested in GN

laboratories in Chester, Nova Scotia. The material was tested against RPET and regular APET. The purpose of the tests was to develop a cycle that produced a well-formed part of like clarity. During experiments a new GN machine was also tested (GN's DX series). The test results showed DPET™ had a faster cycle time, was more efficient and could be run with lower clamping pressure.

OCTAL and GN have developed costing models for thermoformed trays. The two models are presented and compared. The models are then used to show savings to the thermoformer when using DPET™ and GN machines. *It is important to note that the material thickness and part design chosen for this study reflect a process that did not require a plug-assist.*

Based on the costing models up to 24% bottom line savings can be added to thermoformers using the new DX machine and DPET™. The cost models allow the processor to explore their own possible saving. Both models lead to the same answers. The GN model allows one to investigate processing cost, investment cost and return on investment. The most important finding of the model is that 50% less waste on GN thermoformer can lower customer total production cost by approximate 12%. The study shows that investment costs plus return on investment is important but not so much as the waste. The OCTAL model treats only the processing cost.

Furthermore, thermoformers' customers are demanding cost containment while requiring more environmentally friendly products. Thermoformers need to have new innovative technologies not only to contain cost but also to reduce their carbon footprint as legislature points to tougher standards. OCTAL commissioned PIRA (Printing Industry Research Association) to conduct a streamlined comparison of carbon footprint of DPET™ against APET and RPET. The results of the study are shown in Table 1 below.

MATERIAL	CARBON DIOXIDE EQUIVALENCE
APET	4.173 Kg
DPET	3.023 Kg
RPET	3.015 Kg

Table 1. Carbon Footprint.

As per study conducted by PIRA for OCTAL; DPET™ has a carbon footprint 27.6% lower than APET and only 0.2% higher than 50% RPET.

When compared to APET and RPET, DPET™ has a carbon footprint 27.6% lower than APET and only 0.2% higher than 50% RPET (50% RPET+50% APET) assuming that no energy is carried on from the post consumer waste.

## EXPERIMENTAL PROCEDURE

Rolls of APET, RPET and DPET™ were tested in the GN laboratory. All materials were 16 mil (or 400 microns) (nominal). The material was formed into trays with a four to one



draw ratio. A six-cavity mold was used. The criterion was to develop a DPET™ cycle time and then optimize the cycle. The criteria were both the relative clarity and formation of the part. A panel of three judged relative clarity and, formation was judged by a trained GN technician.

DPET™ was first trialed using the standard APET cycle time. Preheats and cycle time were then adjusted to optimize the cycle time. The clarity and formation of parts were ranked at each change. Once an optimum cycle was obtained the recipe was noted. In this trial the formation of the part was always good however; the loss of clarity was noted if the temperature/time was pushed beyond optimum. The surface temperature was then measured using temperature strips. The temperature was noted to be approximately 100°C. The cycle time for DPET™ was noted to be 4.08 seconds.

Once optimization was obtained, a 10-minute trial of DPET™ was run. The material ran without any trouble over this period of time. The machine was left idle for over an hour and the DPET™ cycle was run again. The machine produced good parts on the second cycle and again had no trouble during the 10-minute run time. As a further test for reproducibility a second roll of DPET™ was mounted on the machine from a different cycle in the same production lot of DPET™. Again the material produced good parts on the second cycle and performed well throughout the cycle test.

As a final trial, the original DPET™ roll was remounted on the machine; the trial was run to determine how fast DPET™ could be run. The cycle time was reduced to 3.32 seconds with good parts being formed.

RPET was then mounted on the machine. The first trial was run at the DPET™ settings. The resultant parts were well formed, but showed significant haze. The cycle time and temperatures were adjusted to obtain the clearest parts. The clearest parts were obtained when the preheat

temperature was reduced and the dwell increased. The overall optimum cycle time for RPET was determined to be 4.43 seconds. The surface temperature was tested and found to be approximately 96°C. The results of this test showed RPET did not adsorb heat as fast as DPET™ and retain clarity.

APET was mounted on the machine and optimized per the same procedure as outlined. The results were a cycle time of 4.42 seconds for APET. Again the trial shows APET did not adsorb heat as fast as DPET™ and retain clarity.

Other trials at GN had been run using 20 mil DPET™ and the results were essentially the same with DPET™ running faster than either RPET or APET. The average cycle time will vary with gauge and part configuration. DPET™ runs consistently 10% faster than the APET and RPET.

A field trial was run at a commercial thermoformer on a GN machine. After starting with the standard cycle time, we then increased the cycle time by over 10%. The cycle time was not running at standard at the time of the trial. At the end of the trial we had decreased the cycle time greater than the 10% over standard. The check of the surface temperature at optimum showed a value of between 98°C. and 100°C.

## COST MODELS

Two cost models were developed, one by GN and the other by OCTAL. The two models basically present the same results.

The aim of this model is to compare three different materials APET, DPET™ and RPET on GN machines (contact) versus radiant machines. Table 2 represents variables that are common to all materials.

SPECIFIC WEIGHT	1.35	1.35	g/cm³
SHEET PRICE	1.63	1.63	\$/Kg
SCRAP PRICE	0.38	0.38	\$/Kg
% SKELETAL WASTE AND SCRAP	11	256.8	%
ENERGY CONSUMPTION (GN)	6.8	70	KW/machine
NUMBER OF CAVITIES PER TOOL	10	2000000	N/A
ORDER SIZE	2000000	19.20	N/A
COST OF LABOR	19.20	0.128	\$/Hr
ELECTRICITY	0.128		\$/KwHr

Table 2. Variables Common to All Materials.

Table represents variables that are used to run the cost model. The above variables are used for the example model in this article.

The user has to enter a certain set of data to run the model as shown in Table 3 on the following page. To show an example of how the model works, we have taken a case of 2,000,000 trays (252 x 110 mm or 10" x 4.33") at 250 microns (APET sheet) and a total of 10 trays per cycle. Earlier tests show that APET runs at 13.51 cycles per minute. The cycles per minute of other materials are calculated based on test results at GN labs. The user can opt to run the model either on contact machine (GN) or radiant machine. For this example, we opted for contact heat. Based on

the type of machine, the scrap plus waste and energy consumption will change. For contact heat, the skeletal waste and scrap is calculated to be 11% (25% for radiant machines) energy consumption is rated at 6.8 KW (70 KW for radiant machines). The model is based on two contact machines versus one radiant machine in order to level the throughput of machines for comparison. Other data that need to be entered by the user include cost of labor, cost of raw

*(continued on next page)*



material, cost of scrap and cost of electricity per Kwh.

After entering the data in the input fields the model gives an output based

## RESULTS

This study is based on models created by GN for their thermoforming machine (DX Series) and OCTAL for their DPET™ sheet. These models compare GN's contact technology machines versus European radiant heat technology.

DPET™ is manufactured to a caliper tolerance of ± 1%. This tight tolerance leads to savings as thinner gauges can be specified (as shown in Figure 1 on the following page). Additionally, it was estimated that tighter caliper leads to 3% higher efficiency during forming (based on previous studies where part thickness was measured as a function of starting thickness) and 5% less process waste (based on roll-to-roll changeover and machine restart).

Running the cost model we know that the weight of one 252 x 110mm (10" x 4.33") APET tray weighs 9.355g whereas the same tray in DPET™ weighs 8.607g. Thus the ± 1% tight tolerance helps to reduce the weight of the formed part by about 9%. The tight tolerance enables uniform heating and cooling of sheet during forming, resulting in faster throughput, reducing process waste, increased efficiency and reduced production hours. Reducing production hours (Figure 2 on the following page) reduces cost of labor by about 9%. Graph comparing DPET™, APET AND RPET on the GN machine is shown in Figure 3 on the following page.

Due to the smaller size and lower throughput of a single GN machine, to balance the equation we have used two GN machines versus one radiant machine in the model. The cost of two GN thermoformers is usually comparable to the cost of one European radiant thermoformer. Tooling for GN machines is 25% - 50% lower than radiant machines as shown in Figure 3 on the following page.

The cycle times for DPET™, APET and RPET are 4.08cpm, 4.42cpm and 4.43cpm respectively. This means that DPET™ runs 8% faster than APET and 7% faster than RPET as seen in Figure 4 shown on page 18.

NUMBER OF TRAYS	2,000,000
GAUGE REQUIRED BY CUSTOMER IN MICRONS	250
CYCLES PER MINUTE (APET)	13.51
TRAYS PER CYCLE	10
DOWNGAUGING AND EFFICIENCY (OPTIONAL)	8%
LENGTH OF TRAY (mm)	252
WIDTH OF TRAY (mm)	110
ENTER TYPE OF MACHINE "RADIANT" OR "CONTACT"	CONTACT
SKELETAL WASTE AND SCRAP BEFORE ACTUAL PRODUCTION IN %	11%
ADDITIONAL PROCESS WASTE FOR APET (OPTIONAL)	5%
ADDITIONAL PROCESS WASTE FOR RPET (OPTIONAL)	5%
ADDITIONAL PROCESS WASTE FOR DPET™ (OPTIONAL)	0%
LABOR PER HOUR	\$ 19.20
COST OF RAW MATERIAL PER KILO APET	\$ 1.63
COST OF RAW MATERIAL PER KILO RPET	\$ 1.63
COST OF RAW MATERIAL PER KILO DPET™	\$ 0.38
COST OF SCRAP APET	\$ 0.38
COST OF SCRAP RPET	\$ 0.38
COST OF SCRAP DPET™	\$ 0.38
ENERGY CONSUMPTION (KW)	6.8
COST OF ELECTRICITY PER (Kwh)	\$ 1,128

Table 3. Input table for sample model.

VARIABLE

CHANGES WITH CHOICE OF MACHINE

Screenshot of the model input page, where the user feeds in the variables to run the model.

on the type of machine opted. (Results for this example are shown in Table 4.)

If the same model is run for radiant heat the results are as shown in Table 5.

	Contact APET	Contact DPET™	Contact rPET
TOTAL PRODUCTION HOURS	123.37	113.38	127.74
COST OF LABOR	\$ 2,369	\$ 2,177	\$ 2,337
COST OF MATERIAL	\$ 35,885	\$ 31,442	\$ 35,885
COST OF ELECTRICITY	\$ 215	\$ 197	\$ 212
TOTAL COST	\$ 38,468	\$ 33,816	\$ 38,434
TOTAL COST MINUS SCRAP VALUE	\$ 37,580	\$ 32,999	\$ 37,456

Table 4. Output of model with contact machine.

	RADIANT APET	RADIANT DPET™	RADIANT rPET
TOTAL PRODUCTION HOURS	108.22	99.46	106.79
COST OF LABOR	\$ 2,078	\$ 1,910	\$ 2,050
COST OF MATERIAL	\$ 42,583	\$ 37,311	\$ 42,583
COST OF ELECTRICITY	\$ 970	\$ 891	\$ 957
TOTAL COST	\$ 44,863	\$ 40	\$ 45,591
TOTAL COST MINUS SCRAP VALUE	\$ 43,236	\$ 37,909	\$ 43,195

Table 5. Output table for sample model.

Screenshot of the output for the model based on the type of machine opted and variables used in the sample model input page.

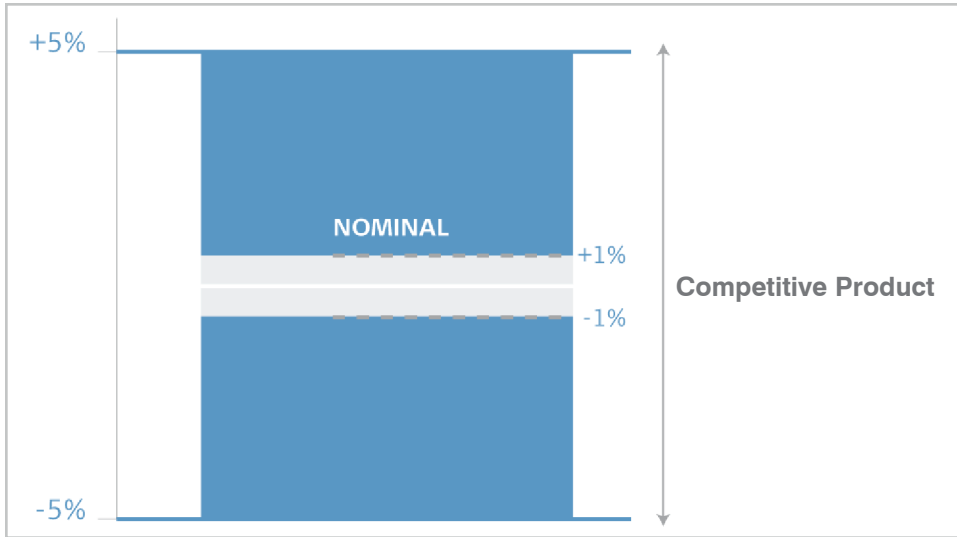
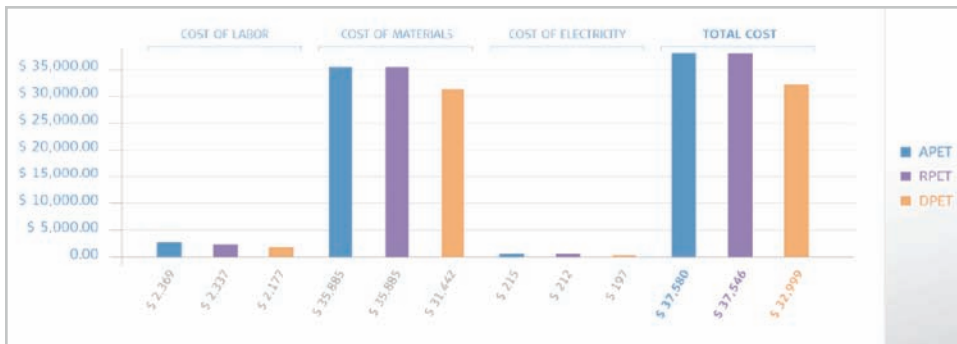


Figure 1. Schematic of Caliper Control of ± 1% for DPET™.



Cost Comparison APET, RPET & DPET™

\$ 4,581  
12.19%

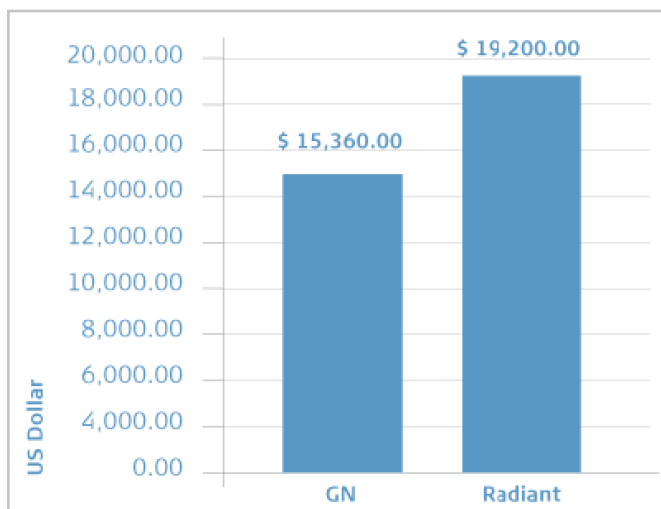


Figure 3. Tooling Cost GN Vs. Radiant.

Radiant heat machines produce an average of 6200kg (13640 lbs.) of scrap whereas the contact heat machine running DPET™ produces only 2,299kg (5058 lbs.) of scrap.

This combination produces about 63% less scrap/waste and reduces cost of electricity by 78% when compared to radiant machines. This will reduce the cost of raw materials to about 16% as

seen in Figure 5 shown on page 18. On running the cost models we see that there is a cost savings of **\$4,585** when using DPET™ vs. RPET and savings of **\$4,551** when comparing DPET™ to APET on the GN contact heat machines. This implies an approximate 12% reduction in the cost of production. Comparing the contact heat machine with the radiant machine, there is a total savings of about 13%. A cost savings of **\$10,240** is achieved when running DPET™ on the GN machines vs. APET on radiant machine, and a savings of **\$10,200** when compared to RPET on a radiant machine. A total savings of 24% is achieved as seen in Figure 6 on page 18.

### ENERGY CONSUMPTION

The GN DX machines use 6.8 KWs to run. In the model, radiant units use 70 KWs to run (based on survey of machines comparable to GN 30" x 21" forming area). Using the models we find the following comparisons shown on page 18.

In summary, the use of GN's machine and OCTAL's DPET™ was found to lower the amount of energy used in the thermoforming process. Thus, the combination of these two new technologies resulted in significant savings potential for the thermoformers in both production costs and energy consumption. |

**See**  
**Figure 4,**  
**Figure 5,**  
**Figure 6,**  
**Table 2,**  
**Figure 7,**  
**& Figure 8**  
**on the**  
**following pages.**

*(continued on next page)*

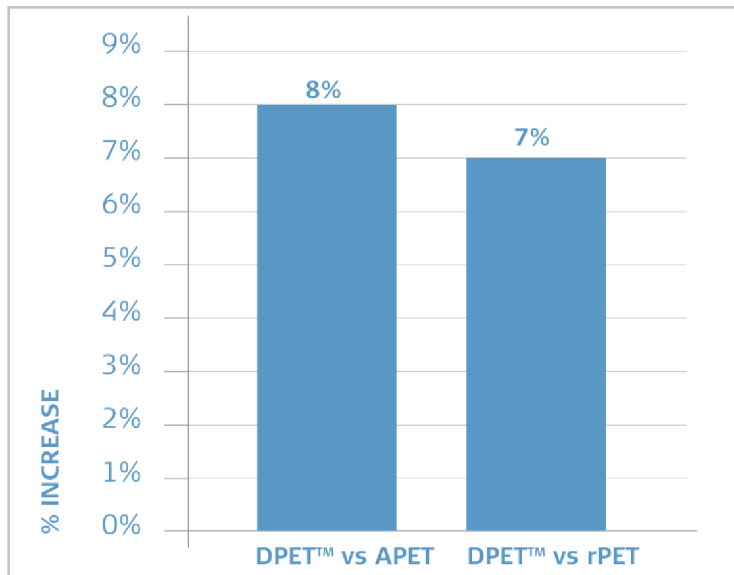


Figure 4. Savings-Cycles per Minute.

Figure indicates that DPET™ runs 8% faster than APET and 7% faster than RPET.

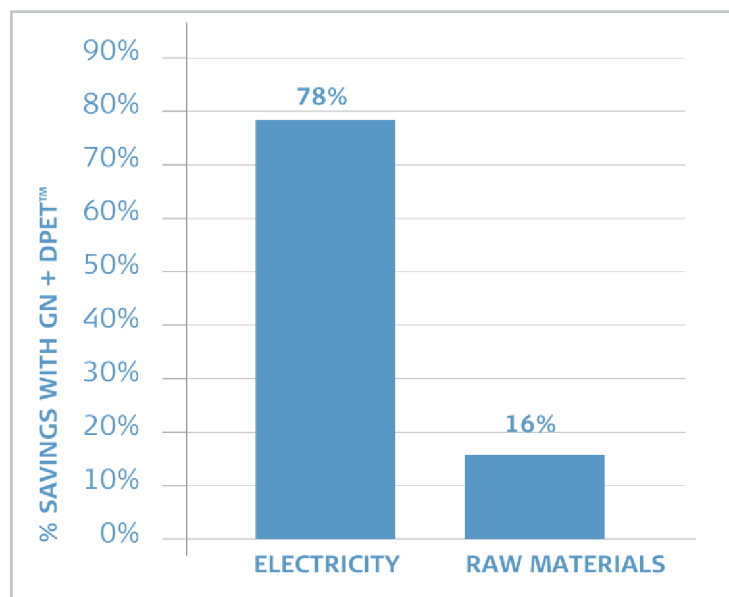


Figure 5. Savings-Electricity & Raw Materials.

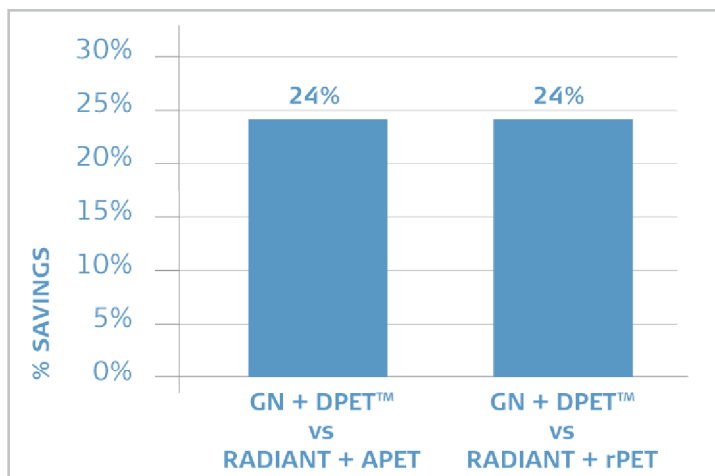


Figure 6. % Savings-Total Cost using DEPT™.

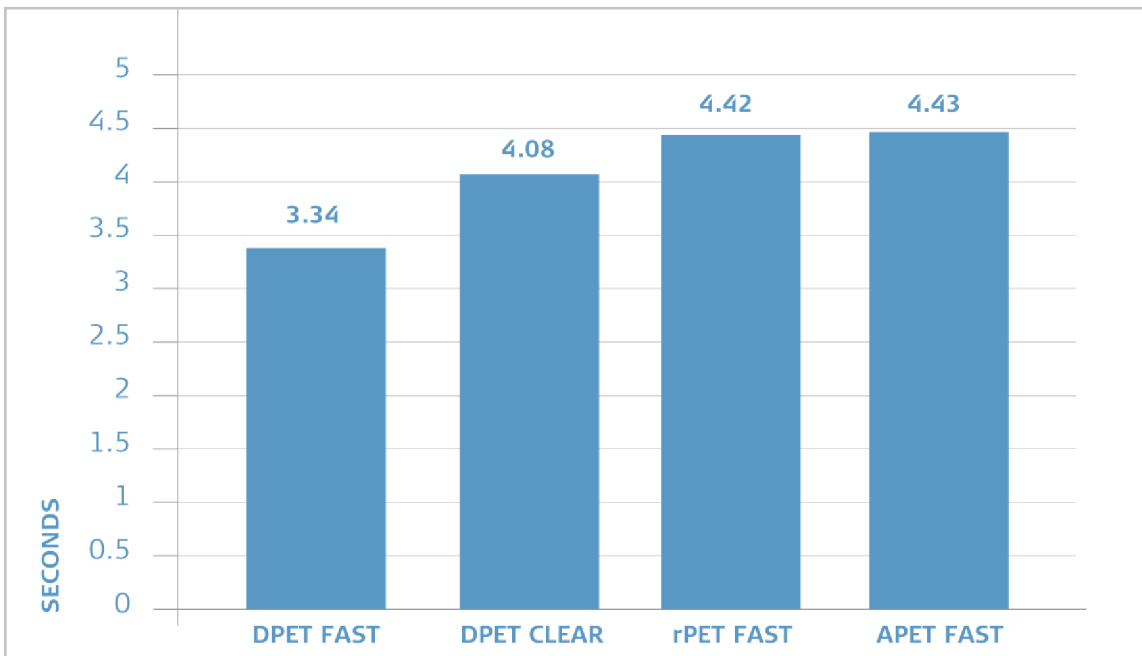
A total savings of 24% is achieved when running DPET™ on GN machine versus APET or RPET on radiant machine.



APET CONTACT GN		RADIANT
ENERGY CONSUMPTION (KW/hr)	13.6	70
NO. TRAYS	2,000,000	2,000,000
HRs	123.4	108.2
MATERIAL (KGs)	20899	24800
KG/hr	169.36	229.21
Mj/hr	48.96	252
Mj/KG	0.289	1.099
DPET™ CONTACT GN		RADIANT
ENERGY CONSUMPTION (KW/hr)	13.6	70
NO. TRAYS	2,000,000	2,000,000
HRs	113.4	99.5
MATERIAL (KGs)	19255	22933
KG/hr	170.149	230.482
Mj/hr	48.96	252
Mj/KG	0.288	1.093

**Table 2. Energy Consumption.**

Comparing energy consumption when running APET and DPET™ on GN machines vs. radiant machines. The data above is for two GN machines and one radiant machine. This is to match the throughput of both the machines.



**Figure 7. Cycle Time Comparison.**

Comparing cycle times for DPET™, APET and RPET on GN's DX machine.

*(continued on next page)*

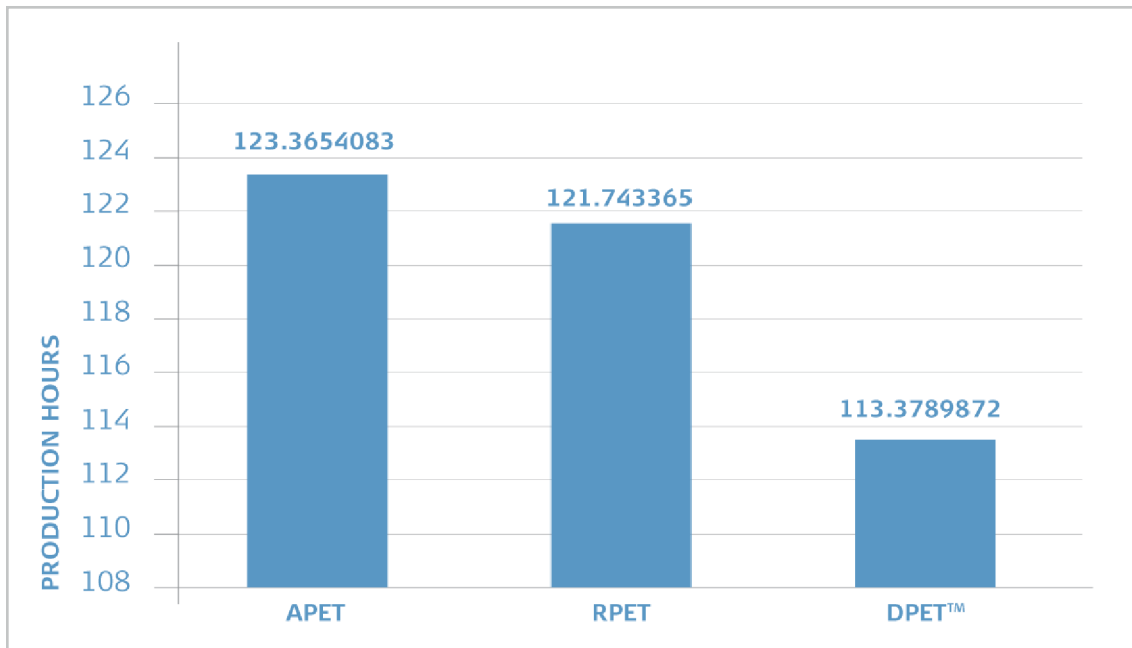


Figure 8. Production Hours.

Comparing production hours when running DPET™, APET and RPET on GN machines.

**For further information or to obtain copies of cost models,  
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# COUNCIL SUMMARY



**Roger Kipp**  
Councilor

## Council Communications

The Spring 2010 Governance Meetings for the Society of Plastics Engineers were held prior to ANTEC in Orlando, FL from May 14th through May 16th. As Councilor, I represented the Division by attending the SPE Foundation Board, the Corporate Outreach Committee, the Strategic Planning Committee, the Divisions Committee, and all Council Meetings.

The Society, like many companies and trade organizations, is focused on continuous improvement through well-planned change. The goal is to create a more efficient Council with increased member value, organizational flexibility and global growth.

This is a global Society striving to bring quality information and technical content about plastics to members around the world. There is no one-size-fits-all value proposition. The Society needs to provide a customized product to the membership. This need is evidenced by the current bombardment of SPE emails we all receive. This issue is concerning yet in many ways effective. Customization or an “a la carte” platform will give members an opportunity to pick their preference. The Strategic Planning Committee is currently working on such a platform with plans for presentation to Council at the Fall meeting.

There is a membership goal of 16,000 for year end 2010 with membership at the end of April at 14,700. The first quarter saw 750 new members join the

Society. Allowing for a 15% annual membership drop as we experienced in 2009, continuing at that level of new membership for the remaining eight months would get us there. Direct mail followed closely by email remain the most effective sources for membership recruitment and retention.

Financially, SPE ran a modest positive bottom line through the first four months. The savings generated from well-planned cutbacks orchestrated by the Executive Director along with the slight upward movement in membership revenue has given SPE that positive first quarter. E-Live Webinars and the new online resource directory are performing well and provide great member value.

A new website has been introduced for Plastics Engineering at [www.plasticsengineering.org](http://www.plasticsengineering.org). This website is fully integrated with [www.4SPE.org](http://www.4SPE.org) and is a showcase for more “commercial” content including new pages for the online technical library and the consultants circle.

Our Thermoforming Division was acknowledged for our contribution as gold sponsors to the ANTEC Student Activities Program. In addition, the Thermoforming Division received the Pinnacle Award for outstanding Division achievement presented at the leadership awards luncheon. With 5% of SPE membership represented by students and another 5% under the age of 35, this continues to be a worthwhile Division investment.

The Thermoforming Division and the European Thermoforming Division can be proud of our continuing impact and overall support of the SPE goal to promote the education, promotion and technical advancement of plastic processing throughout the world. If you have questions or input for Council, please contact me directly. |

Roger Kipp  
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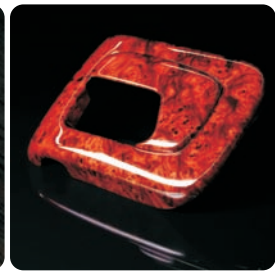
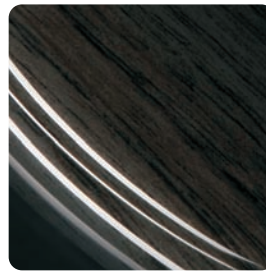
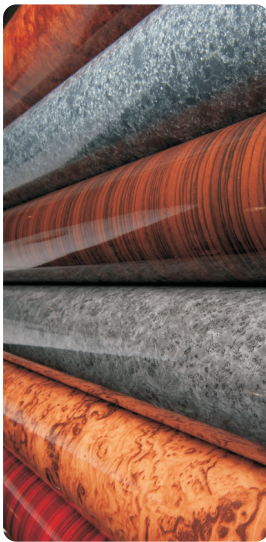
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## Need help with your technical school or college expenses?



If you or someone you know is working towards a career in the plastic industry, let the SPE Thermoforming Division help support those education goals.

Within this past year alone, our organization has awarded multiple scholarships! Get involved and take advantage of available support from your plastic industry!

Here is a partial list of schools and colleges whose students have benefited from the Thermoforming Division Scholarship Program:

- UMASS Lowell
- San Jose State
- Pittsburg State
- Penn State Erie
- University of Wisconsin
- Michigan State
- Ferris State
- Madison Technical College
- Clemson University
- Illinois State
- Penn College

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### Segen Griep Memorial Scholarship



**ADAM W. MIX** is the recipient of the \$5,000 Thermoforming Division/Segen Griep Memorial Scholarship. He attends the University of Wisconsin-Madison where he is a graduate student in the College of Engineering, working on his M.S. and Ph.D. in Mechanical Engineering. He obtained his B.S. in Chemical Engineering, with a minor in polymer science, from Michigan Technological University.

As a graduate Research Assistant at UW-Madison, Adam conducts research with Professor A. Jeffrey Giacomini as part of the requirements for his M.S. and Ph.D. His research focus is on polymers, rheology of polymer melts, and plastics processing, specifically those common in thermoforming. He works with Plastic Ingenuity, a local thermoforming company, to help them understand and solve their thermoforming problems. He helped them solve a coatings problem on their PET line, developing a method to determine

Young's modulus from a durometer. Once that problem was solved, a different type of surface quality problem was observed, so Adam worked with the process engineers to develop a sag experiment using a laboratory thermoformer and video camera to record the sag over time. He and the engineers are now looking at the rheological properties of the resins to determine if they can detect the problems before processing bad sheet. His paper on sag in thermoforming has been accepted for publication in a refereed journal.

Adam is active in the SPE Student Chapter at UW-Madison, serving as Vice President in 2008-09 and as President in 2009-10. He gave a presentation on Dimensionless Durometry to the Society of Rheology Conference in 2009. Adam also volunteered at the 9th Annual International Polymer Colloquium 2009 where he ran the registration desk and at the Second Harvest Foodbank of Southern Wisconsin. |

### Thermoforming Division Memorial Scholarship

**CLINTON L. REGES** is the recipient of the \$2,500 Thermoforming Division Memorial Scholarship. He attends East Carolina University, where he is a Senior working on his B.S. in Engineering.

A high school honor society member and athlete (wrestling, football, track & field), Clinton serves as a volunteer wrestling coach on both the middle school



and high school level. He also works as the assistant junior varsity/varsity football coach for the Pitt County Schools. When assigned a research paper as part of his sophomore materials and processing class at East Carolina University, he chose to research football helmets. It was this research that really opened his eyes to the field of polymers and plastics.

Clinton currently works for CMI Plastics in Ayden, NC, where he works as a production assistant, helping to design and build tooling, and helping with thermoforming set-ups. He also works with the quality manager at CMI, learning to read customer specs and then implement them. He also has experience culling through parts to determine the point of origin for rejects. This job has expanded Clinton's knowledge of plastics to the point that he has determined that thermoforming is where his career will take him. Along with his passion for sports, he hopes that, one day, he will be working in the field of sports equipment. |



# SCHOLARSHIP RECIPIENTS

## PTi Memorial Scholarship



**JEROME FISHER** is the recipient of the \$2,000 SPE Thermoforming Division Scholarship, sponsored by PTi of Aurora, IL.

While attending Oakland University, in Rochester Hills, MI, Jerome held a full-time internship with Faurecia Interior Systems. For the past two and a half years, he has worked for the France-based Tier 1 automotive supplier within the Research & Innovation group where the focus is on sustainability, creativity, and

the exploration of new materials and processes. Jerome has both led and participated in several projects, including processes from male/female vacuum forming to cut & sew and injection molding. Materials used include polypropylene foils and urethane foams. Jerome plans to pursue a future in the field after graduation as his interest continues to grow through the knowledge he has gained both in the classroom and in hands-on experience with plastics manufacturing.

Jerome is part of the Oakland University Formula SAE team where he serves as the Marketing Manager. Formula SAE is a competition to design, build, and compete against international teams with a Formula-style racecar. Aside from school, internship, and Formula SAE interests, Jerome has also designed and built a motorcycle engine-powered, street-legal, two-seater formula style car for road driving, as well as at local autocross and track day events. |



**Our mission is to facilitate the advancement of thermoforming technologies through education, application, promotion and research.**

### **SPE National Executive Director**

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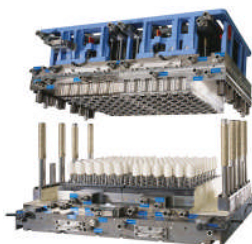
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## Letter from Los Angeles

Juliet Oehler Goff, President/CEO, Kal Plastics

I recently had the pleasure of visiting UCLA Architecture and Urban Design to meet the thermoforming team who are currently using a MAAC thermoformer made possible by the SPE Thermoforming Division matching grant program. The machine was installed in the summer of 2008.

They are actively using the machine a great deal and they expressed their gratitude for the SPE grant program. I saw photos of some of the work generated and encouraged them to submit parts for the competition at the next conference.

I also asked to get annual updates on the output by the students and copies of student reports and/or any technical papers that could be published in *Thermoforming Quarterly* and possibly presented at future conferences. I will re-connect with the teaching faculty on these points once school resumes in the fall.

I learned there is a real need for assistance on procuring sheet plastic. They would appreciate help with getting materials donated and/or at a discount. I let them know that our group may very well be able to help. All in all, it was a great meeting and hopefully it will be a start to establishing regular contact. Shown are some photos I took during the visit. The person I met with, Philip Soderlind, is the shop supervisor where the machine was installed. |



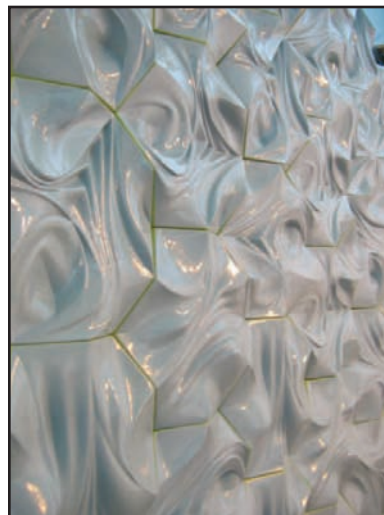
*Workshop at UCLA*



*Juliet Goff (Kal Plastics) and Philip Soderlind (UCLA) with MAAC Thermoformer*



*Decorative surface in PETG formed by UCLA School of Architecture and Urban Design*



*Detailed view of PETG part which was painted after forming*



*Full-size of formed pieces on display*



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The SPE Thermoforming Division invites you to join our 19th Annual Conference exclusively created for the Thermoforming Industry. Our conference is your opportunity to network with clients, prospective partners, colleagues, vendors, and industry leaders. With meeting everyone in one location, you will save precious time and travel expenses.

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Learn how to take advantage of new technical developments to maintain and grow your business in the current economy. Our comprehensive conference program includes technical presentations by recognized industry experts highlighting new and exciting developments in the industry as well as extensive and detailed industry assessments and a market outlook. We also offer full day workshops with respected industry experts to help your technical staff gain more practical insight into the thermoforming processes. Newly introduced expert panel discussions allow our audience to interact with industry specialists and discuss topics related to Tooling, Machinery, Materials and Processing. Our conference registration also includes 2 Breakfasts, Lunches and our traditional "Thermoformer of the Year" Grand Reception and Dinner.

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The conference offers an array of sponsorship, exhibiting and advertising options that provide your organization with a cost-effective way to promote your products and services, establish your brand, build new business relationships and secure your position as a leader in the industry. Our Sponsors and Exhibitors will have the unique opportunity to introduce their new and exciting products and technologies to a target audience during our newly introduced "Innovation Brief" Presentations located directly on the exhibit floor. Exhibiting at our conference is the perfect opportunity to reach industry decision makers.

**Parts Competition**

We invite you to enter your unique packaging or industrial parts in our annual parts competition. Winners will be selected during our conference and honored during our "Thermformer of the Year" dinner. We will also showcase the winning parts in various print media and on our website.

**Register Early and Save**

Register today and receive the early registration rate of \$395 for SPE Members. Registration includes two continental breakfasts, two lunches, refreshment breaks, conference packet and admission to all conference sessions, the tradeshow, and evening reception & dinner. Registration does not include lodging. Download the registration form or register online [www.thermoformingdivision.com](http://www.thermoformingdivision.com)





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## HIGHLIGHTS

- Hands-on Workshops
- Technical Sessions
- Expert Panel Discussions
- Market Outlook
- Exhibit
- Parts Competition
- Networking Receptions/Dinner

### 2010 Parts Competition Announcement

Coming off a very successful 2008 Parts Competition, we look forward to our 2010 Competition and what it may yield. The quality of the parts submitted was exceptional two years ago with pieces ranging from complex food packaging parts to very large Twin-Sheeted and Pressure Formed parts. As advancement in the industry continues, we can only imagine what the parts competition will yield this year regarding innovation in design and manufacturing.

The industry considers the parts competition a key element in the educational efforts of the SPE Thermoforming Division, due directly to the state of the art components submitted by manufacturers. This year's conference again offers the opportunity to showcase your most recent innovations and advancements.

We made a concerted effort two years ago to provide greater media coverage and access to all of the parts submitted. This made it easier for highlights of each part to be understood and showcased throughout multiple trade publications. Every part that is received and entered is due their recognition, but unfortunately every part does not receive an award. In light of this, each submittal will receive a "Certificate of Acknowledgment" from the SPE Thermoforming Division.

### Take Advantage of this Opportunity

We encourage all interested parties to start thinking now about how to take advantage of this opportunity to showcase their talents and introduce your firm through the press. We welcome all Thermoforming related businesses to submit a piece to our prestigious competition. This includes all material suppliers, tool builders, designers, and proprietary product manufacturers.

Drawing upon a more simplified entry process that we implemented two years ago, we have decided to continue on in this same vein and have simplified the categories even further. The product fields will remain the same as Roll-Fed and Heavy Gauge. The categories within Roll-Fed include Industrial Parts, Food Packaging, and Medical Packaging. The categories within Heavy Gauge will include Vacuum Form, Pressure Form, and Twin Sheet.

### Download Entry Form

We encourage you to take a few moments and access the SPE Thermoforming Division website and download the entry form at [www.thermoformingdivision.com](http://www.thermoformingdivision.com). Along with the entry form, participants will be required to submit a product image in jpeg format (1MB or smaller) plus a product description in MS Word explaining critical elements of design, intended use, materials used, and innovative aspects.

All submissions or questions regarding the competition can be directed to [bret@joslyn-mfg.com](mailto:bret@joslyn-mfg.com). Early submissions to the parts competition may also have the opportunity to be showcased in one of our pre-conference newsletters. We look forward to seeing you in Milwaukee in September.

# 2010 EDITORIAL CALENDAR

Quarterly Deadlines for  
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30-JAN Spring 15-APR Summer

31-JUL Fall 30-OCT Winter  
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Society of  
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## 7th European Thermoforming Conference, Antwerp 2010: Another highly successful event of the Thermoforming Industry

**What are the current trends in thermoforming technology? How can intelligent technical solutions be translated into higher productivity and decisive competitive advantages, and which innovative materials can help in this respect?**

**These were the key issues discussed at the 7th European Thermoforming Conference, designed and run by SPE – European Thermoforming Division, which was held between 22nd and 24th April 2010 in Antwerp, Belgium**

Although a bizarre five-day stretch of flight cancellations due to heavy atmospheric ash from the Iceland volcano eruption, some 200 delegates including many of the key players within the European Thermoforming Industry, found their way to Antwerp, where they discussed various technological aspects and future developments. This year's forum once more has been an interesting platform for exchanging experiences with experts and business partners alike.

The conference programme included a rich and varied combination of well-researched presentations and highly-charged discussions. The event concluded with a series of expert presentations organised by a leading company in the thermoforming sector.

In a competent and comprehensive way the presentations covered the theme of the conference "All Facets of Thermoforming".

Following this theme, the General Session started with the topic "Plastics and the World in 2030", presented by Dr. Wilfried Haensel from Plastics Europe. Dr. Haensel highlighted the never-ending, amazing, dynamic evolution of plastic, which makes plastic the material for the 21st century.

A thin gauge session and a parallel heavy gauge session offered the audience informed insights into new

developments, materials and market opportunities that exist. Further presentations gave room for comprehensive discussions around Industrial Design, environmental challenges, the thermoforming process and trends.



Conference room

The Conference has been complemented by an informative and comprehensive exhibition of relevant latest product developments and services offered by a variety of leading suppliers to the thermoforming industry. This event was a major success and demonstrated E.T.D.'s ability to pull together many of the engineers and managers of the European thermoforming industry as guest speakers to ensure lively debates and unrivalled networking opportunities.



View of the Tabletop Display



With special thanks to our Conference Sponsors!



Society of  
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### 3rd European Thermoforming Parts Competition at SPE's Thermoforming Conference, April 2010

The Parts Competition showed 33 very qualified thermoformed parts from European and American producers. Three winners were selected by the Jury in both Heavy and Thin Gauge applications.

Heavy Gauge winners were:

- "Round Bailer Door" made by 'Vitalo Industries', Belgium.  
The complete design and development was made by Vitalo, made of two formed ABS parts (inner-and outer skin) bonded together with glue by a robot system in combination with a plasma treatment.
- "Spot light housing" made by 'AB Formplast', Sweden.  
Material ABS. A quite difficult forming requiring tooling with several moveable parts. Parts show an even wall thickness distribution and a nice surface. This part was realized in thermoforming "against the odds".
- "Window for electric bicycle" made by 'Greijn Form Technics', The Netherlands.  
This fantastic drape forming is done with a perfect surface quality enabling plastics to be used instead of a traditional and a more heavy glass solution.

#### K' exhibition 2010

27 October – 3 November 2010 – Düsseldorf, Germany  
SPE Stand: Hall 11 - E21  
SPE Reception on Thursday 28 October at K' show.  
All members are welcome to join this get-together.



Round Bailer Door



Spot light housing



Window for electric bicycle

*(continued on next page)*





Society of  
Plastics  
Engineers

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division

In Thin Gauge competition we tried to find winners in 3 different categories (Medical, Electronic and Food applications). It is always very difficult to find the winner as there were many very sophisticated interesting smart complicated packages from which we had to pick just 1 from its category.

Thin Gauge winners were:

- In Medical applications the winner was "Universal Blister for Knee Prothesis" produced by 'Cartolux Thiers', France. This universal blister for knee produced from PETG is easy to use mainly because of its screw thread. It can be adjusted to a large range of prothesis size without any additional insert. One of the main difficulties of this innovative product was to ensure the geometry of the cover after cutting, and also for the retainer to ensure an easy unmolding despite of big undercuts in the screw thread.
- In Electronic applications the winner was "Electronic Card Reader" produced by 'Protective Pack, Syst/Plastique', UK. This ingenious 'all in one' pack from recycled HDPE replaces the need for a complex corrugated die cut insert arrangement within the existing pack. Final product is enclosed it has a 360 degree protective wrap with shock absorption features designed into the pack. The finished pack size is also reduced considerably ensuring a sizeable reduction in vehicle movements for shipping – estimated reduction of one trailer load per month.
- In Food application the winner was "Soup in the Air Cup" produced by 'Faerch Plast', Denmark. The challenge of this special CPET soup tray was to create a packaging that could keep the soup in the tray which at the same time could equalize the air pressure in the airplane. It should also be able to let the steam out when heated in 20 minutes at 185°C in the air and it should be easy to handle for the cabin crew when serving. The grooves around the top edge are designed to let the pressure or steam out and keep the soup in.



Universal Blister for Knee Prothesis



Electronic Card Reader



Soup in the Air Cup

# Thermoformer of the Year 2011

The Awards Committee is now accepting nominations for the **2011 THERMOFORMER OF THE YEAR**. Please help us by identifying worthy candidates. This prestigious honor will be awarded to a member of our industry who has made a significant contribution to the thermoforming industry in a technical, educational, or managerial aspect of thermoforming. Nominees will be evaluated and voted on by the Thermoforming Board of Directors at the Winter 2011 meeting. The deadline for submitting nominations is December 1st, 2010. Please complete the form below and include all biographical information.

Person Nominated: \_\_\_\_\_ Title: \_\_\_\_\_

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## Biographical Information:

- Nominee's Experience in the Thermoforming Industry.
- Nominee's Education (include degrees, year granted, name and location of university)
- Prior corporate or academic affiliations (include company and/or institutions, title, and approximate dates of affiliations)
- Professional society affiliations
- Professional honors and awards.
- Publications and patents (please attach list).
- Evaluation of the effect of this individual's achievement on technology and progress of the plastics industry. (To support nomination, attach substantial documentation of these achievements.)
- Other significant accomplishments in the field of plastics.

Individual Submitting Nomination: \_\_\_\_\_ Title: \_\_\_\_\_

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**(ALL NOMINATIONS MUST BE SIGNED)**

**Please submit all nominations to: Juliet Goff,  
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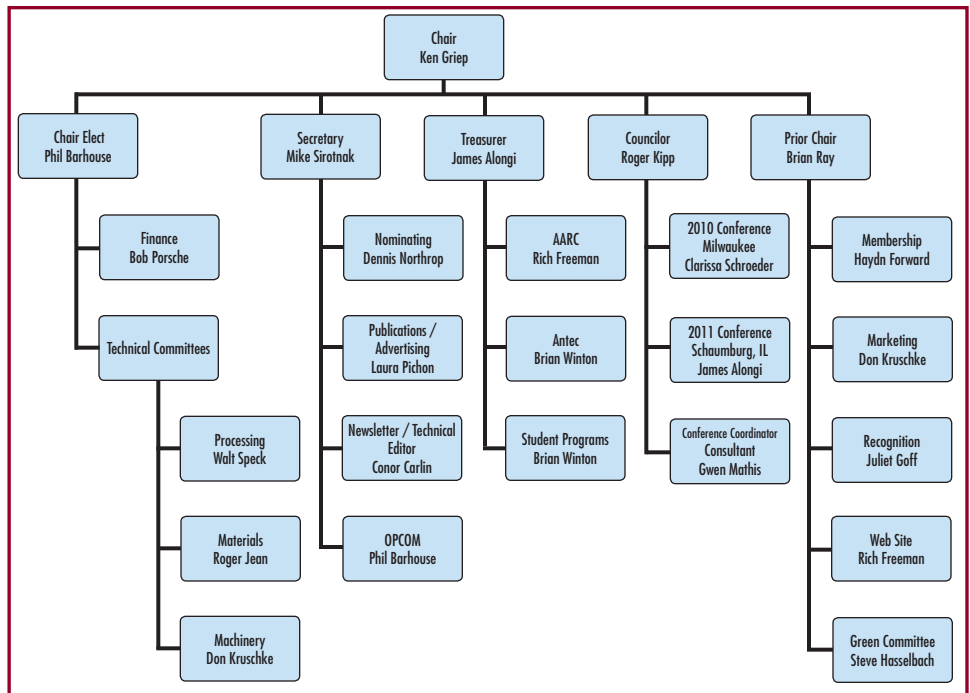
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**Thermoforming Quarterly** is proud to publish news and stories related to the science and business of thermoforming:

- New materials development
- New applications
- Innovative technologies
- Industry partnerships
- New or expanding laboratory facilities
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We are also interested in hearing from our members and colleagues around the world. If your school or institution has an international partner, please invite them to submit relevant content. We publish press releases, student essays, photos and technical papers. If you would like to arrange an interview, please contact Ken Griep, Academic Programs, at:

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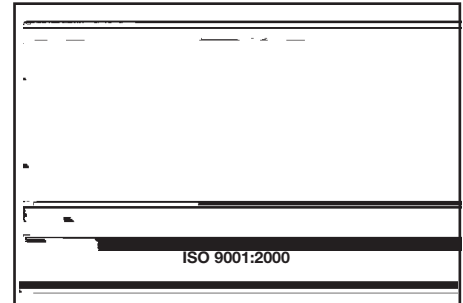
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