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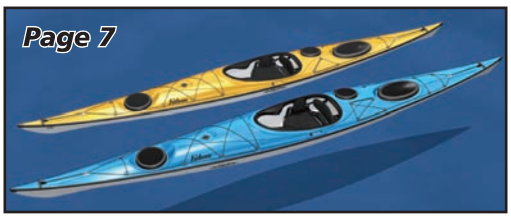

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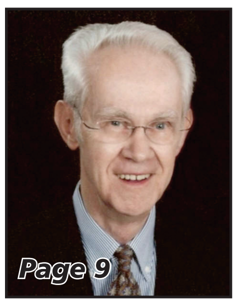

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Thermo 2008 FORMING
Minneapolis, MN
"Discover Your Leading Edge"
The Competitive Advantage

Thermoforming Quarterly®

A JOURNAL PUBLISHED EACH CALENDAR QUARTER BY THE THERMOFORMING DIVISION OF THE SOCIETY OF PLASTICS ENGINEERS

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Walt Walker

Full Steam Ahead!

EXPECT HIGH ROI AT SEPTEMBER CONFERENCE

Despite the economy's turbulent waters, your Thermoforming Division is slicing through the choppy waters, on-course, to deliver you the best ever Thermoforming Conference – September 20-23, 2008 in Minneapolis.

Every year we are committed to growing the Conference, the technical sessions and the exhibits. And every year our members have been attending in ever-larger numbers because they realize there is no other place where they can learn about the latest developments in the thermoforming industry under one roof.

Although on a day-to-day basis you are dealing with the rising costs of energy, shipping, equipment, plastic, etc. it is important to remember that the return on investment on conference attendance can be very high. Professional development and networking are solid investments in revenue-generating opportunities for your company. Attendees tell us they benefit from the Conference's business networking opportunities, highly relevant technical sessions, the up-close look at new equipment, plus the latest industry developments and best practices. Where else under one roof can you get all this? Our Conference is all thermoforming – all the time.

Conference attendance is an investment in yourself and your company, especially if you seek out and pursue answers to difficult business-related questions. Do not short yourself. Do not misjudge the importance of this gathering of experts who share their strategies for success and growth.

NEW THERMOFORMING PAVILION AT NPE 2009

Because NPE's International Plastics Showcase is such a major event for the plastics industry where over 75,000 attendees and billions of dollars worth of annual purchasing power converge in one place, our SPE Thermoforming Division has decided to host a Thermoforming Pavilion at NPE (June 22-26, 2009 in Chicago's McCormick Place).

Our Thermoforming Pavilion will be an opportunity for show attendees to find thermoforming information, products and services through a one-stop-shopping experience. It will be a place to learn more about emerging markets for thermoforming and its growing use as an alternative, cost-effective and versatile answer to other plastic processes. We will be offering a variety of industry information, plus the location of suppliers and thermoforming practitioners exhibiting throughout NPE. Watch for more information.

CONGRATULATIONS TO GEORGE LUEKEN!

An SPE member for 46 years, George J. Lueken, owner of Mullinix Packages, Inc., Fort Wayne, Indiana, is our 2008 Thermoformer of the Year. Over the years, his engineering and inventiveness has resulted in numerous breakthrough concepts for the custom thermoformed rigid plastic disposable food packaging industry. Congratulations, George!

CHANGING OF THE GUARD

I'm very excited about the make-up of your new Executive Board. For one thing, there's not as many graybeards! The leadership is comprised of your new chairman, Brian Ray of Ray Products. Brian is a young, energetic and dynamic leader from California. His chair-elect is another young man, Ken Griep of Portage Casting and Mold from Wisconsin. The secretary will remain Mike Sirotnak of Solar Products, New Jersey, another energetic, outspoken young man. This Executive Committee is quite diverse and will be covering all the bases as they serve our membership and industry. Expect some good give-and-take as well as outstanding work.

I encourage anyone interested in joining the Board of Directors to step forward and contact a current Board member. If you are interested in giving back to the industry, we welcome your participation. We especially need the input of practitioners.

MY HEARTFELT THANKS TO ALL

My two-year term as chair is now coming to an end. What a marvelous opportunity and a personal privilege it has been to work for such a dedicated group of individuals. You may have seen the most recent write-up about our Division in "Plastics News." It made us all proud of what a volunteer group can do together. I especially want to congratulate all our leaders over the past 10 years for transforming our organization into a plastic industry powerhouse.

I thank you for the opportunity to serve amongst these leaders. It's been a total joy. And, as the new Prior Chair of the Executive Committee, I look forward to continued service to an industry that has been so good to me personally and professionally. |

IT'S A GREAT DAY IN THERMOFORMING!

Walt Walker

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Thermoforming in the News

Packaging pushes through economic problems

By Tony Deligio

Bucking sentiments in other plastics-heavy markets like construction and automotive, more than two-thirds of converters of single-use foodservice packaging in North America, and their suppliers, expect sales volumes to be better in 2008 than in 2007. That's according to the latest Foodservice Packaging Industry Survey from the Foodservice Packaging Institute (FPI; Falls Church, VA). The survey polls foodservice manufacturers and suppliers in North America and Europe. Nearly 66% of those surveyed also expect profits to improve in 2008, and almost 75% plan to purchase new machinery in 2008, while almost half plan to expand operations in 2008.

In Europe, almost 75% of foodservice packaging processors expect an increase in volumes, with almost all expecting profits to be up. One-third will purchase new equipment, and slightly more plan to expand their operations in 2008.

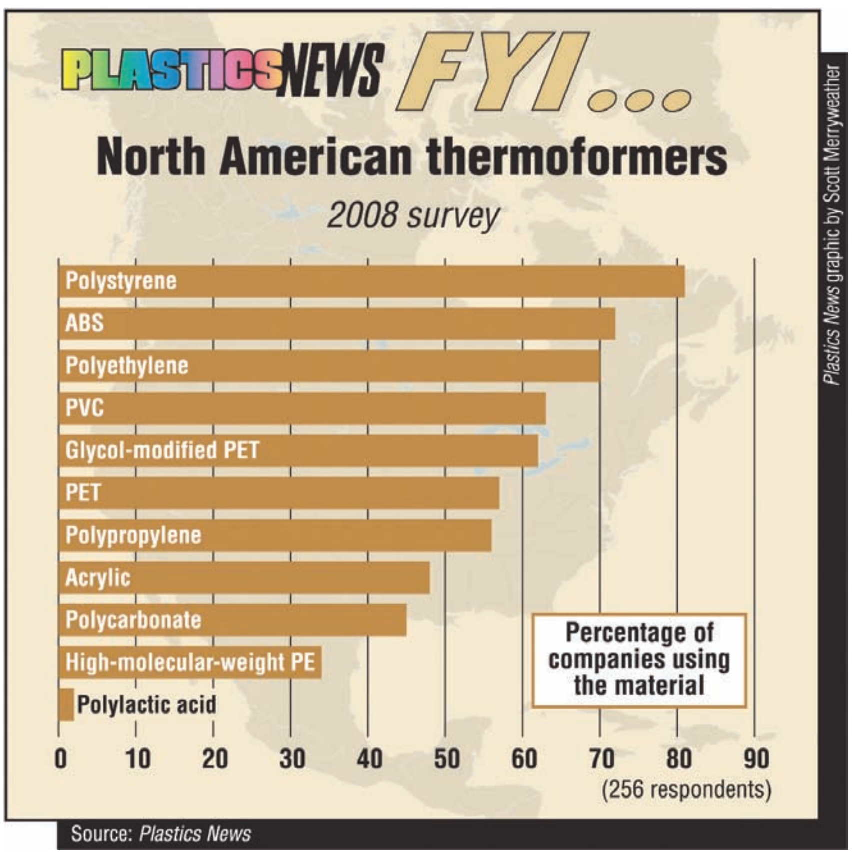
Among common issues cited by European and North American foodservice-packaging firms were increasing raw-material costs – the top challenge according to North America converters and raw-material suppliers – as well as developing new sustainable-packaging products.

The Packaging Machinery Manufacturers Institute (PMMI; Arlington, VA) released its own survey in early March, the 2008 U.S. Packaging Machinery Purchasing Plans Study, which reported that consumer and industrial goods companies plan on spending $6.304 billion for packaging machinery in 2008, a 0.6% increase over 2007. Only two of the eight tracked market segments will show growth, with foods up 2-4% and personal care to expand from 0-2%. The study is based on interviews with 511 representatives of 1,564 U.S. plants – tdeligio@modplas.com.

Automation in Thermoforming

Automation means much more than pick-and-place robotics destined for injection molding, with many processes, including thermoforming and blowmolding automating their lines. An example of front-to-back automation was recently put in place by Irish packaging thermoformer Quinn Packaging, which uses a vacuum tray unloader as an extraction system for steel-rule cutting machines. The automation supplier, Mould & Matic, has fitted a thermoforming machine with substantial automation equipment for separate forming and punching, with the vacuum tray unloader extracting lids and trays from the machines and placing them in stacks. The system also enables the automatic sleeving of the stacks.

These articles are reprinted with the kind permission of Modern Plastics Worldwide *and appeared in the February & March 2008 issues.*



Thermoforming in the News

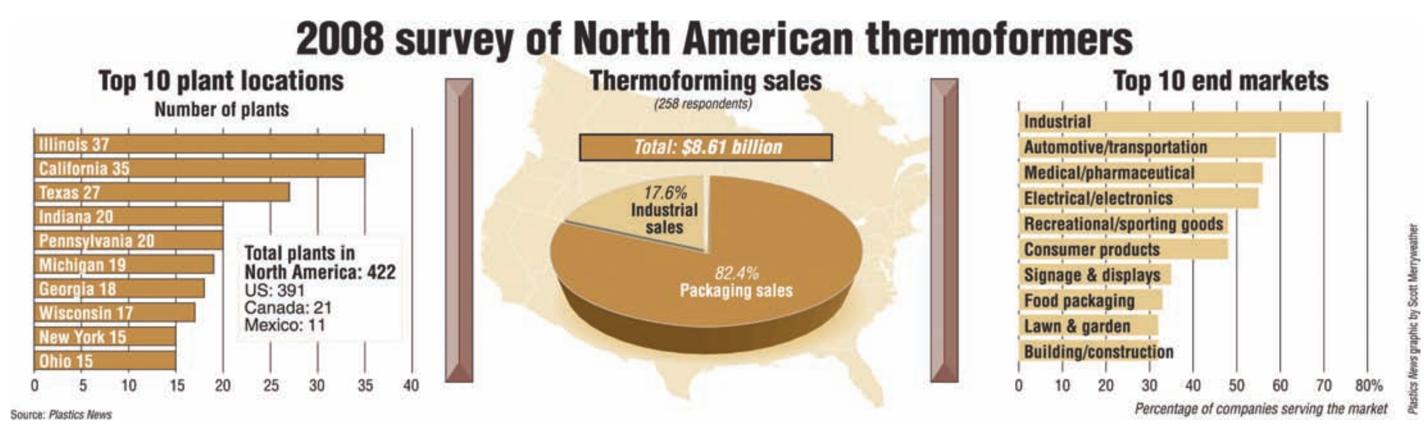


PHOTO CONTEST WINNER

Photo Taken by Tom Derrer, Founder, Eddyline Kayak LLC

The winning photograph was taken at the Eddyline Factory in Washington. The photo was taken during the forming process and shows the clarity and definition of the kayak. It is a great example of what can be achieved in thermoforming.

PROSPECTIVE AUTHORS

Thermoforming Quarterly® is an "equal opportunity" publisher! You will notice that we have several departments and feature articles. If you have a technical article, send it to Barry Shepherd, Technical Editor. All other articles should be sent to Conor Carlin, Editor. Please send in .doc format. All graphs and photos should be of sufficient size and contrast to provide a sharp printed image.

Eddyline Kayak LLC

By Tom Derrer, Owner and Founder, Eddyline Kayak LLC

Eddyline began making whitewater kayaks in the early 1970s. The only technology used at the time was in the manipulation of fiberglass. The typical practice included hand lamination using polyester resins, chopped strand mat and cloth or roving. Then we began to explore vacuum bag molding which involved putting the wet laminate under vacuum and atmospheric pressure using a flexible (2 mil) nylon film, the "bag." We would then seal the bag around the mold perimeter and pull a vacuum under it. This allowed us to increase the glass/resin ratio from about 40% (glass) in the hand lamination process to 70% in this new "vacuum" process. Using this method (and adding Kevlar and carbon fiber) we were able to build 13' whitewater slalom kayaks that weighed 13 lbs. and were suitable for whitewater racing. High performance slalom kayaks are still built this way today. The first company to introduce rotomolded PE kayaks was High Performance Plastics in California. They no longer produce kayaks; however, they were followed by Perception Kayaks in Easley, S.C.

The big challenge posed by the material used to make a whitewater kayak comes in the form of impact. The hydraulic forces in rivers are immense and when those forces collide with rocks, something has to give. We experimented with vacuum bag lamination and exotic fibers like Kevlar 49 and S-glass to improve the impact strength of the boats. In the late 1970s, the first rotomolded polyethylene kayaks developed by other companies appeared on the market. The increase in impact strength convinced everyone that the technology had evolved and there was a landslide of sales of rotomolded kayaks. This occurred despite the fact that the kayaks gained 10-15 lbs. in weight and suffered a considerable loss of performance.

Some years later when the sea kayak industry began to grow rapidly, we were still making fiberglass kayaks as the first rotomolded sea kayaks began to appear. Being longer and larger, they were quite heavy. Given the limitations of linear low density polyethylene, the boats behaved poorly but were less expensive to make. With low abrasion resistance and low heat distortion temperatures, the boats suffered rapid loss of performance from abrasion (scuffing) and dimensional change. As a company that had always been focused on performance, quality and innovation, we scratched our heads and continued to "smell the styrene," so to speak. I knew something better would come along and eventually it did.

Interestingly, it turned out to be a manufacturing backlog that led us to the solution. It seems that companies often think in terms of familiar technology. Therefore it was natural that we not only built the kayak shells from

fiberglass, but all the interior components as well. There are numerous small parts in a kayak including cockpit rims, seats, backrests, bulkheads and hatch covers. In 1990, we found ourselves sitting on a large quantity of unfinished inventory because small part production could not keep up with the large parts (decks and hulls). Inevitably, the realization dawned that these parts need not be made from fiberglass. After visiting a few spa companies, we started construction of our own thermoforming machine. Power was limited so we settled on "Vulcan" gas radiant heaters and added the rest. ABS turned out to be a perfectly suitable material for the small components and in no time our backlog issue was resolved. There were other unintentional benefits that really got our attention: no spraying, no dust, no mold preparation, no need for multiple molds, no drying time, no smell, and on and on.

At this point it was a relatively minor synaptic closure (the light bulb thing) to the next rhetorical question: "Can't we make the kayaks this way?" This initiated a two pronged search: one for an appropriate material and one for a former large enough to do our testing. This technology was new to us and no one else was attempting to build a product like ours so the learning curve was fairly steep. Mold construction was complex because it made no sense to design and build metal molds for untested prototypes made from untested materials. We went through numerous iterations of material configurations, adhesive concoctions, mold construction and repair and so on, learning quite a bit on the way. The few large machines that were in close proximity to us to make testing practical were primitive calrod machines with manual controls. We had problems with uneven wall thickness, chill marks, cold-flow and other familiar forming foibles.

At about the same time we had begun CAD/CAM modeling of our new designs. Our software enabled us to do multiple subtle reiterations of a design configuration and this led to rapid improvements in performance. Another real benefit however, was in the expedient and accurate manner in which our masters were created.

We could move from a CAD file to a prototype mold in a matter of weeks with great dimensional accuracy. Minor changes were easy to implement on our prototype molds allowing a fairly rapid path from concept to product.

By 1996 we were ready to release two models of kayaks designed for thermoform production and materials. They were well received and we very quickly realized we needed our own machine. We contracted with General Plastics Machines to build us a 4.5' x 20' thermoforming machine. The multiple zones and computer controls made life much better. We used IR sensors to control the forming and demolding temperatures. With mated parts of this size, it was imperative to control shrinkage. We found ways of plumbing our high volume forming tools that minimized stress on the tool from heat and vacuum and expedited air removal. Our tool design and the elaborate zone structure of our oven facilitated exceptional control of local temperatures so we could increase material thickness in heavy wear areas.

Eddyline has since developed a "lean" business strategy with just-in-time single part flow and our involvement in thermoforming has partnered well with that strategy. Sticking with small batch or single part flow helps us to dramatically reduce rejects, rework and inventory loss due to design changes. The latter occur fairly rapidly given our interest in keeping our product line fresh and competitive. We pride ourselves on our ability to deliver rapidly, eliminating the need for our dealers to overstock our product.

Today, we have eliminated all fiberglass production, increased our manufacturing volume by a factor of ten in the same floor space, added two CNC trimming machines and currently produce eleven models ranging in length from 12' to 18'. All models have been designed expressly for thermoforming technology. We take great pride in producing kayaks of extraordinary quality to the delight of our growing customer base around the U.S. and Europe.


Automated Part Removal

Looking ahead, Eddyline will invest even more in lean principles and constant improvement *(Gemba Kaizen)*. And we cannot help but keep an eye on twin sheet technology. We do entertain outside thermoforming work and have the ability to produce affordable prototype and short run tooling when it is compatible with our equipment. In fact, a number of our customers are boat builders (not kayaks) that have also discovered that all those parts do not need to be built of fiberglass.

George J. Lueken
Owner
Mullinix Packages, Inc.
Fort Wayne, Indiana

Born April 2, 1929 in Central Illinois, George Lueken served in the Marines during the Korean War and reached the rank of Buck Sergeant. After leaving the service, he received his business degree from the University of Illinois in 1957.

George joined Dow Chemical where he first developed an interest in plastics. In 1965, with three partners, he started a plastic extrusion company called ALCHEM. He eventually sold his interest to start Mullinix in the back of a small machine shop in Saginaw, MI. Mullinix was incorporated in 1970 and remains a closely-held manufacturer of custom thermoformed packages serving the disposable food packaging industry.

In 1976, Mullinix moved the company to Fort Wayne, IN to be closer to their primary customer, Peter Eckrich & Sons Meat Company supplying them a Barex luncheon meat package known as the "Meat Keeper." Mullinix rapidly developed a reputation for identifying new applications for thermoformed packages, including the use of barrier films for the meat processing industry. Superior design and rapid development of new manufacturing technologies allowed Mullinix to capitalize on new business opportunities during the early stages of a product's life cycle.

In the 1980s and 1990s, the company was recognized as a leader in crystallized PET (CPET) thermoforming for airline food service applications and dual-ovenable prepared foods packaging. Allegheny Airlines (later US Air) was an early customer. Mullinix worked with Lyle Machinery on this project and was the first to develop the two-stage CPET forming process. In 1982, Mullinix became the first company to conventionally form APET when they developed a rim rolled cup for cream cheese which by 1984 developed into a two-layer coextruded silver/white PET container which was double-seamed. Clear containers followed including an ice-cream container for Breyer's Ice Cream. In 1988, Mullinix developed the Impromptu Line with General Foods. It was the first retorted CPET shelf-stable package ever developed for dinner entrees. Mullinix was instrumental in forming the package with sealing techniques to stand the pressures of retorting. Mullinix continues to work with most of the major national food processing companies.

By 1995, the company had developed technology for wide-web inline forming of polypropylene giving Mullinix a significant strategic advantage over the competition. Gladware® was the breakthrough product line where the technology was applied and the company was awarded several patents for this development.

In 2000, Cryovac/Sealed Air chose Mullinix to be its exclusive supplier of barrier polypropylene trays for the case-ready meat market. The product is distributed throughout the U.S.

George has been a member of SPE since 1962 and in 1996 was awarded the Jack Barney Award for recognition of his contributions to the sheet extrusion industry. Specifically, Mullinix worked on the development of the gear pump (melt pump) with Eastman and Welex which greatly enhanced the ability to run PET quality sheet and subsequently the quality of thermoformed parts.

Mullinix Packages currently occupies 400,000 square feet in Fort Wayne, IN, and employs over 450 dedicated people. George Lueken continues to play an active role in the company and is known for being one of the most progressive and respected business owners in the thermoforming industry.

Membership Benefits

- Access to industry knowledge from one central location: www.thermoformingdivision.com.
- Subscription to **Thermoforming Quarterly**, voted "Publication of the Year" by SPE National.
- Exposure to new ideas and trends from across the globe. If you don't think your company is affected by globalization, you need to think again.
- New and innovative part design at the Parts Competition.
- Open dialogue with the entire industry at the annual conference.
- Discounts, discounts, discounts on books, seminars and conferences.
- For managers: workshops and presentations tailored specifically to the needs of your operators.
- For operators: workshops and presentations that will send you home with new tools to improve your performance, make your job easier and help the company's bottom line.

JOIN D25 TODAY!

The Economic Stimulus Package – What It Means for Thermoformers

Deduction for capital equipment nearly doubles to $250,000

The information and examples provided in this article are courtesy of Stopol, Inc.

On February 13, 2008, President Bush signed into law the "Recovery Rebates and Economic Stimulus for the American People Act of 2008." This act provides business growth incentives by increasing Section 179 expensing and bringing back bonus depreciation.

What This Means For You

- **Increased Section 179 Expensing.** Prior to the Act, small businesses could expense up to $128,000 of the cost of new and used equipment placed in service during that year. The Act increases the maximum expense amount to $250,000.
- **Return of Bonus Depreciation.** The Act brings back the special rules of bonus depreciation by permitting a bonus first-year depreciation deduction equal to 50 percent of the cost of the new property placed in service during 2008.

How This Could Work For You

The following example illustrates how current tax rules regarding depreciation can benefit those making capital equipment purchases in 2008:

Example

A company purchases a $400,000 machine. The company purchased no other capital equipment during 2008, so it may deduct $250,000 under Section 179. The remaining $150,000 is then depreciated, generating an estimated additional deduction of $21,500. The sum of these two deductions is then subtracted from the cost of the equipment, resulting in a total first-year deduction of $271,500 or 67.9 percent of the $400,000 investment. This deduction equals a real cash savings of $95,025, which means the customer essentially spent $304,975 on the machine.

Snapshot View

Cost of Equipment	$ 400,000
Section 179 Expense	$ 250,000
First-Year Depreciation	$ 21,000
Total First-Year Deduction	$ 271,500
Real Cash Savings on Your Equipment Purchase	$ 95,025
(assuming a 35% tax bracket)	
Cost of Equipment After Tax Savings	**$304,975**

This example presumes that the mid-quarter convention does not apply.

Please note that your annual deduction cannot exceed your aggregate net taxable income for 2008.

For Profit Thermoforming

Nick Mebberson, Scope Machinery Pty Ltd

How we do we make a profit in this game called thermoforming? How do we make decisions on how to play the game for profit? Reinhold Niebuhr's "Serenity Prayer" from the 1930s is a great place to start:

Lord,
Give us grace to accept with serenity the things that cannot be changed, courage to change the things that should be changed, and the wisdom to distinguish one from the other.

If we apply this wisdom to our chosen profession, we have "The Thermoformer's Prayer":

Give us the grace to accept with serenity things that cannot be changed (customers, material prices, tool prices, part prices, labor rates, birth, death, taxes); courage to change the things that should be changed (automation, machine rates, scrap rates, efficiencies, tool change time); and the wisdom to distinguish one from the other.

In other words, let us examine the areas where we do have the most control in order to make a profit.

We all have spreadsheets to cost jobs on existing equipment but these are often limited to items we consider "fixed." How do we separate what we can change, understand the profit implications of the choice and thereby select equipment to increase profits?

We are faced with seemingly endless combinations of machines, layouts and tooling. How do we decide which combination is the most profitable?

For example, here are some examples of the questions that a typical thermoformer might ask himself every day on the job:

- Am I better off spending $100K on automation to reduce labor from 1.2 to 0.3 people?
- My labor costs have increased 20% – what can I do?
- Am I better off running faster or adding cavities?
- Am I better off spending $10K on programmed maintenance or holding spares to get 3% more machine time available?
- What if I can get the cavities closer and reduce scrap by 5%?
- Should I buy cheap knives that I must re-sharpen every run or should I spend more on quality knives?
- What if I halved my tool change time?
- What is my economical run length? Should I store parts?
- What if I reduced my air consumption by 25%?
- Should I spend $25K in a valve upgrade and get 5% reduction in cycle times?
- Do I spend $5,000 to flood cool my cavities to run 3 cycles faster?
- Do I use a manual machine or do I fully automate?
- Do I buy a cheap Chinese machine that requires lots of labor and maintenance?
- Do I buy the latest million dollar rocket from Europe that makes coffee as well trays?

In this article we will examine the variables and come up with a spreadsheet that we can use to examine our options. Being an engineer, not an accountant, this will be a practical approach.

It is limited to partial absorption costing with costs directly related to the equipment and the specific job. It is not going to be perfect, but it can at least give us an idea for what costs are, what savings are available and what increased profits are possible with some informed equipment selection. (*Note*: let's not get caught up with the minute details of what type of compound interest calculation is the most appropriate as this is for illustrative purposes.)

There are two main schools of thought on the business of thermoforming:

1. There are those companies that look to make a gross profit on the raw material with the machine/labor/costs as the expense, i.e. I buy APET for $2/kg and I sell it for $3.50/kg. This applies to both extruder/thermoformers and pure converters with the thermoforming being a means to sell or convert sheet, i.e. I buy resin/sheet for $1/$2 and sell it as sheet/product for $2/$3.50 with its conversion to product an expense.

2. Others look to the equipment investment with an hourly return, i.e. $150/hr. with material and labor being the expense. The end result is the same but the approach and analysis are quite different. In the spreadsheet, we will combine the philosophies and look to make our product for the lowest net price.

The aim is not to develop a costing sheet but rather to illustrate a method of evaluating "what if" sensitivities on equipment in order to decide how to make this part for increased profits. I have setout and input data from a typical roll-fed thin gauge machine, with the option for robotic stacking, and each entry is explained off to the side. The layout is fairly self explanatory and in a format that I am sure is familiar to all.

The base case is a $350,000 base machine with robotic stacking working at good rates.

The run is a 1,000,000 part run, 20-up at 4.5 second cycle, 1/3 of an operator with robotic stacking. From here we will examine a number of scenarios to determine what is the "profit effect" of various decisions:

Q: Should I invest in automated stacking?

If we don't invest $100,000 and don't use a robot, labor increases to 1 person full time. Keeping all else constant, the part cost increases by 5%.

A: A robotic stacker is money well-spent.

Q: Should I invest the latest technology with good resale value or a buy basic machine with little resale?

Here we see the effect of a slower cycle, less resale value, higher labor costs, longer uptime and slower tool changes. Use of basic equipment with these limitations will increase part cost by 10%

A: The upfront cost is not the only factor to consider and will cost more in the long run.

Q: What is the effect of a reduction in cycle time, all else being equal?

Here we reduce cycle time by 1 second (in 4.5) and see a 3% reduction in part cost – this can be directly compared to the cost of implementing these changes, i.e. preheaters, flood cooling.

A: It is worth spending money to reduce cycle times.

Q: What if my scrap rate doubled (even if I was recovering waste)?

Here we double scrap from 15 to 30% and we see a 10% increase in part price

A: Even if I recover my scrap, keeping it to a minimum makes financial sense.

Q: What are the economies of short and long runs?

Should I run the year's order and store it or do 12 shorter runs? Here we look at part cost for 1,000,000 part run compared to 10,000,000 run. We see a 5% part cost reduction for the longer run.

			BASE	no Auto	cheap M/C
Equip Costs	Capital Machine cost	$	$350,000	$350,000	$150,000
	Automation cost	$	$100,000	$0	$0
	Cost of funds	%	6%	6%	6%
	life	years	6	6	6
	worth after life years	%	40%	40%	10%
	hrs per week	hrs	100	100	100
	weeks per year	wks	45	45	45
	Run hrs available per year	*hrs*	*4500*	*4500*	*4500*
	% machine used over available time	%	80%	80%	80%
	total hrs to recover	*hrs*	*21600*	*21600*	*21600*
	Cost of funds	*$*	*$356,961*	*$356,475*	*$163,987*
	Hrly equip finance cost (ideal)	***$0.00***	***$16.53***	***$16.50***	***$7.59***
MACHINE	Power	kw	35	35	35
	Air CFM	CFM	75	75	75
	Cooling	kw	5	5	5
	Price power per kwh	$0.00	$0.10	$0.10	$0.10
Utils	*Power per hour*	*$0.00*	*$3.50*	*$3.50*	*$3.50*
	Air cost per hour	*$0.00*	*$1.13*	*$1.13*	*$1.13*
	Cooling	*$0.00*	*$0.50*	*$0.50*	*$0.50*
	Cost Untils per hour	***$0.00***	***$5.13***	***$5.13***	***$5.13***
Maintenance	cost per annum incidental	$	$1,500	$1,500	$1,500
	Programmed cost to get reliabilty	$	$2,500	$2,500	$2,500
	available to run ie not broken down or being fixed	%	98%	98%	98%
	Actual run hrs given reliabilty	*hrs*	*21168*	*21168*	*21168*
	Hrly equip finance cost (with reliabilty)	***$0.00***	***$16.86***	***$16.84***	***$7.75***
	Hrly Maintainace cost	***$0.00***	***$1.13***	***$1.13***	***$1.13***
	hrly cost for Equip (fin,utils,maint)	***$0.00***	***$23.12***	***$23.10***	***$14.01***

		BASE	no Auto	cheap M/C
Run Details				
Run length (parts)	prts	1000000	1000000	1000000
Tool cost to be amortized this run	$	$1,000	$1,000	$1,000
additional tool spend for cycle improvements	$	$1,000	$1,000	$1,000
cycle time	sec	4.5	4.5	5.5
# Cavities		20	20	20
Parts per hour	*prts*	*16000*	*16000*	*13091*
part actual weight	0.0000 Kg	0.0150	0.0150	0.0150
Material cost	$0.00/Kg	$2.20	$2.20	$2.20
Scrap recovery per Kg	$0.00/Kg	$0.30	$0.30	$0.30
% scrap ideal	%	15%	15%	15%
Roll size	Kg	750	750	750
Kg per hour	Kg/hr	276.00	276.00	225.82
material cost per hour (raw)	***$0.00***	***$607.20***	***$607.20***	***$496.80***
Net material cost per hour (inc recovery)	***$0.00***	***$524.40***	***$524.40***	***$429.05***
Roll change time	hr fraction	0.25	0.25	0.25
Tool change time	hrs	2.00	2.00	3.00
Run Hours (at ideal rate no changes)	***hrs***	***63***	***63***	***76***
% overrun due to poor running (eg cutting problems)	%	110%	110%	120%
Running Hours in the real world	***hrs***	***69***	***69***	***92***
Parts that go to scrap (during overrun and setting)	%	2%	2%	2%
Actual Material run	Kg	17595	17595	17595
Net material cost this run (inc recovery)	***$***	***$33,431***	***$33,431***	***$33,431***
Number of Roll changes	*num*	*23*	*23*	*23*
Time lost to roll changes	*hrs*	*6*	*6*	*6*
lost time (tool and roll changes)	***hrs***	***8***	***8***	***9***
Time on the Machine (running+changes,total)	***hrs***	***77***	***77***	***101***
hrs needing operators this run	***hrs***	***77***	***77***	***101***
setter needed time (tool/matchnge/setting)	***hrs***	***16***	***16***	***29***
Operator number (people to pack off machine)	num	0.3	1	1.2
Operator cost per hour	$	$35	$35	$35
Setter operator cost	$	$65	$65	$65
operator cost this Job	*$*	*$804*	*$2,682*	*$4,222*
Setter cost this job	*$*	*$1,009*	*$1,009*	*$1,883*
labor cost this Run	***$***	***$1,814***	***$3,691***	***$6,105***
Average hrly labor rate	***$***	***$24***	***$48***	***$61***
hrly cost for Equip (fin,utils,maint)	$	***$23.12***	***$23.10***	***$14.01***
Net material cost per hour (inc recovery)	$	***$524***	***$524***	***$429***
Average hrly labor rate	$	***$24***	***$48***	***$61***
Tooling amortization	***$***	***$26***	***$26***	***$20***
Total run cost	***$***	***$39,016***	***$40,891***	***$42,944***
Net part cost	***$0.00***	***$0.039***	***$0.041***	***$0.043***

This is an abbreviated version of the spreadsheet.

It is designed to give examples of how thermoformers can compare variables and determine costs.

For a complete version, please contact Nick Mebberson at sales@scopemachinery.com.

A: Try to do longer runs, especially if tool change causes long downtimes.

Q: What if I don't keep the machine busy?
If we halve the available hours on the machine (assume day shift only) we see a 3% increase in part cost, maybe not as bad as first glance.
A: We need to keep the machine running but not for profitless volume.

Q: What if my power costs doubled?
If we double rate from 10 to 20 cents per kw/hour, we see little change.
A: Power cost may not be as significant as other factors?

Q: What effect does roll size have?
What if I can only get 100 kg rolls instead of my usual 750 kg rolls? We see an increase in part cost of over 10%.
A: Keeping roll change frequency and down time to a minimum is critical and has a big influence on part cost.

Q: What if I don't spend any money on preventative maintenance and the machine is broken down or being fixed 25% of the time?
The part price increases by 3.5%.
A: We can estimate the costs of unreliable machine.

In summary, the initial capital cost is relatively insignificant compared with other hourly costs such as material and labor. We have more options to change in order to increase our profits than we perhaps realize. We can measure and analyze these options and make informed decisions.

We must change what we can and have the wisdom to focus on those areas where we can have the most positive impact on the bottom line.

Note: The spreadsheet and article are intended only as guides for thermoforming companies. They are not intended for reproduction. Copies of the full spreadsheet are available by contacting the author directly at sales@scopemachinery.com.

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- 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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SPE® Thermo Forming Division

Thermoforming Pre-Printed Materials

Adolf Illig

Technical Editor's Note: Thermoforming of pre-printed materials should not be attempted without a thorough knowledge of factors such as ink compatibility with materials and heat, distortion and form to print registration. I designed and produced several runs of roll fed pre-printed parts on in-line machines 20 years ago. Improvements in computer simulation, inks, machines and materials have been made since then. If I had the knowledge contained in this article by Adolf Illig 20 years ago, I may have less grey hair today.

PRINTING INK SPECIFICATIONS

The printer must be familiar with the thermoforming process, the materials being specified and the heats that the inks must withstand. Here are the points to be addressed:

- Ink must match the material for adhesion properties.
- Ink color must not fade or crack when heated.
- Ink must stretch with the material.
- When contact heat is used a coating should be applied to prevent transfer of ink to the heater.
- Ink suppliers can recommend the ink types that are compatible with this process.

PLASTIC MATERIAL SPECIFICATION

- Some plastics such as PP and PE must receive preliminary treatment of the surface to be printed to create good ink adhesion.
- The printer will require the plastic material to be free from twisting and warping as it is unwound, have a width tolerance of +/- 0.25mm (.010"), have a thickness tolerance of +/- 0.1mm (0.004"), minimum sag characteristics and be free from internal stresses under heat.

MACHINERY SPECIFICATIONS

- Thermoforming equipment must operate with repeatable precision.
- Material temperature must remain very stable throughout the run.
- Tool temperature must remain very stable throughout the run.
- Chain and press movement must repeat accurately.
- For sheet fed operations, edge stops on printing press and former must be accurate and consistent.
- Roll fed machines must have servo chain drives that are indexed by way of a photocell that reads a printed mark on the material. This feature is imperative and must be capable of backing up the material if it overshoots the mark.

PRINT DISTORTION

The printed image on the material is known as the *distorted print* because its final appearance becomes apparent only after thermoforming. Distortion can be done using computer simulation or by taking a formed sheet and compensating for the stretching of the sheet into the print art work. Either way, the process can be best understood by taking a sheet of material to be thermoformed, accurately drawing a ¼" x ¼" grid pattern over the full sheet, thermoform it over the mold and witnessing the stretching in the printed grid. The art work and printing plates must then be distorted accordingly. This is a simplified explanation. A detailed method is presented here.

HINTS FOR PRINTING IMAGE DESIGN

- Color transitions or edges should not coincide with the corners or edges of the formed part. This makes print to form registration very difficult.
- Precise symmetrical and straight lines and designs should be avoided.
- Flowing or script type styles are preferred to avoid a distorted look.
- Keep distorted images that are to appear on a side wall or cavity at least 10mm (0.5") away from a flat surface or edge of the part.

DETERMINING THE CORRECT DISTORTED IMAGE

There are some preprinted applications that do not require a lot of time to arrive at the correct distortion on the art work. It could be an item like a cake dome with a random pattern that does not appear out of place after the material has stretched. Or it could be an item like a very shallow draw plate that will not stretch very much. Even with shallow draw items it is recommended to keep the web width as narrow as possible to avoid excess sag and consequently stretching prior to forming. Heat must be uniform throughout the oven and the image should not conform to the geometry of the part.

BASIC RULES BEFORE STARTING THE DISTORTION PROCESS

- Establish material specs that can be maintained for the whole production run (thickness, shrink, sag).

- In the case of sheet forming, establish sheet dimension tolerances.
- Molds and plugs must be temperature controlled.
- The same machine should be used for every run.

STEPS TO GETTING AN ACCURATE IMAGE ON THE THERMOFORMED PART

- Print a 1mm x 1mm grid pattern on a roll of material or number of sheets in the case of sheet forming.
- Using the production machine and form tooling, form and trim the material.
- When acceptable parts have been formed with this material stop the machine and record the machine settings.
- Take 3 indexes or sheets of acceptable parts and mark each part with the index number 1, 2 or 3, the cavity number and an arrow pointing in the direction of transport.
- Save the web and place the parts back in the web in their correct location, see Fig. 4.61
- Prepare a sheet of thin material as least as long as 1.5x the index length with 1mm x 1mm grid lines.
- Draw a coordinate system (Fig. 4.62) onto the as yet unheated production material and the already formed blank. This is done in the scrap area.
- The zero points of the 2 coordinate systems must have identical spacing from the edge of the material.
- The axis lines of the coordinate system must coincide with the lines on the grid.
- The deformed lines of the grid are then traced on the formed material.
- Print only the most important colors on the first distorted print run to save cost.
- The more grid points transferred from the completed parts to the coordinates of the unformed material, the more accurate the distortion will be. Refer to Fig. 4.63.
- The resultant first print is the first distortion printing.
- The material is printed with the established first distortion print and a superimposed grid pattern. With roll-fed material the reference marks must be established in the coordinate system with the aid of the feed stroke.
- This material with the first distortion print is then thermoformed with the established machine settings.
- The described procedure is repeated with corrections from the first distortion and the second distortion is printed using all of the colors in the image.
- In all probability, the described process will have to be repeated in the case of complex art work until the optimum has been established.

As in all multi-step manufacturing operations, the more experience one gets with this procedure the easier it becomes. However it is highly recommended that the initial attempts to thermoform preprinted material should be done with simple print images on shallow draw parts until a reasonable level of confidence is achieved.

(See Figures 4.61, 4.62 and 4.63 on page 19.)

Thermoforming Pre-Printed Materials

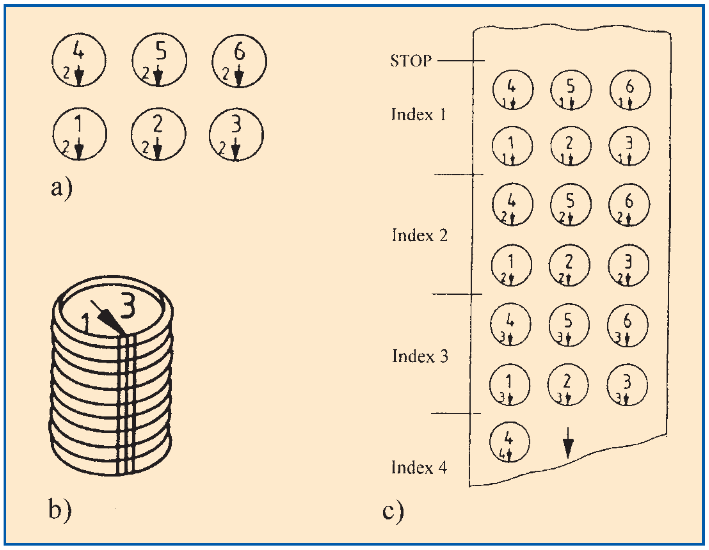

Figure 4.61
Example of a section of web with 3 indexes of lids (6 up tool)

a) 6 up index shot from the #2 index with arrows marking the direction of travel

b) Stacked lids from index #3

c) Lids replaced in the web

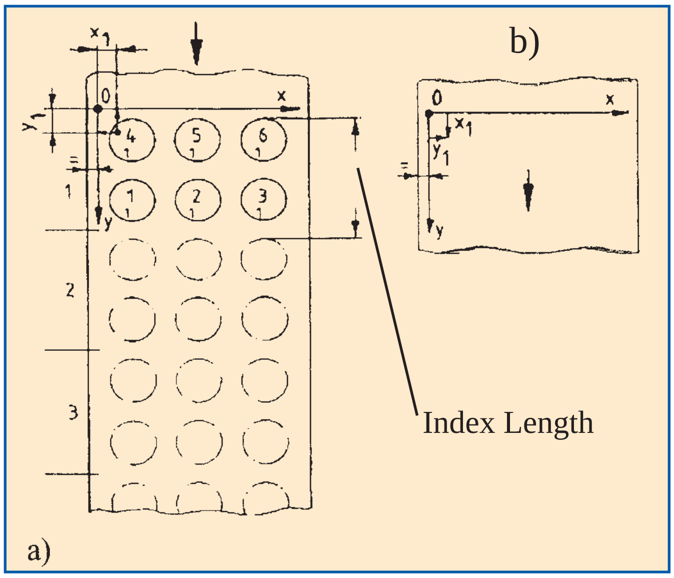

Figure 4.62
x/y coordination system for calculating distortion

a) Establishing the web coordinates

b) Transferring the coordinates to the unformed material to establish the distortion print

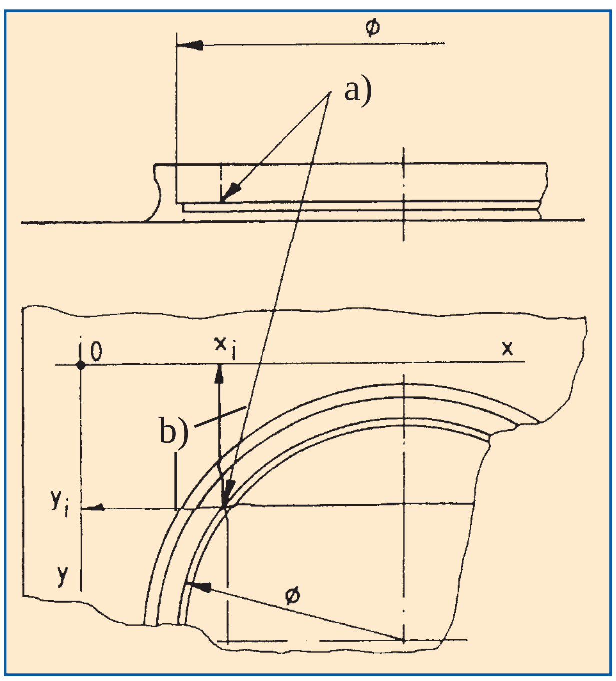

Figure 4.63
Reading the x/y coordinates of a point on the print

a) Point at the edge of the print

b) Move along the distorted grid line to the x and y axis of the coordinating system

UNIVERSITY NEWS

Alumni Gifts Help UML Plastics Program Go Green

Entrepreneurs Create Professorships with Million-Dollar Gifts

LOWELL – Two million-dollar gifts announced in February will help UMass Lowell advance the study of environmentally friendly plastics through teaching, research and laboratory experiences. Mark Saab ’81 and Jim Dandeneau ’80, both plastics engineering alumni, have each donated $1 million to fund two professorships in green plastics.

Each gift includes a $500,000 match from a $20 million state trust fund that supports the creation of endowments related to the environment. The fund was created in 2004 by the sale of 110 acres of land owned by the University of Massachusetts on Nantucket to the Nantucket Conservation Foundation.

Saab and Dandeneau are long-time supporters of the University and both have previously funded scholarships, discretionary endowments and laboratory renovations to support UMass Lowell students. Saab, who lives in Lowell, is president, co-founder and co-owner of Advanced Polymers Inc., in Salem, N.H. Dandeneau, from Thompson, Conn., is founder and president of Putnam Plastics Corp. in Dayville, Conn., and serves on the board of directors of Memry Corp.

“These two successful, innovative alumni are not only leaders in their field, they are leaders in giving back to the University. We appreciate their support of the outstanding research work being done here, and their commitment to making a difference in the lives of students at the University,” says Chancellor Marty Meehan.

Saab has nearly 25 years of experience in the plastics industry, including 20 years in the medical device field, and holds more than 30 patents. His company, Advanced Polymers Inc., manufactures the world’s thinnest, strongest and smallest heat-shrink tubing and produces high- and low-pressure balloons for the medical device industry.

A 2004 gift funded the Mark Saab Advanced Polymers Physical and Rheological Properties Testing Laboratory – a teaching facility dedicated to polymer property evaluation. He and his wife, Elisia, also established two scholarships at UMass Lowell, one for a plastics engineering student and the other for a student in any major. Saab received the Distinguished Alumni Award in 2007.

UMass Lowell Plastics Engineering alumni Mark Saab and Jim Dandeneau recently each donated $1 million to fund new professorships to support study and research of “green” plastics. Shown at the event announcing the donation on February 14th are (from left): Chancellor Marty Meehan, Jim Dandeneau, Debbie Dandeneau, Elisia Saab, Mark Saab, and Robert Malloy, chair of the Department of Plastics Engineering.

Under Dandeneau’s leadership, Putnam Plastics became a national leader among specialty polymer-extrusion companies for the medical device industry. In 2004, 20 years after its founding, Putnam Plastics was acquired by Memry Corp. Dandeneau was named a vice president of Memry Corp. and was subsequently elected to the company’s board of directors.

In 1999, Dandeneau created the Dandeneau Family Endowed Scholarship Program. He was inducted into the University’s Francis Academy of Distinguished Engineers. Putnam Plastics also funded the renovated the S.J. Chen Extrusion Laboratory in Plastics Engineering.

“UMass Lowell has been a leader in plastics engineering education and research for the past 50 years. These professorships will allow our department to embrace the next generation of technology, one that addresses the growing need for environmental sensitivity,” says Prof. Bob Malloy, chair of the Plastics Engineering Department.

Saab and Dandeneau were honored at a lunch on Thursday, February 14 in Alumni Hall.

With an endowment such as those being funded by Saab and Dandeneau, the principal of a gift is invested in perpetuity and a portion of the annual interest is used by UMass Lowell for the purpose for which the fund was established. For these research professorships, the proceeds will be awarded on an annual basis to faculty who are teaching and researching green plastics. Endowed gifts are managed for UMass Lowell by the University of Massachusetts Foundation Inc.

These are the third and fourth professorships created at UMass Lowell. The other two are the Roy J. Zuckerberg Leadership Chair and the Howard P. Foley Endowed Professorship in workforce development.

UMass Lowell, with a national reputation in science, engineering and technology, is committed to educating students for lifelong success in a diverse world and conducting research and outreach activities that sustain the economic, environmental and social health. UML offers its 11,000 students more than 120 degree choices, internships, five-year combined bachelor's to master's programs and doctoral studies in the colleges of Arts and Sciences, Engineering and Management, the School of Health and Environment, and the Graduate School of Education. www.uml.edu.

Contact: Christine Gillette, 978-934-2209, Christine_Gillette@uml.edu.

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The Thermoforming Board of Directors has taken your advice from your completed surveys and beginning in 2008 we will be going back to our old dates –

DATES:
Saturday, September 20th, 2008 through Tuesday, September 23rd, 2008

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HEADQUARTER HOTEL: MINNEAPOLIS HILTON & TOWERS

2008 Chairman:
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Avery Dennison Performance Films

Cut Sheet Chairman:
Jim Armor
Armor & Associates

Roll Fed Chairman:
Phil Barhouse
Spartech Packaging Technologies

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MINNEAPOLIS CONVENTION CENTER

**Please note! The hotel will require a deposit of one night's room and tax at the time the reservation is made. Cancellations made after August 15, 2008 will result in the forfeiture of one night's deposit. Any reservation made after August 15, 2008 will require a non-refundable one night's deposit at the time the reservation is made.*

TWO DAYS FULL TECHNICAL PROGRAM

(PROGRAM SUBJECT TO CHANGE)

WORKSHOPS INCLUDED WITH FULL CONFERENCE REGISTRATION (Please Select One)

SATURDAY, SEPTEMBER 20, 2008
(Please Select One)
Hilton Hotel - 8:30am - 4:00pm
McConnell-Buckel Cut Sheet Workshop - Limited to 100
"Adapting to Form the Future & Interactive Troubleshooting Workshop" – Part I

SPE Decorating & Assembly Division - Limited to 100
"Innovations in Decorating Thermoforming Applications"

TUESDAY, SEPTEMBER 23, 2008
(Please Select One)
Hilton Hotel - 8:30am - 4:00pm
Strachan Roll Fed Workshop - Limited to 100
"Advanced Cost Saving Techniques In Thin-Gage Thermoforming"
Mark Strachan, Global Thermoforming Training, Inc.

PLANT TOUR - Limited to 50
Wilbert Plastic Services, White Bear Lake, MN Facilities
Leave Hilton Hotel at 8:30am

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CONTACT: Gwen Mathis, Conference Coordinator at 706.235.9298 or gmathis224@aol.com

PARTS COMPETITION INFORMATION:
Contact Haydn Forward – 858.450.1591 or hforward@smi-mfg.com

FOR THE LATEST UP-TO-DATE INFORMATION ON THE MINNEAPOLIS CONFERENCE, CHECK OUT OUR WEBSITE:
www.thermoformingdivision.com

SEPTEMBER 20 - 23, 2008 • MINNEAPOLIS, MINNESOTA

SUNDAY, SEPTEMBER 21, 2008: JOINT SESSION

"Infrared Temperature Measurement Applications" - Jimmy Earle, Raytek
"Accelerated Package Development & Testing" - Hossam Metwally, Ansys
"Real Time Shop Floor Data Collection" - Brian Lynch, Dunsirn Industries

"Thermoforming Tooling" - Martin Haex, Bosch-Sprang
"The Latest in Thermoforming Equipment" - Bill Kent, Brown Machine

"A Brief History of Sheet Co-Extrusion" - Frank Nissel, Welex
"Achieving Optimum Production Results Through Sophisticated Control Systems" - Dana Hanson & Tom Limbrunner, PTi

"Thermoforming of Polypropylene – The Effect of Stabilization on Regrind and Part Performance"
Ronald Becker & Lyondell Basell
"Bio Materials" - Paul Uphaus, Primex Plastics
"Expanding Your Portfolio with PLA Materials" - Nicole Whiteman, Natureworks

MONDAY, SEPTEMBER 22, 2008: HEAVY GAUGE SESSIONS

"Engineering Resins – Options and Opportunitites for Extrusion Market" - Roger Petit, Sabic Innovative Plastics
"Low Gloss Flexible Thermoplastic Polyolefins" – Laura Weaver, Dow Chemical
"The Next Generation of TPOs" - Todd Hogan, Dow Chemical
"TPO Innovation in Design" - Brad Rickle, Premier Materials

"Designing Parts Using Bayblend (PC/ABS)" – Prakash Vizzeswarapu, Bayer Material Science
"Improved Rigid TPO Sheet Products for Large Part Forming Applications"
Michael Mahan & Steve Campbell, Spartech Plastics
"It's a Game of Inches" - Bob Marshall, ZMD

"Thermoformable CFR Composite Sheet: A Viable Alternative to Metal" - Peter Lindenfelser, Lingol Corporation
"Forming CFR Composite Sheet" - Art Buckel, McConnell Company

"Fluorex Bright Film – The Chrome" - Jeff Bailey, Soliant LLC
"The Latest in TPO & Ionomer: How They Can Help You" - Joe Schulz, Invision
"Next Generation of 5 Axis Trimming & Modeling" - Jim Bullis, Thermwood Corporation
"Robotic Trimming – Improve Your Competitive Advantage" - Paul Schuch, KMT Robotics
"Color Control for Extruded Sheet" - Axel Kronewitter & Larry DeBow, Senoplast
"Application Specific Equipment is Your Best Competitive Advantage" - Paul Ryan Alongi, Maac Machinery
"Halogen Heaters are Your Competitive Advantage" - Michael Roche, Geiss Thermoforming USA

MONDAY, SEPTEMBER 22, 2008: ROLL FED SESSION

"Novel High Performance PP Products for Thermoforming: Stiffness, Toughness and Clarity"
Tim Pope & Jason Brodil, Dow Chemical
"High Stiffness High Clarity PP" - Tom Gallagher, Sonoco
"The Challenges of Closing the Loop with Thermoformed Plastic Packaging" - Michael Brown, Packaging 2.0

"Leveraging the Wal-Mart Scorecard to Increase Your Thermoforming Business" - Lawrence Dull, Marspkg LLC
"Providing Value with Thin Gauge Applications" - Jonathan Cage, Spartech Packaging Technologies
"Your Leading Edge – Today's Weakness May Be Tomorrow's Competitive Edge" - Mark Zelnick, Zed Industries
"Using Tools, Machines & Materials to Optimize Your Process and Maximize Profits" - Lars Ekendahl, Frimo

"Optimization of Thermoformed Products" - Thomas Stahl, Illig
"PVC and the Environment" - Richard F. Ali, The Vinyl Institute
"Dynamics of the PET Market" - Clarissa Schroeder, Invista
"Steel Rule Dies – Are You Building Them Properly?" - Julie Griswold, W.R. Sharples Co.
"Advances in OPS for Thermoforming" - Jeff Pristera, Reynolds Packaging Kama
"PLA & Pin Chains – From Problem to Possibility" - Charles Hildebrand, Kiefel Technologies

**Program is subject to change. Please check our website for updates and announcements:* www.thermoformingdivision.com

2008 PARTS COMPETITION ANNOUNCEMENT

Haydn Forward
Chair
Parts Competition

<u>2007 PEOPLE'S CHOICE AWARD & TWIN SHEET AWARD</u>
Spencer Industries Inc.
Dale, IN
Shelter Trailer

<u>2007 ROLL FED MEDICAL</u>
Specialty Manufacturing Inc.
San Diego, CA
Multi Probe Tray

If our 2007 Parts Competition was an indication of technical advancement within our industry, we all should be elated. The quality of parts submitted was outstanding. This is building the excitement for 2008 as we will continue to showcase advancements in thermoforming design, innovation and capabilities.

Once again this year we are excited to welcome all thermoforming businesses to our prestigious competition. This includes material suppliers, proprietary product manufacturers, designers and tool makers, as well as custom thermoformers.

We made a concerted effort last year to provide greater media access to those who submitted parts. This enabled each representative to tell the story of their part and highlight notable features. As a result, submitters who may not have received an award were still publicized in trade print.

The industry considers the Parts Competition to be a key element in the educational efforts of the SPE Thermoforming Division. This is a direct result of your successful efforts in producing state-of-the-art components. This year's conference again offers the opportunity to showcase your most recent innovations and advances.

History has shown that every part entered deserves recognition, but unfortunately not every entry receives an award. In light of this, each submission will receive a "Certificate of Acknowledgment" from the SPE.

It will be easy to start thinking now about how to take advantage of this annual opportunity to showcase your capabilities and introduce your firm to and through the press.

We will be using a simplified entry process which will be your first opportunity to describe the innovative part entered.

I encourage you to take a few moments and forward your e-mail address to me at hforward@smi-mfg.com. Once sent, you will be on the list to receive the necessary (short and easy) instructions to enter the 2008 SPE Thermoforming Division Parts Competition.

The official entry form will be available on the web: www.thermoformingdivision.com.

I look forward to seeing you all in Minneapolis!

How to Structure, Fund and Finance a Clean Technology Venture: Trends for Developing Innovative Technologies in a "Greening" Marketplace

Eric A. Koester, Esq., CPA, Heller Ehrman LLP, Seattle, WA

Abstract

The plastics industry and related markets represent a substantial opportunity for entrepreneurial and intrapreneural activity – particularly in the emerging Clean Technology space. Investment into clean technology is one of the fastest growing markets. However, the plastics industry is currently lagging in its ability of startup technologies to tap into those funds. In order to increase access to capital, the plastics industry must continue to foster innovation through its development of clean technologies companies. These companies will be built on entrepreneurial and scientific talent, broad market opportunities, and cutting edge technologies. There are many challenges faced by clean technology companies, but with the right foresight and planning, success can be achieved and new technologies commercialized.

Introduction

Investment in clean technology is no longer a niche play. According to information released at the Clean-Tech Investor Summit held January 23-24, 2007, venture dollars in this sector represented over 10% of the total venture dollars invested in 2006, the fastest growing sector, and experts predict that these investment totals stand to grow. With bipartisan political support on the issue and growing public interest in eco-friendly products, investment dollars continue to pour into the clean-tech market and new technologies are quickly moving from R&D or university labs to commercialization.

Venture capital investment in clean technology investment topped $2.9 billion in 2006 according to data from the Ann Arbor, Mich.-based industry tracker, the Cleantech Venture Network. This represents a 78% increase over the 2005 investments of $1.6 billion and a 140% increase over 2004 investments of $1.2 billion. In 2006, IPOs from clean-tech companies more than doubled over the previous year, according to Skip Grow of Cowen & Company. Investment dollars have not been limited to the United States as investors have invested heavily in Europe, as well as throughout China and India.

Clean Technologies

Clean technology represents a broad range of products and markets including technologies in alternative energy such as wind or tidal power, advanced recycling technologies, residential and commercial solar projects, smart-grid technologies for the utility grids, electric or hybrid-electric transportation, advanced materials including biodegradable plastics, water technologies, and alternative fuels including biodiesel and ethanol. Clean energy projects continue to receive the most attention in the clean technology space; however, the market appears to be expanding into a variety of applications and areas. Energy-related investments accounted for $2.1 billion, or 74% of the total, with large investments in bio-fuel companies and new solar technology developers dominating the category, according to the Cleantech Venture Network. Investments in technology companies tackling recycling and waste totaled $192 million and investments in clean transportation technologies reached $164 million.

Dow Jones Venture One has defined the clean technology sector as "companies that directly enable the efficient use of natural resources and reduce the ecological impact of production. Areas of focus include energy, water, agriculture, transportation, and manufacturing where the technology creates less waste or toxicity. The impact of cleantech can be either to provide superior performance at lower costs or to limit the amount of resources needed while maintaining comparable productivity levels." As climate change and carbon taxes have entered into the human consciousness, so too have unique solutions arisen. This broad diversity of technology and seemingly limitless market potential makes investing "green" a huge opportunity for "green."

However, this boom in clean technology investment also offers a unique set of challenges for investors and companies in the space. Said Clean-Tech Investor Summit keynote speaker Steve Westly, "If you are going to be a player or an investor in the clean-tech space, it is absolutely critical to have a lawyer who understands the unique and regulated markets you have to play in." This market represents a convergence of emerging technologies and old industries, extensive government regulation and involvement, global intellectual property strategies, and international markets. And without expertise in each of these areas, success may never be attained.

Presently, most clean-tech investments have needed some form of government assistance to be competitive – including tax subsidies and government mandates. Solar power installations in homes and business could not compete in the marketplace without these subsidies. And investments in ethanol and biodiesel require continued government tax subsidies to compete with traditional oil company products. While the price of electricity from wind farms and solar facilities continue to fall, they still cannot directly compete with traditional power production.

Westly also noted at Clean-Tech that the current structure and relative age of the clean-technology industry leaves it poised for a wave of future consolidations and acquisitions. “The company that will be successful here,” said Westly, “may not be the one with the absolute best technology. It will likely be the company with a good technology and the ability to execute a plan to consolidate and partner within its respective industry – to create industry standard technology.” For example, in January 2007 the solar power industry saw SunPower finalize its deal to purchase Powerlight with aims to enhance profitability across the entire distributed solar power line. And this consolidation may come through purchases or joint ventures by established companies. Executives from both AES Corporation and Dow Chemical stated that new clean technologies for their companies could likely be developed externally and eventually acquired via direct acquisition or partnering.

Venture investment into the clean-technology space has been compared to investments in traditional life sciences – where a long-term product life cycles are the norm. For example, while technologies currently being developed to convert wave or tidal energy into electricity are now receiving provisional licenses from the Federal Energy Regulatory Commission, experts believe that any material energy production from these types of technologies are likely ten to fifteen years (or more) away. In addition, substantial power production from these alternative energy sources will require access to the grid and some level of partnership with utilities – a regulated partner that is often slow to embrace changes. Likewise, the transportation sector has recently seen changes with the introduction of hybrid vehicles, but consumers remain hesitant to give up performance to help the environment – hence the limited adoption of any full electric vehicles. Said one VC, “We have to throw out our models for some of these companies. We like the technology and the opportunity, but it is an industry of ‘ifs’. ”

The “clean technology play” for a venture capitalist is one that likely requires involvement in the political process for any type of sustained success. Many of these clean technologies could not exist without some level of government assistance, and continuing that assistance while technology develops is crucial. “It’s very different from the business world, where you come in with a good idea and leave with a deal,” said Mark Baldassare, research director for the Public Policy Institute of California, a nonpartisan research group, in a January 28, 2007 *New York Times* article. The question, he said, is whether venture capitalists “have the patience to be part of the political process.”

How to Draw Investment into New High Technology Plastics Companies

Today’s technology-based entrepreneurs in the plastics marketplace needs to have more than an novel or unique product or technology. Investors look for three things when evaluating where to invest their capital: (1) Team, (2) Market, and (3) Technology.

Team. Many successful entrepreneurs will tell you that they would much rather have a top-tier management team than the most novel or unique technology. Many new technologies are developed in labs and universities around the globe – but only a few successful companies are able to leverage that technology to build a successful company. Those companies have a top tier management structure.

Market. Investors are traditionally looking for a company that has an existing market for its technology of $100 million dollars or more. While some companies will consider a market of $50 million, the real sweet spot for technology investors is a marketplace of $100 million to $500 million and a company that intends to capture $100 million in sales within five years. These may seem to be extremely substantial numbers, but the expectation for a high technology company that will receive outside investor funding is that the company has a potential market large enough for rapid growth – and oftentimes lacking an established competitor to tackle that market. Either way, it is important for new technology companies to identify and target the key customers within this market.

Technology. Technology is the third leg of the necessary platform for a successful investment by a technology investor. High technologies companies in any space – from wireless to information technology to biotechnology to clean technologies – must have a technology that is novel, protected, and scalable. Without a technology that is a market differential, your company is competing in a commodity market.

How do innovative ideas from current industry leaders and individual entrepreneurs become successful opportunities? It requires the combination of these three key platforms to leverage a business. But the plastics industry must continue to establish itself as an innovative market to draw talented entrepreneurs. Companies developing innovative bio-based polymers, recycling and recovery techniques, unique production methodologies, efficiency tools, and many other cutting edge technologies will be developed as these companies are rewarded in the marketplace.

In addition, established companies should help foster innovation through investment in internal and external development. Researchers have noted that the major advances in technology in the past fifty years have been made by startup businesses. Industry leaders are not, by their nature, the best place for innovative leaps to occur. Xerox developed the platform that would become Microsoft Windows, but was unable to recognize and leverage the potential. Today's clean-technologies will be developed by entrepreneurs, but must be fosted by an entire industry.

Innovative startups in the plastics space require licensed technology, talent with experience in major industry companies, and a marketplace that accepts new technology.

Unique Challenges for "Clean Companies" in the Plastics Marketplace

As Steve Westly stated, in the clean technology space the successful companies may not be the one with the best technology, but instead with the best strategy to consolidate the space and create a successful platform. Westly should know, he was part of the team at eBay that went on an acquisition wave to ultimately develop today's leading online auction service.

Much like industry consolidation and standardization of software and the World Wide Web in the 1990s, the most successful companies will be those that create a leading edge company. In the Clean Technology marketplace, companies will require an expertise in traditional energy and regulatory policy to be competitive. In the clean-tech space, it is simply not enough to develop a great technology; you must navigate the regulatory waters and pay your lobbyist well. For example, development of the alternative fuel production will require a sustained government commitment to tax subsidies, fuel standard mandates, and project finance assistance. Solar project siting requires a partnership with state and local governments. Innovative development of "clean" polymers or bio-based plastics will need the support of the FDA. A sustained commitment to the clean-tech space will require partnership with governmental entities and sidestepping of the potential challenges. Accomplishing these goals in a largely regulated marketplace requires a unique level of finesse.

Second, clean-technology is and will be closely linked with the traditional energy, automotive, chemical, and natural resources sectors and therefore will advance more rapidly from handshakes and partnerships rather than battles and turf wars. Today's solar or wind farms are likely to be supported by traditional utilities. The hybrid car industry grew from traditional auto manufacturers. And ethanol is being mixed with traditional gasoline and delivered to your pumps by traditional oil distillers (with a handsome tax break).

As Bob Hemphill, Executive Vice President, Global Development of AES Corporation, stated, "We are serious about the sector and that requires working together." The clean-tech space will not grow in isolation from traditional companies, but must get them on board. Oil & Gas companies, auto manufacturers, and utilities hold assets with long lives – and clean technology adoption will not be as rapid as may be seen in other industries. But partnerships and collaboration may speed adoption of clean technology initiatives.

Third, the clean technology industry will be driven by new and developing technologies. Protection of that intellectual property will require an aggressive IP strategy and a systematic approach to ongoing development. Particularly, any IP strategy will need to take into account the substantial markets in both China and India, and the challenges that will result. The importance of these developing international markets cannot be understated, but the potential for investments to be lost due to a poor IP strategy are significant.

Finally, clean technology companies will require an expertise in emerging company issues. As money continues to be pumped into the sector, today's great idea will need to become tomorrow's sustainable venture. Any successful company will need to navigate the funding landscape from Angel investors to government grants to VCs to joint-ventures to acquisitions. Additionally, companies interested in market-leading technology will need to be aware of the potentially ripe marketplace for consolidation and be prepared to be both bold and aggressive. Financing a clean-technology company could require a blended strategy from traditional capital sources, venture dollars, private equity, federal grants, and others. Many clean-tech companies are capital intensive and faced with varied financing models. Clean-technology investments may require creative financing.

Conclusion

The Clean-Tech bet has been made. And as new investors and companies enter the fray, a new set of challenges and obstacles will arise. According to one member of the VC community, new rules are now being written for clean-technology companies. "The energy, transportation, chemical, and fuel sectors are multi-billion dollar industries. Clean-Tech is bringing something new to these old industries – and to be successful, you have to be ready for that challenge and that discussion."

The plastics industry must continue to embrace technology from both entrepreneurial activity and intrapreneurial activity in the large industry players. There is substantial money to be made and opportunity to be had in the marketplace. Today's startup companies in the plastics world may produce tomorrow's key technologies and advances. |

REDUCE!

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Plastics 101: Defining "Biodegradable", "Biobased" and "Compostable"

Reprinted with the permission of the Biodegradable Products Institute (BPI)

Many are confused by the terms "biodegradable" and "biobased." They do not mean the same thing and cannot be used interchangeably. The fact is that not all materials that come from renewable or biobased feedstocks are biodegradable. Manufacturers, and others, need to use the appropriate ASTM tests to pinpoint the percentage of a product that comes biobased resources. Also, they must use the correct ASTM specifications to determine if the products are biodegradable or compostable.

BIOBASED

Words like *biobased* and *renewable* refer to the sources of the raw materials for products. Wood, corn, soybeans, and grasses are all forms of renewable or biobased feedstocks. The agricultural crops like corn and soybeans can be harvested every year and are *annually renewable*. These feedstocks "renew" themselves on a predictable timeframe, ranging from annually in the case of grains or grasses to as long as a human lifespan in the case of lumber from sustainably managed forests. Think of these products as *biologically based*.

The American Society for Testing and Materials (ASTM) defines a biobased material as *an organic material in which carbon is derived from a renewable resource via biological processes. Biobased materials include all plant and animal mass derived from carbon dioxide recently fixed via photosynthesis, per definition of a renewable resource*.

But note: just because a product is labeled "biobased" or contains "renewable resources" does not mean that it based entirely on renewable resources. Rather, many of these products combine petroleum-based materials with naturally based ones, in order to provide the properties that consumers desire, while at the same time reducing the overall amount of synthetic polymers contained in the product.

The United States Department of Agriculture (USDA) has the task of defining the percentage of renewable resources in a product that is necessary in order for the product to be called "biobased." ASTM D6866 – "Standard Test Methods for Determining the Biobased Content of Natural Range Materials Using Radiocarbon and Isotope Ratio Mass Spectrometry Analysis" – is a method that accurately determines the percentage of the product that comes from renewable resources.

BIODEGRADABLE

If, under the right conditions, the microbes in the environment can break down a material and use it as a food source, that material is called *biodegradable*. Biodegradation is a process that can take place in many environments, including soils, compost sites, water treatment-facilities, marine environments, and even the human body. This process converts carbon into energy and maintains life. Not all materials are biodegradable under all conditions. Some are susceptible to the microbes found in a wastewater-treatment plant, while others need the conditions and microbes found in a compost pile or in soils.

For plastics to biodegrade, they must go through a two-step process. First, the long polymer chains are shortened or "cut" at the carbon-carbon bonds. This process can be started by heat, moisture, microbial enzymes, or other environmental conditions, depending upon the polymer. This is called "degradation," and you know it is taking place because the plastics become weak and fragment easily. This first step is *not* a sign of biodegradation!

The second step takes place when the shorter carbon chains pass through the cell walls of the microbes and are used as an energy source. This is biodegradation – when the carbon chains are used as a food source and are converted into water, biomass, carbon dioxide, or methane (depending upon whether process takes place under aerobic or anaerobic conditions).

WHAT IS A COMPOSTABLE MATERIAL?

When products are designed to be composted, they should meet ASTM Standard D6400 (for Compostable Plastics) or ASTM D6868 (for Compostable Packaging). Products that meet the requirements in these two specifications will:

- Disintegrate rapidly during the composting process (so no large plastic fragments remain on the composter's screens when the process is finished).
- Biodegrade quickly under the composting conditions.
- Not reduce the value or utility of the finished compost. The humus manufactured during the composting process will support plant life.
- Not contain high amounts of regulated metals.

WHERE CONFUSION EXISTS

Some consumers and manufacturers believe that if a material is based on a renewable resource, then it must be biodegradable and compostable. This is not true. Some natural materials do not biodegrade; for example, some forms of cellulose are not biodegradable. The only way to know if the material or product is biodegradable or compostable is if it meets ASTM D6400 or D6868.

Conversely, many people believe that materials based on petroleum will not biodegrade or compost. Again, this is not the case. There are synthetically based plastic resins that will biodegrade and compost, just like paper and yard trimmings. All these materials meet ASTM D6400 or D6868. |

Thermoforming Quarterly® thanks the Biodegradable Products Institute (BPI) for permission to use this article. If you have questions or comments, email the BPI at info@bpiworld.org or visit the website www.bpiworld.org.

ATTENTION!

ALL AMATEUR PHOTOGRAPHERS!

PHOTO CONTEST

Deadline:

The deadline for each contest will be announced in each new Quarterly. The deadline for the contest is June 30th, 2008.

The **Thermoforming Quarterly** is sponsoring a digital photo contest to highlight one or more aspects of the thermoforming industry. One winner will be chosen to receive a new Canon digital camera (value $250). The winning submission will also be featured in the following quarter's issue.

Criteria:

- We are looking for striking digital photos that feature some aspect of thermoforming: the process, tooling, machinery or parts.
- All photographs should accurately reflect the subject matter and the scene as it appeared. Photos that have been digitally altered beyond standard optimization (removal of dust, cropping, adjustments to color and contrast, etc.) will be disqualified.
- Entries should be submitted with the highest graphic quality in mind. JPEG format is preferred with resolution of 300 dpi.
- Entries must include a brief description of the photo including photographer name, company name and address.
- Images will be judged on originality, technical excellence, composition, overall impact and artistic merit.
- The judges will be a panel of editors and SPE board members.
- Only one winner will be chosen. Based on the number of eligible entries, the criteria may be modified in the future to award multiple prizes.
- All decisions made by the judges are final.

SUBMISSION:

ALL ENTRIES SHOULD BE SUBMITTED ELECTRONICALLY TO:
conorc@stopol.com

GOOD LUCK!!

~ THE EDITORS

TQ

Lola Carere
Councilor

TO: THE COUNCIL

This summary is intended to help you review the highlights of the Council meeting held in Savannah, Georgia, on January 26, 2008. Please note that all supporting documentation remains available to Councilors and Section/ Division board members at:

http://extranet.4spe.org/council/index.php?dir=2008.01%20Council%20(Savannah)/

SPE President ***Vicki Flaris*** called the meeting to order.

The Council weekend format was as follows:

- Council Committee of the Whole - there was a separate meeting of the Council Committee of the Whole.
- Council Meeting - a formal Council meeting was held. Officers were elected.

Key Agenda Items:

- ***Tom Martin's*** presentation on the passing of ***Jack Ryan***
- HSM & Fellows election results
- Governance elections
- Bylaw reading
- Policy approvals
- Section changes
- ANTEC at NPE 2009

Elections:

Council elected the following individuals as Society officers for the 2008-2009 term, which begins at ANTEC (May 4-8)

President-Elect – Paul Andersen

Senior Vice President – Ken Braney

Vice President (nominated by the International Committee) – Jon Ratzlaff

In addition to these formal offices, each year Council also elects a Chair for the Council Committee of the Whole. ***Brent Strong***, Councilor for Great Salt Lake, will hold this position for the 2008-2009 year.

Executive Director's Update:

Executive Director ***Susan Oderwald*** provided Council with a detailed staff report, which can be viewed on the SPE website at: http://extranet.4spe.org/council/index.php?dir=2008.01%20Council%20(Savannah)/.

Ms. Oderwald discussed activities for the current year and major initiatives for the coming year.

At the end of her report, she fielded clarifying questions and comments.

Treasurer's Update:

Treasurer ***Ken Braney*** reviewed the 2007 financial performance of the Society. While final audited numbers were not available at the time of the meeting, 2007 results were predictably down from the prior two years, with a projected loss of roughly <$250,000> for the Society overall. *Plastics Engineering* magazine was the main reason for the loss.

Mr. Braney reported that since the last Council meeting, three staff positions on the magazine have been eliminated, and that SPE is actively pursuing a co-publishing arrangement with Wiley Publishing for the magazine as a means to significantly reduce losses and have the magazine return to a "break-even" or modest profitability within 5 years. In addition to the staff reductions, the magazine will now publish 10 issues per annum.

Mr. Braney reviewed the critical components of the current budget to meet expenses and grow income leading up to and beyond ANTEC.

Other Business:

Presentations and discussions also took place on the following topics:

Parliamentary Procedure

The SPE Foundation update

Officer Reports

Readings and Votes:

Approval of Bylaw changes:
7.3.4 Specific Nominations – change in wording.
7.3.4.3 was eliminated.

Approval of:

- Policy 013 – Section Establishment.
- Policy 018 - Establishment of a Quorum for Council and Committee Meetings.
- **Council approved moving the Annual Business Meeting in 2009 from San Antonio, Texas, to Chicago, Illinois. Council also provided a vote of confidence in the ANTEC/NPE co-location in 2009 to enable staff to finalize the details of an agreement with SPI.**

Section Changes:

Council approved the following Section changes:

- France Section was placed on Provisional Status.

- Rock Valley Section was placed on Provisional Status.
- Scandinavia Section was placed on Provisional Status – with the anticipated formation of smaller independent Sections within the Scandinavian bloc in the near future (Norway, Sweden, Denmark Sections).
- A new Section-in-Formation in Turkey was also approved.

A new Strategic Growth Committee, which will replace the International Committee, was proposed to the Council by President-Elect *Bill O'Connell* and approved at this Council Meeting.

Presentations:

All presentations and supporting documentation for Council and committee discussions can be viewed on the SPE website at: http://extranet.4spe.org/council/index.php?dir=2008.01%20Council%20(Savannah)/.

Contributions:

SPE is grateful to the following organizations for their contributions in support of SPE and The SPE Foundation:

- Pittsburgh Section to the SPE Foundation for the Pittsburgh Section Scholarship, $5,000
- Color & Appearance Division to SPE for their Conference, $20,082.24
- Thermoforming Division to SPE for their Conference, $56,251.69
- Blow Molding Division to SPE for their Conference, $4,972.81

The next formal Council meeting is scheduled for Sunday, May 4, 2008, in Milwaukee, Wisconsin, USA.

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BOOK SPACE IN 2008!

Thermoforming Division Board Meeting Schedule 2008

May 14-17 – Sedona, AZ

September 17-20 – Minneapolis, MN

Board meetings are open to members of the thermoforming industry.

If you would like to attend as a guest of the board, please notify Membership Chairman Conor Carlin at conorc@stopol.com.

Visit us on the Web!

www.thermoformingdivision.com

Our website is continually being updated with news and events. Find all the information about thermoforming in one convenient site: lists of material suppliers and machinery builders, instructional videos, useful links and much, much more.

You can download all important forms online including the membership application and the nomination form for Thermoformer of the Year.

Feel free to send us your comments, suggestions, etc.

2008 EDITORIAL CALENDAR

Quarterly Deadlines for Copy and Sponsorships

FINAL COPY FOR EDITORIAL APPROVAL

7-DEC Winter — **1-JUL** Summer

15-MAR Spring — **15-OCT** Fall

DEADLINE FOR AD COPY

15-DEC Winter — **15-JUL** Summer

31-MAR Spring — **31-OCT** Fall

All artwork to be sent in .eps or .jpg format with minimum 300dpi resolution.

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

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2006 - 2008

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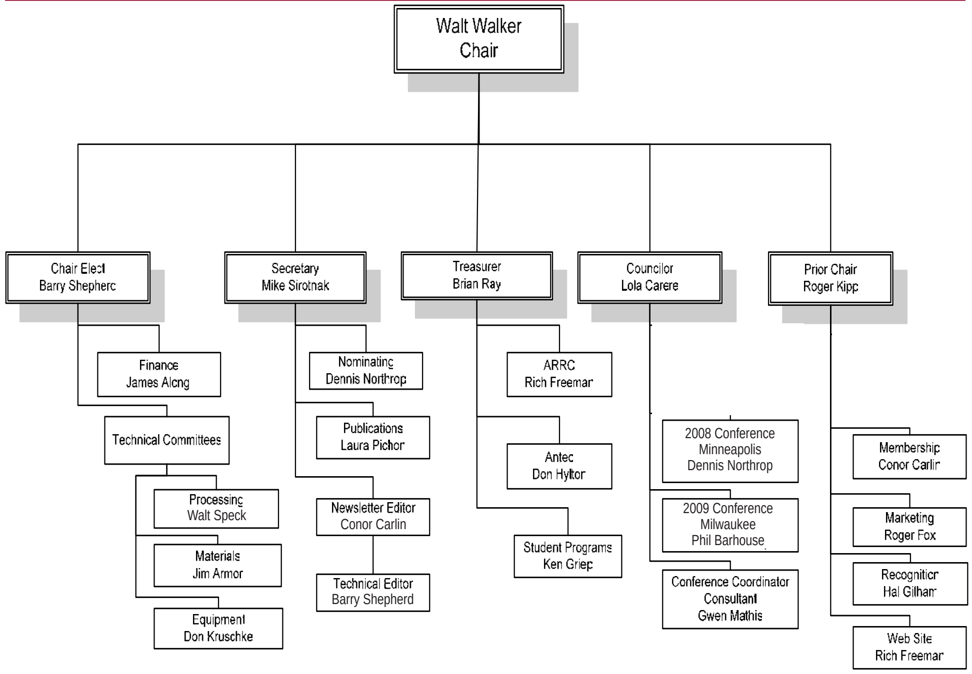

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