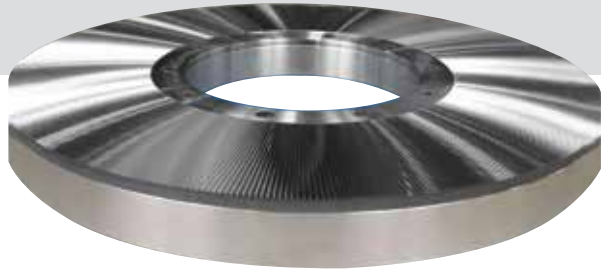


# Rotational Moulding Product Showcase.





## Turn Up Your Powder Production



- Up to 25% increased production rates and lower operating cost with patented disposable disc
- High Performance Pulverizing Technology
- Maximum output with lean and efficient machine design
- Touch screen controls for safe and easy operation
- Dual and single mill machines in stock

### **FREE ON-SITE MACHINE AUDIT**

You have to work twice as hard to be the industry's leader in Pulverizers. That's why our equipment is twice as reliable. Let us help you maximize the efficiency and throughput of your machine with Reduction Engineering's free on-site machine audit program!



# **ROTO SPEED**<sup>®</sup>

**ROTATIONAL MOLDING MACHINES**



*Independent-Arm & Fixed-Arm Turret Carousel Machines*



*In-Line Shuttle Machines*



*Operator Work Platforms*



*High-Intensity Mixers*



*Material Dispensing*



**FERRY**<sup>®</sup>  
**INDUSTRIES, INC.**



[WWW.FERRYINDUSTRIES.COM](http://WWW.FERRYINDUSTRIES.COM)

[SALES@FERRYINDUSTRIES.COM](mailto:SALES@FERRYINDUSTRIES.COM)

PH: +1.330.920.9200 • FX: +1.330.920.4200

4445 ALLEN ROAD, STOW, OH 44224 USA

# Introduction

5

**Letter From The Chair**

6

**Meet the ARMO Board of Directors**

10

**2017 ARMO Rotational Moulding Product Showcase**

Tulpi®-Seat – The Netherlands	12
Soft Touch Seat Swing – Turkey	14
Bioquell Qube – Europe & USA	16
SEME Bean Lamp – India	18
Symba Paediatric Hospital Bed – South Africa	19
H2O Pedal Boat – Italy	20
New Rap Chair – Italy	22
Washboard – México	24
Showtime 10 Poltrona Chair – Spain	26
Lifesaving Utility Wheelbarrow – Australia	28
Electric Vehicles – India	30
Dame of Love – Italy	33
Y-Module Floats – India	34
Fire Extinguisher Box – India	35
Prolocker System – México	36
Getaway Hot Tubs – USA	40
Drift – USA	42

44

**Rotomolding's Modern Edge**

by Paul Nugent, MNOP – USA

50

**Designing with Rotational Moulding**

by Satish Gokhale, Design Directions, Pvt. Ltd – India

52

**Designing for the Future**

by Martin Spencer, Unique Roto – UK

56

**Solid Designs with Rotational Molding**

by Michael Paloian, Integrated Design Systems, Inc. – USA

60

**PP The Black Swan**

by PSD Rotoworx – Australia

64

**Want your Rotomolding Plant to be on Top?**

by Ferry Industries, Inc. – USA

68

**Reduction Pulverizing Systems**

by Maag / Reduction Engineering Scheer – Europe & USA

71 - 72

**ARMO Announcements / Calendar**

73 - 74

**Credits / Sponsors & Advertising**





## Let's educate the world about the possibilities of Rotational Moulding.

Welcome to the first annual edition of the ARMO (Affiliation of Rotational Moulding Organisations) Rotational Moulding Product Showcase. This has been created to show the world what a fantastic process Rotational Moulding is and how it can be used to create innovative, attractive, practical and economic products. Our intention is that with the invaluable help of our sponsors, this will become an annual publication that can be used throughout the world, both within and outside the industry to raise the profile of Rotational Moulding. ARMO currently has 12 Affiliates around the world working together to advance and promote the Rotational Moulding process. This publication is intended to give an overview of what is possible - featuring what is happening with processing technology including 'Rotomoulding's Modern Edge' and technology updates from our sponsors.

The Rotational Moulding industry is expanding at an unprecedented rate with the total number of moulders probably having more than doubled in the last 10 years. This is giving us an ever-growing pool of entrepreneurial innovators who are advancing and expanding the possibilities of the process throughout the world. ARMO, through its affiliates, needs to help to educate and inform this growing industry worldwide to help ensure that the quality and integrity of these moulded products enhance the reputation of the process.

Rotational Moulding is continually innovating and improving. New machinery advances including semi- and fully-automated machines are improving the efficiency and productivity of the industry. The first fully 'lights out' production cell is now fully operational in Europe producing mouldings with no labour input. The increased use of automation is changing the image of the industry. The advances in machinery control and electrically heated tools has opened a whole range of materials that have now become practical to rotationally mould. These include ABS, PVA, Polycarbonate and Peek along with many others under development. These materials can offer infinite application and design possibilities for the future of the process. This control offers consistency in processing and finish that can lead to quality levels way beyond those associated with our process in the past.

The industry is beginning to engage the greater design community with the freedom it allows in shape and form for aesthetic and industrial products. The ability of the process

to manufacture one-part designs, that using other processes would involve multiple parts and assembly, saving time and cost, and allows designers to think in a very different way. ARMO and its affiliates must continue to educate and inform the international design community of the possibilities that are becoming available using the Rotational Moulding process. We must also reach out to the OEM's demonstrating that with much better control and more efficient automated machines we can offer the consistency, quality and cost effectiveness of other plastic processes and a justifiable alternative to traditional materials such as metal and wood.

### **Let's educate the world about the possibilities of Rotational Moulding.**

- We have a process that can be adapted to suit an infinite range of products.
- The industry is growing rapidly worldwide.
- Automation is opening many new markets for the process.
- Better control and alternate heating methods is increasing the materials practical to process and the consistent quality of those products.
- The entrepreneurial and innovative culture within the industry ensures the technology is always advancing.
- ARMO and its Affiliates can help share information and educate the industry, designers and OEM's worldwide.
- Expanding knowledge and appreciation of Rotational Moulding worldwide will help ensure its continued expansion to the benefit of all.

In September 2018, ARMO will be holding its Triannual European meeting in Hamburg. With its theme of 'Function Meets Design', the event will showcase all the latest technology in an extensive exhibition and the conference will offer insights into the current and future direction of the industry. This will be an ideal opportunity for designers, OEM's, moulders and suppliers to meet and network together to 'Mould' the future of our industry. I look forward to meeting you there.

Sincerely,

Martin Spencer  
ARMO Chair

## MEET THE ARMO BOARD OF DIRECTORS



**Philippe Goreaud**  
philippe.goreaud@rotomoulage.org  
AFR - Association Francophone  
du Rotomoulage  
[rotomoulage.org](http://rotomoulage.org)



AFR, an association founded in accordance with Law 1901, brings together rotomoulders, suppliers of materials, accessories and raw materials, engineering and design firms and centres of training and expertise. Its principal goal is to increase awareness of the rotomoulding process and to identify and promote new market sectors in the French-speaking world. AFR's goal is to expand, to share its expertise, to interact with its members and to cater to their needs.



**Horacio Lobo Zertuche**  
horaciolobo@negesa.com  
ANIPAC - The Mexican Plastic  
Association  
[anipac.com](http://anipac.com)



Anipac's mission is to promote the integral development of the productive chain within the Mexican plastic sector, and also to produce tangible benefits to its associated companies through the necessary elements that assure its global competitiveness.



**Bill Spenceley**  
bspenceley@flexahopper.com  
ARM - Association of Rotational  
Molders  
[rotomolding.org](http://rotomolding.org)



ARM promotes, educates, and inspires the rotomolding industry.



**Graeme Hall**  
graeme.hall@viscount.com.au  
ARMA - Association of Rotational  
Molders Australasia  
[rotationalmoulding.com](http://rotationalmoulding.com)



Our mission is to do everything possible to help the rotational moulding industry and our members thrive. We will achieve this by working to contribute to the overall stability and integrity of the Rotational Moulding industry. By encouraging and promoting research and development within the Rotational Moulding industry. We will encourage and promote fair trading practices by our members. And liaise and cooperate with other organisations of a similar nature on a world-wide basis in the best interest of this associations members. We will promote the process of Rotational Moulding wherever an appropriate opportunity exists.

## MEET THE ARMO BOARD OF DIRECTORS



**Oliver Wandres**  
ow@maus-gmbh.de  
ARM-CE - Association of Rotational  
Moulders Central Europe  
[rotational-moulding.de](http://rotational-moulding.de)



ARM-CE represents the interests of ARM-CE members towards national authorities and organizations. Maintaining a live linking to other national rotomoulding associations as to represent ARM-CE members interests and to keep members informed about global activities in the rotomoulding world.



**Wayne Wiid**  
wayne@pioneerplastics.co.za  
ARMSA - Association of Rotational  
Moulders Southern Africa  
[armsa.co.za](http://armsa.co.za)



ARMSA's mission is to serve, promote and grow the Rotational Moulding industry with integrity and commitment.



**Martin Spencer**  
martin@uniqueroto.com  
BPF Rotational Moulders Group  
[bpf.co.uk](http://bpf.co.uk)



The BPF Rotational Moulding Group was founded in 1978 and represents and promotes the interests of all those involved in the rotational moulding process – these include small and large sized moulders, material suppliers, machinery manufacturers, ancillary equipment suppliers and service providers.



**Katia Zoppetti**  
katia.zoppetti@dramsrl.com  
IT-RO Italia Rotazionale  
[it-ro.it](http://it-ro.it)



The mission for IT-RO is to further the Rotational Moulding Industry and assist all its members in growing their businesses through quality education and resources. IT-RO's objectives are to enhance rotomoulding knowledge in all its facets: raw materials, tooling, machinery, auxiliary equipment and complementary accessories; and to promote our technology to develop the market for rotomoulded products.



## MEET THE ARMO BOARD OF DIRECTORS



**Ronny Ervik**  
Ronny.Ervik@ultrapolymers.com  
Nordic Association of Rotational Moulders (Nordic ARM)  
[nordicarm.org](http://nordicarm.org)



The Nordic Association of Rotational Moulders (Nordic ARM) was founded in 2007 by a small group of enthusiastic Rotational Moulders. Nordic ARM was established to provide a forum where manufacturers, suppliers, consultants and others from the rotational moulding industry in Iceland, Denmark, Norway, Sweden and Finland could come together to exchange information, promote the market in rotomoulding and encourage the use of rotomoulded products in new applications.



**Dr. Marek Szostak**  
Marek.Szostak@put.poznan.pl  
"ROTOPOL" Association  
[rotopol.put.poznan.pl](http://rotopol.put.poznan.pl)



The mission of the 'ROTOPOL' Association is developing the rotational molding technology in Poland and in neighboring countries by supporting research at the universities and rotomolding companies, promoting this method of polymer processing in the plastics industry and taking care of economic interests of association members. The Association also promotes the scientific and technical solutions resulting from the research inspired by members of the Association.



**Peter Yan**  
peteryyx@163.com  
RPC-CPPIA  
[chinarotomoulding.com](http://chinarotomoulding.com)



RPC - CPPIA's mission is to abide by the constitution, laws and regulations; implement relevant national guidelines and policies; follow the social morality; issue industry requirements; maintain the legitimate rights and interests of RPC-CPPIA members, support rotomolding related companies through sharing the latest international rotomolding situation, technology, regulations and policies, and promote healthy and sustainable development.



**Ravi Mehra**  
MARAMEHRA@aol.com  
Society of Asian Rotomoulders (StAR)  
[starasia.org](http://starasia.org)



The mission of StAR is to engender the development and growth of a world class rotational moulding industry in India and the region by focusing on its members requirements for global knowledge, business and technical knowhow, education, awareness and networking; all to enable high-tech / high-quality rotomoulding helping to expand and grow the market for rotomoulded products and solutions it offers in the region by encouraging contacts, networking and interaction between its members; promoting goodwill and camaraderie for mutual benefits.

# A GUARANTEED WIN



## POWDER KING<sup>®</sup>

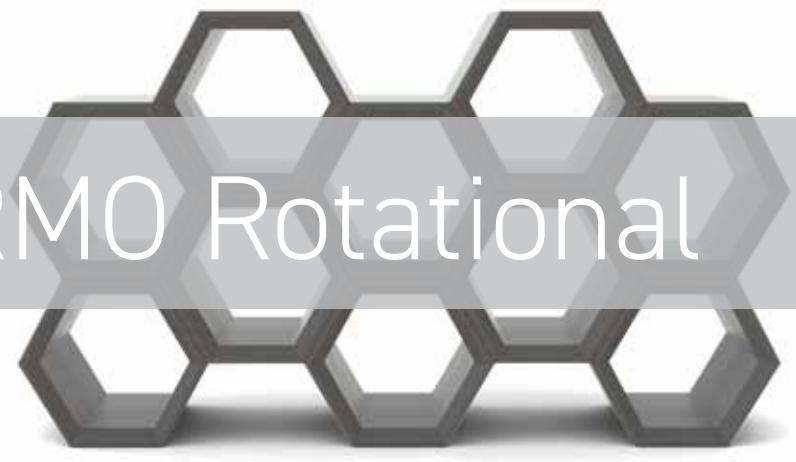
Powder King, LLC.    41780 N Vision Way    Units 120-125 Bldg. 2    Anthem, AZ 85086  
P: 1+623-551-9897    F: 1+623-551-8571    [www.powder-king.com](http://www.powder-king.com)    [sales@powder-king.com](mailto:sales@powder-king.com)

Jim Hummel, CEO



Made In America





2017 ARMO Rotational







Moulding Product Showcase.



# Tulpi®-Seat

To “flower” and brighten your surroundings.

Designed by Marco Manders and rotomoulded by Roto-Art BV – The Netherlands

The eye-catching Tulpi®-Seat, developed by Dutch designer Marco Manders, will add colour to any environment. The Tulpi®-Seat is a perfect combination of design, ergonomics and sustainability with a huge fun factor! The Tulpi®-Seat automatically folds when its occupant gets up... guaranteeing a clean and dry seat for the next user. With a full 360 degree rotation, the Tulpi®-Seat lets you pick your own view. This clever contemporary product is typical Dutch design, entertaining and quirky. It will “flower” and brighten up your surroundings.

The Tulpi®-Seat is designed for semi-public spaces and is a seat which has to be assembled on hard ground (concrete/ asphalt/stone) or a concrete block. The folding element of the seat offers a constant dry and clean seat. The seat consists of a sitting and back element of Polyethylene (LLDPE, ICO 4-3590), bolts and leg made from stainless steel (Quality: 1.4404 (AISI type 316L), and an anti-theft lock system.

Designer, Marco Manders, pitched his design idea to the Dutch Government in a contest for design ideas for public spaces. While Manders did not win the contest, his design was very well received. Not being deterred from not winning, Manders had fallen in love with his design and decided to further develop his Tulpi®-Seat.

The overall size of the Tulpi®-Seat is 688 mm in width, 1157 mm in height, and 418 mm in depth. The rotationally moulded seat and back parts are fitted with a stainless steel hinged system and gas spring construction with anti-theft construction. The Tulpi®-

Seat is produced by Roto-Art BV in The Netherlands using a small McNeil rotational moulding machine. Roto-Art BV used a cast aluminium mould and the material used is a high flow pre-colour compounded LLDPE.

The Tulpi®-Seat won the coveted award for the Most Original Design and Good Industrial Design (GIO) during Dutch Design Week in 2011. In addition, the Tulpi®-Seat was also awarded with the prestigious Golden A' Award in Milan – 2015 and the IDA Design Award in New York – 2016.

[roto-art.nl](http://roto-art.nl)

The rotationally molded seat and back parts are fitted with a stainless steel hinged system and gas spring construction with anti-theft construction.





# Soft Touch Seat Swing

A soft material prevents bumps and knocks during fun play.

Designed and rotomoulded by Cemer Urban Equipment – Turkey

The most common material used for playgrounds are metal, wood and polyethylene. Cemer is striving not only to design and manufacture products that allow children and parents to socialize, but also partially to contribute social peace. Their motto is “Dreams come true” and their target is to have a rightful place in the sector without concessions from quality and innovation.

Consequently, Cemer was awarded as “Best product design” of 2014 by Red Dot in its international design competition and is the first Turkish company in Playground Equipment.

They will continue an endless run behind the innovation through its own design office and self-organized national and international competitions by being conscious of high quality production and customer satisfaction. Therefore, Cemer is designing and producing their own moulds, and uses the best materials to assure high-quality standards.

The target group for the baby seat swing are babies and toddlers and therefore a soft material to prevent bumps and knocks during their fun play time as well as good strength and impact to provide long-term safety was required.

Cemer has chosen a soft touch grade that is easy to mould, safe for toddlers and will meet Toy Safety Directive. Also, the material should be fully UV stabilized for long-life and available in colour compounds.

One of their targets was having a material with super mechanical properties in extreme hot and cold climates to withstand constant

abuse. For this reason, Cemer is using material from A. Schulman, the leading supplier of High Performance Rotomoulding Powders in Europe with its trademark powder ICORENE®.

The grade they provided to Cemer is a TPE based grade called ICORENE® 9402. This grade is an olefin elastomer which is virtually unbreakable and has excellent soft touch feel.

The soft touch seat swing is used today in several places in Turkey with satisfied results.

[cemerplayground.com](http://cemerplayground.com)

The target is to have a rightful place in the sector without conceding quality and innovation.





# Bioquell Qube

Ensuring aseptic workspace for a safe and productive working environment.

Designed and rotomoulded in-house by Bioquell Inc. – Europe & USA

The Bioquell Qube is a configurable isolator integrated with Bioquell's Hydrogen Peroxide Vapour technology. From its unique design to rapid cycle times, the Bioquell Qube ensures that the aseptic workspace needs are met for a safe and productive working environment.

Healthcare professionals are looking increasingly towards the 'in-house' hospital pharmacy team to prepare personalised medication for patients. As this aseptic production process develops, bio-contamination control is essential in order to reduce the risk to patients. Traditional disinfection methods rely on a manual spray and wipe process using alcohols or other cleaning wipes.

To meet the challenges seen in aseptic processing, Bioquell has developed a fully integrated hydrogen peroxide vapour (HPV) modular workstation, the Bioquell QUBE. It offers a rapid, validated 6-log sporicidal decontamination capability that maintains an EU Grade A / ISO 5 quality environment. This HPV technology has been shown to reduce finger dab contamination assessment failure rates to less than 0.1%.

The bulk of the Qube is moulded in-house; all the light grey, dark grey and purple parts that you see are rotationally moulded. A basic Qube consists of 14 rotomoulded parts and a three Qube system comprised of 54 rotomoulded parts. The Qube has 19 different assembly configurations with customers based all over the world.

A brand new in-house facility was set up to ensure that the quality demands and the engineering challenges were achieved with this process. In all, an investment of over one million pounds was spent in the machinery, a 3M two arm Rotoline Shuttle Machine,

seventeen CNC aluminium moulds and the site infrastructure to make this a mouldable item produced in a very clean and safe working environment.

Quality is paramount and our standards go above the normal expectations of a 'general trade-moulder'. We constantly use Mini K-Paqs to monitor or processing temperatures to ensure we do not, under or over cook the material. There are several challenging aspects to the design, not only are we holding moulding tolerances to +/- 0.15%, having mouldings free from pinholes and contamination, but moulding everything in polypropylene to achieve this. We also have several very clever moulding techniques to achieve the 'impossible', using high quality CNC moulds produced by Persico Spa.

Our most complex mould is the Qube Main Chamber part which measures 2.4M x 1M x 1.8M and weighs 740Kg. We also have to release 43 mould-in inserts and 8 threaded and two smooth cores. This is a seven piece mould that has four sides that slide apart and remain captive to the mould, a central inner core that's hoisted away and by doing so extracts the 40Kg moulding, which when removed, reveals a hidden inner core that's the last piece to be extracted during the twenty minute demoulding time.

This is a very technical and complex product that has impressed so many industry leading experts, from mould making to polymer suppliers who are in awe of what has been achieved.

The Qube is only the beginning as we are developing even more complex parts to be rotationally moulded....watch this space.

[bioquell.com](http://bioquell.com)

This is a very technical and complex product that has impressed so many industry leading experts.



# SEME Bean Lamp

We all think about the fruit, but what about the seeds?

Designed by Falguni Gokhale, Design Directions Pvt. Ltd. and rotomoulded by Frontier Polymers – India

The SEME Bean Lamp, part of the SERENO range of moulded products, produced by Mr. Yuvraj Singh Ahuja of Frontier Polymers of India, is inspired from the seed pods of the legume plant Entada Giga. This plant is one of nature's largest vines and its seed pods are one of the largest. A tough woody cord connects these giant beans with many seed compartments. These pods hold seeds also called 'Sea Heats' or 'Love Beans'.

They are revered as good luck charms and believed to be sent as gifts from ancestor's bestowing blessings of a good future.

SEME Bean Lamp is 7 feet tall and gives a feeling of climbing the skies, gracefully and glowing with a quiet energy. It diffuses a soft ambient light that brings life to interiors and exteriors, and is available either with floor or ceiling mounting options.

SEME Bean Lamp is rotational moulded on a Reinhardt machine, utilizing a cast aluminium mould and LLDPE material.

SEME Bean Lamp has received an Honours Award in the SPE Competition in 2014.

[designdirections.net](http://designdirections.net)



# Symba Paediatric Hospital Bed

Designer Jed Aylmer creates an award winning hospital bed and a rotomoulding conversion success story.

Designed by Jed Aylmer and rotomoulded by Pioneer Plastics – South Africa

The Symba Paediatric Hospital Bed designed by Jed Aylmer and manufactured by Pioneer Plastics recently won the 2017 ARMSA Product of the Year Competition. While studying for an honours degree in Industrial Design and following an architecture blog at the Nelson Mandela Children's Hospital, Aylmer had a vision of a hospital bed for children. The idea of the new Symba bed arrived after touring a hospital for women and children. The steel beds being used in the hospital were a very old design and felt cagey. After much research and sharing his idea with the hospital, he was commissioned to make this bed a reality.



Aylmer states that "design is an opportunity to create products that better society, challenge conventions of manufacture for economic uplifting and offer new considerations of form and function." It is with this belief that Aylmer researched and gathered data to best understand the functionality of a Symba bed and how to improve it. He created a prototype to test and develop a proper set of standards. By the time the design was complete, the prototype Symba bed underwent 35 revisions. While there are not set government standards in South Africa, Aylmer looked to Europe for the CE mark process and the USA for FDA approval as well as ISO certification. The road to the final Symba bed took 4 years.



Design is an opportunity to create products that better society and challenge conventions of manufacture for economic uplifting.

Aylmer decided that rotational moulding was unique to the because it allows the Symba bed to be sooth, hollow and seamless which offers uncompromising benefits for hygiene and infection control for hospitals. The process also allows the product to retain a "bubbly" appearance. Finally, the materials used are strong and capable of bearing weight and softer than steel. Rotomoulding also suited the large batch type production of the product. The first 50 beds are being placed in September 2017.



[pioneerplastics.co.za](http://pioneerplastics.co.za)





# H2O Pedal Boat

Robust, affordable and beautiful.

Designed and rotomolded by Euro Tank Nord S.r.l. – Italy

The H2O pedal boat was designed by combining aesthetic and structural features to utilize rotational moulding technology to its fullest.

H2O, a Euro Tank Nord product, was born from the great experience of EuroTank in rotational moulding technology combined with Italian design and the innovative 3-Layer “Ultra-Light” rotational moulding material. In a constantly evolving market such as hotel equipment, resorts, bathing establishments and rentals, operators need products that are innovative and functional, but at the same time products that are reliable and durable.

The H2O pedal boat was designed by combining aesthetic and structural features to utilize rotational moulding technology to its fullest. With great collaboration among everyone involved including: Euro Tank Nord, mould maker Tecnomodel Engineering and raw materials supplier A. Schulman, this practical and good looking pedal boat has been created.

EuroTank’s H2O is the only pedal boat in Europe produced with 3-Layer “Ultra Light” material. Thanks to the 3 layers of polyethylene, the product has exceptional strength and stiffness while remaining surprisingly light weight. Made entirely in polyethylene, and foamed internally in accordance with EC standards, H2O is completely unsinkable and 100% recyclable.

A granite effect finish, more commonly used in planters, has been used to great effect in this high-performance PE pedal boat with outstanding impact and abrasion resistance. Rotational moulding technology made it possible to fully co-mould all the pedal boat components so handrails and handles would be fully integrated. This means total water tightness and zero maintenance. H2O branding

with Mold In Graphic Systems® permanent graphics added the finishing touch.

Euro Tank has been present in the Italian and international market for years and is a leading company in rotational moulding for the production of industrial tanks, canoes and kayaks, urban furniture and plastic games. Euro Tank employs some of the most important quality control instruments, such as calibration gauges and ultrasonic thickness gauges. It is also able to carry out pressure testing on the manufactured parts.

At the customer's request, Euro Tank Nord can provide quality check cards to be attached to the delivered items. A barcode sticker label is applied to each piece of the product to allow it to be traced and always provide final certification of the checks carried out. Eurotank manufactures polyethylene, polypropylene, cross-linked articles and works with planetary systems.

[eurotank.it](http://eurotank.it)

(L-R) The H2O Pedal Boat, with a granite finish, has exceptional strength and stiffness, and is light weight.





# New Rap Chair

Offering comfort, relation and a sense of self-confidence.

Designed in collaboration with Karim Rashid and rotomolded by SLIDE S.r.l. – Italy

Karim Rashid signs the second element of the Rap collection: Rap Chair armchair is the smaller and single version of Rap Sofa. It reminds of the same essential and linear design of the whole collection.

Rap Chair mimics the wrap-around shape of the RAP Sofa and it has the same comfortable seat. Karim Rashid created a collection that embraces the people who try it offering comfort, relaxation and a sense of self-confidence that allows you to fully enjoy and share happy moments with other people.

The Rap collection is ideal for creating minimalist and contemporary furniture for both contract and private homes, for indoor and outdoor use. Rap collection is available in all standard and lacquered colours and in two lighting colours (white and fuchsia). The seats are realized in polyethylene with the technology of rotational moulding and they are finished with a comfortable polyurethane cushion, available in three different colours: white, grey and anthracite. The dimensions are 115 x 78 cm / h 75 cm.

Rap Chair and Rap Sofa together can compose a contemporary and minimal living room, elegant and warm and suitable for domestic environments and contract. The seat is more comfortable and useful thanks to the new polyurethane cushion. Rap Chair is ideal to give personality to private gardens, terraces and every kind of outdoor and indoor space.

[slidedesign.it](http://slidedesign.it)

The seats are realized in polyethylene with the technology of rotational moulding.



# Washboard

Serving millions around the world who wash clothes manually.

Designed and rotomolded by Versaplas – México

Following on the success story of the plastic water tank (tinaco), developed in México and used around the world, Versaplas has developed a similar product. The Versaplas rotationally molded washboard is now used in every Latin American country and many countries throughout the world. Millions of people today wash their clothes manually and many have never used a washing machine.

Traditionally made from stone or wood, the washboard in the last 80 years has been made from cement mixed with gravel and reinforced with a construction rod. Cement washboards are very heavy and break easily making manufacturing, transportation, storage and installation problematic. More than 25% break or become deteriorated prior to delivery to the end user. Cement washboards are installed by embedding them permanently with cement in the wall and 1-2 skilled workers, requiring 1-2 skilled workers and a couple of days for installation.

## The Challenge

The challenge, when developing the rotomolded washboard to substitute the traditional cement product, was to maintain the following characteristics: a wavy zone for scrubbing clothes; firmness while pressuring and leaning toward it; structural firmness to avoid additional support at the cantilever zone; great durability and mechanical resistance; and a competitive price.

## Design

The washboard design was similar in shape and size to the traditional product to preserve market acceptance and ensure that people would not only see it as a substitute product, but as a product with new advantages including:

- Improved borders and ratios to obtain a more aesthetic product
- New material (polyethylene) to render the product weightless, easy to transport, handle and practically unbreakable
- A small integrated area to for soap - making the product more practical

- Double-wall design using several kiss offs for mechanical resistance
- Structural holes designed for pressure resistance due to holes generated by the installation of the screws
- A mounting system using only buckles and screws – an innovative system patented by Versaplas

## Performance

Once the installation and mechanical resistance problem was resolved, the second step was to evaluate the efficiency of the following characteristics:

- **Effective Washing** was achieved thanks to the deepness of the wavy zone in the scrubbing area. The Versaplas product provided effortless scrubbing while removing stains and washing clothes.
- **Gentleness with the Clothing** was achieved thanks to the smooth surface of the scrubbing area. The Versaplas product ensured that clothes will not tear or wear out due to washing.
- **Hygienic Cleaning** was achieved thanks to the smooth pore-free surface avoiding the adhesion of bacteria. Water and can be cleaned away with a cloth.
- **Wear & Tear Resistance** was achieved as it will last many years outdoors and is not affected by chemical substances such as detergents or cleaners.
- **Installation Efficiency** was achieved through its mounting system, developed by Versaplas – a simpler, faster and cheaper process than that of traditional washboards.
- **Ecological Responsibility** was achieved because it is better to wash a few clothes on the washboard rather than using a washing machine – saving detergent, water and electricity.

The characteristics of the washboard and its performance surpass those of traditional washboards, which has allowed Versaplas to quickly and successfully enter the market.

[versaplas.com](http://versaplas.com)

The characteristics of the rotationally molded washboard and its performance surpass those of traditional washboards.

(L-R) Washboard, kiss-off cut in half and close up cut washboard.





# Showtime 10 Poltrona Chair

A collection in which plastics consorts with upholstery.

Designed by Jaime Hayon for BD Barcelona – Spain

Jaime Hayon is the most intriguing figure in new Spanish design. He has energy, talent and a style of his own, all of which are distilled into the Showtime collection he has designed for BD Barcelona Design, the most prestigious Spanish design company. This happy encounter between a young designer and a veteran producer has led to the birth of a furniture collection meant for the home, but which has the adaptability and the personality needed for contract furnishing. A collection in which plastics consort with upholstery, depicting the gleam of lacquered wood and the tradition of fine ceramics. In these contrasts between classicism and modernity, Showtime reflects what has always been the very essence of BD.

The Showtime collection includes an armchair, sofa, hooded chair and rear leg, which are all made in a single-piece with rotomoulded medium-density gloss-lacquered polyethylene in various colours. The armchair and sofa always include interior upholstery in capitone (sewn in rhomboids) leather of various colours. Ferrules are used for the feet in grey rubber.

The dimensions for the armchair are 790 x 720 x H.950/mm/13kg. Dimensions for the armchair with cover are 900 x 820 x H1680 mm/38kg. Dimensions for the hooded armchair are 1450 x 730 x H.950 mm/22kg.

Showtime is cleaned with a damp cloth using only water and PH neutral liquid detergent. Alternatively, they can be cleaned using an ecological cleaning flannel cloth, using the same treatment as above and dried with a cotton cloth.

The armchairs and sofa are certified in accordance to the norms: UNE-EN1022-06, UNE ENV 581-2:00, UNE 11012:89, UNE 11021-02 "Home furniture, Seatings, Determination of Stability" UNE-EN ISO 4892-2:00 Plastics.

Hayon was born in Madrid in 1974.

His artistic vision was first fully exposed in the "Mediterranean Digital Baroque" and "Mon Cirque" installations. These collections put Jaime at the forefront of a new wave that blurred the lines between art, decoration and design and a renaissance in finely-crafted, intricate objects within the context of contemporary design culture.

Hayon further defined his vision in subsequent solo exhibitions and shows at major galleries, and design and art fairs all over the globe. After founding Hayon Studio in 2001, his wide client base has spanned diverse functions and mediums, including domestic furniture for BD Barcelona, Cassina, Fritz Hensen, @Traditions, and Magis; lighting fixtures for Parachilna, Metalarte and Swarovski; and sophisticated objects for Bisazza Lladro and Baccarat. He has also executed complete interiors for leading hotels, restaurants, museums and retail establishments worldwide.

Hayon Studio's creative base is in Valencia, Spain with offices in Barcelona and Treviso, Italy. Jaime's work has appeared in the most prestigious art and design publications worldwide. He has won numerous awards, including multiple Elle Decoration International Design Awards, was included by Wallpaper Magazine in its "Top 100" list and recognized by the magazine as one of the most influential creators of the last decade and lauded as a "visionary" and one of the most creative icons by Time magazine.

[bdbarcelona.com](http://bdbarcelona.com)

The Showtime collection are all made in a single-piece with rotomoulded medium-density gloss-lacquered polyethylene in various colours.





# Lifesaving Utility Wheelbarrow

Mitigating and improving the experience and risks during urban floods.

Designed by student designers Lachlan Meadows and Hugh McKay of Swinburne University of Technology of Melbourne – Australia

Students at Swinburne University of Technology in Melbourne, Australia were up to the task when asked to design a product to mitigate the risks or improve the experience during urban flooding. The idea for the design formed from heavy research into the needs of residents living in parts of the world effected by frequent flooding (3-5 times a year). The key needs and problems to be addressed included:

- Keep people out of contaminated floodwaters
- Keep valuable belongings dry and safe
- Provide people who stay at home during dangerous floods with a means to transport possessions through floodwaters
- Evacuation of elderly and children, keeping them out of floodwaters
- Maintain work during floods lasting for weeks as many work at local markets but cannot get their vendor cart through floodwaters
- Assist clean-up efforts due to a large amount of debris left after the flood and rubbish clogging drains before the flood

The Utility Wheelbarrow was born from these basic needs, and while storage space was precious, having multiple uses all year around means the space is not wasted.

The features of the Utility Wheelbarrow include the following:

- 120L tray, used for standard loading as a wheelbarrow
- Balanced weighting to sit level in deep water with user seated inside
- An internal tray shape to comfortably sit 95th percent of users
- Hollow buoyant body capable of supporting up to 300kg on the water
- Hollow interior provides 200kg

equivalent buoyant force even if the barrow fills with water

- Removable handles for storage and transportation
- 4 guide rings used to support a shelter for use as a market stall
- 4mm High Density Polyethylene
  - Durable
  - Impact resistance
  - Abrasion resistance
  - UV resistance
  - Chemical and solvent resistance

Rotational moulding was the best manufacturing process to achieve a hollow body for buoyancy purposes, while allowing the design to feature strong yet organic forms, much like a Kayak. The material used will be high density polyethylene. There is currently a prototype of the Utility Wheelbarrow and the students will be seeking manufacturing partners in the next 6 months. The lifesaving Utility Wheelbarrow is a finalist in the James Dyson Award Competition.

[swinburne.edu.au](http://swinburne.edu.au)

Rotational moulding was the best manufacturing process to achieve a hollow body for buoyancy purposes.





# Electric Vehicles

A welcome alternative to manual and fuel-powered options.

Designed and Rotomoulded by OK Play Limited – India

The ergonomically and aerodynamically designed vehicle, introduced in early 2016, became an instant hit and the demand generated was phenomenal.

Understanding the need for a Green reliable solution for last mile connectivity, OK Play India Limited, the leading Rotomoulding company of India designed and developed a state-of-the-art electric vehicle meant to carry up to four passengers and a driver. The ergonomically and aerodynamically designed vehicle, introduced in early 2016, became an instant hit and the demand generated was phenomenal. This vehicle was a welcome alternative to the existing manual and fuel-powered options as also to the relatively low quality steel body E rickshaws imported from China.

To cater to the huge nationwide demand, OK Play India Limited has now set up manufacturing facilities in 9 geographically different locations across India to meet the real time demand of the country. Between these facilities, the company has now an installed capacity of over 2 million electric vehicles per annum.

Spurred by the huge success of OK Play India Limited's first Electric Vehicle passenger offering, the "E-Raaja", the company has designed and developed a range of user friendly Electric vehicles to cater to the needs of the growing population of the country. These vehicles have been introduced with the object of offering a value proposition to the existing fuel or manual powered options.

Amongst others, the variants include loaders, vending carts, mobile shops, garbage collectors and multi utility vehicles.

The common USP's of the latest generation, air and noise pollution free vehicles is the

innovative manner in which high quality plastics has been used. The company has exploited its considerable skills, expertise and experience in rotomoulding to deliver a robust, durable, maintenance free, aesthetically and ergonomically designed world-class product range. This range is available in an array of pleasing light fast colors.

Amongst others, the new offerings include E Loaders, E Vending Carts, E Mobile Shops, E Garbage Collectors and E Multi Utility Vans.

## **E-Garbage Collectors**

Envisioned to ensure functioning of a nationwide efficient and modernized solid waste and garbage management system, the E Garbage Collector is meant to collect garbage from densely populated areas where movement of the regular compactors is a challenge due to narrow roads. This vehicle has a hydraulically operated garbage bin, moulded from hexane grade, UV stabilized polyethylene thus ensuring optimum performance. The wipe clean plastic bin is a hygienic rust free option to the conventional metal containers currently being employed for this purpose. With India's focus on creating a clean nation, this vehicle is projected to have a huge demand in the coming months.

## **E-Loaders**

The E Loaders have been designed to carry small loads for short distances. These are a welcome alternative to the comparatively large capacity fuel driven goods carriers. These vehicles have a huge application

(L-R) E-Vending Cart, E-Loader Half Body, E-Rickshaw, E-Mobil Shop, E-Garbage Collector and E-Loader Full Body

The variants include loaders, vending carts, mobile shops, garbage collectors and multi utility vehicles.

in carriage of goods in densely populated areas. They also find usage in movement of material within a complex- factories, office buildings, residential complexes, educational institutions, etc.

#### **E-Vending Carts**

India has a huge population of on road vending carts dispensing a variety of wares from fruits and vegetables to hot and cold snacks etc. The E Vending Carts from OK Play are a welcome alternative to these manual options. Not only do OK Play vending carts offer a well-designed space to display and sell the products but also a generous storage space allowing more material to be stocked. The ease of maneuverability coupled with the upmarket ethics giving a feeling of hygiene makes this is the preferred choice for the street vendors.

#### **E Mobile Shops**

Extending its retail reach has always been the biggest challenge of the FMCG companies and it is their constant endeavor to come as close to the customer as possible. OK Play's E Mobile Shop is just the right option to take the product to the customer, rather than the customer going to the market. The flexibility offered by OK Play in suitably modifying its vehicles to meet the requirements of most product lines, makes it is the perfect choice of the FMCG companies. Thus not only does this option permit the product to reach the end buyer, it also saves on expensive fixed rentals of brick and mortar shops. Thus, this new innovative mode of retailing is fast catching up.

#### **E Multi Utility Vans**

This is another rather innovative offering – a closed body van that can be used for multiple applications – from transporting nursery children to their schools to delivering perishable goods in a safe environment to being a pet ambulance and several other usages.

To ensure availability of the product across the country, OK Play is in the process of setting up a penetrative distribution network, which will cater to an extensive dealer network. Understanding the importance of preventive and on road maintenance, OK Play has set up a unique concept of "Service on Wheels, which guarantees real time on road support to the owners of these vehicles. The company has also entered an exclusive relationship with one of the largest finance companies of India who would provide easy and affordable financing options to prospective customers of the company's electric vehicles.

The company's products have been recognized and appreciated by all segments and apart from the huge media reporting, several prestigious awards have also been conferred on the company.

OK Play is now evaluating prospects of licensing its technology and knowhow to other countries. Considering the global initiatives toward E mobility, the company's products would find a huge traction in developing as well as developed countries across the world.



# Dame of Love

Exhibiting a typical dome shape, but also with enriching baroque details.

Designed by Moro and Pigatti and rotationally moulded by SLIDE S.r.l. – Italy



Dame of Love has the pop and ironic features of Design of Love thanks to the bright colours and polyethylene.

DAME OF LOVE is a hanging lamp which belongs to the Design of Love collection. Thanks to the collaboration between the designer Moro and Pigatti and SLIDE production, the Design of Love collection enriches its products with Dame of Love. This new item has the typical shape of a dome, but it enriches of baroque details, as with the whole Design of Love collection. Dame of Love has the pop and ironic features of Design of Love, thanks to bright colours and polyethylene.

Dame of Love is made in polyethylene with the technology of rotational moulding. It comes in standard, lacquered and luminous colours. Its dimensions are diam. 100 cm / h 54 cm.

The Design of Love collection by Slide becomes richer thanks to new protagonists: Master of Love high table, Mister of Love

high stool and Dame of Love hanging lamp. Master of Love and Mister of Love furnish with refined irony any kind of contract or event with their baroque and design rich in details. The pop style of the polyethylene in 13 different colors for the stool and the table base matches perfectly with the stylish and resistant top of the table in white HPL. Dame of Love hanging lamp is characterized by the elegance and the luxury typical of the Italian baroque style, but it keeps its pop soul thanks to the polyethylene and its contemporary shape.

Design of Love collection, purchased in 2015 by Slide and has had a great enrichment of products and this year thanks to the three new products Master of Love, Mister of Love and Dame of Love, realized primarily for the contract world.

[slidedesign.it](http://slidedesign.it)

# Y-Module Floats

A conversion from RFP – fiberglass reinforced plastics to rotational moulding.

Designed and rotomoulded by KK Nag Pvt. Ltc. for Yellow Troups Pvt. Ltd. – India

Specially designed rotomoulded Y- Module Floats are used for providing a floating platform for mounting solar panels on lakes and bodies of water for the generation of clean renewable energy. These floats have been converted from FRP – fiberglass reinforced plastics.

The floats, exposed to full sun and natural outdoor water, are moulded from a high UV [UV-15] high ESCR hexene grade LLDPE. Post moulding, the Y-Modules are filled with EPS [expandable polystyrene] beads. These beads are expanded and fused in place by injecting steam. EPS is the preferred foam for these floats as the water absorption of EPS is negligible compared to PUF – polyurethane foam. The moulds are fabricated from machined steel.

## A platform for mounting solar panels.

The Y-Modules have been in the market for couple of years, and further design refinements are in progress. Y-Module floats are also being used to provide floating fishing cages.

The product design has been done jointly by KK Nag Industries and Yellow Troups Pvt. Ltd. in India.

[kknag.com](http://kknag.com)



# Fire Extinguisher Box

Converting metal to rotational moulding.

Designed and rotomoulded by KK Nag Pvt. Ltd. for New Age Industries – India

This conversion from traditional metal to rotomoulded PE fire extinguisher box was motivated by the need to overcome drawbacks of the metal fire extinguisher box while ensuring better aesthetics and functionality. While getting rid of heavier weight, rust / corrosion – peeled paint box in metal, rotational moulding allowed for a lighter non-corrosive box with much improved shape and design aesthetics.

One key requirement was to allow for a see through window in the lid to visualize the fire extinguisher inside. Initial attempts on a post moulding added-on pane in polycarbonate [PC] gave a poor look and aesthetics. A high level of transparency was necessary to mitigate adverse ambient conditions in an emergency. After many trials and much design and process development efforts, an encapsulated moulded-in PC window pane was provided, maintaining good aesthetics.



A high level of transparency was necessary for adverse emergency situations.

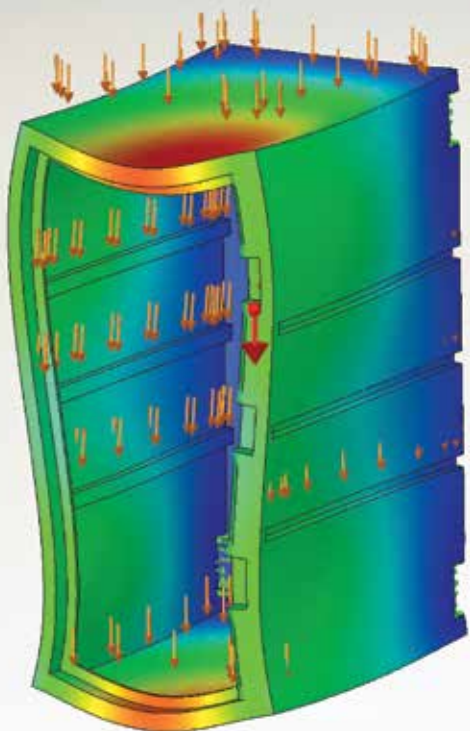
The converted rotomoulded fire extinguisher box consists of two pieces, the containment box and a hinged lid with a see through PC window. A suitable grade of pre-coloured LLDPE material is used for both moulded pieces. The mould is a machined aluminium mould, designed and made in house. Post moulding operations consist of: hanging bracket, toggle locks, plastic hinges and holding strap. The concept was developed and designed jointly by the moulder KK Nag Industries and customer New Age Industries in India.

[kknag.com](http://kknag.com)





**PRO  
LOCKER.**



# Prolocker System

A conversion success story with rotationally molded storage systems.

Designed by Eduardo Guizar and rotomolded by Spincraft – México

A better looking, more durable, resistant, washable locker system.

While the water tank industry in México was extremely popular in the early 2000s, Spincraft México, a custom rotomoulder, saw a great opportunity for more new and innovative rotomoulded products in México. Looking at the typical steel sheet lockers, Spincraft México set out to design and produce a better looking, more durable, resistant, washable locker system. There are currently three versions of the Prolocker systems: 1) The Tower is 36" tall and two can pile up to 6 feet in a standard vertical line; 2) The Maddim is a locker with three doors in a vertical link and stand around 24" tall; and 3) The Little One, the smallest and most popular, has 4 doors and is 18" tall.

Spincraft maintains their value proposition as, "For hotels, schools, factories, and every service unhappy with rusted, broken, unhealthy steel sheet or wood lockers, Prolocker is the polyethylene locker that provides property guarding free of corrosion, with design and spare parts, unlike any other locker".

The benefits of using the rotomolded Prolocker System:

- Prolocker can be installed in many ways due to its design, using recycled PE 2' X1" bars. The PE bars, bolts and nuts used in the installation are weather proof which increases durability.
- Prolocker allows wet cleaning and sanitization of the installation which is excellent in food and pharmaceutical industries.

- Prolocker is excellent for beach and coast clientele due to heat and humidity playing a big role in material degradation.
- Prolocker can be fitted with security cameras and can be coin operated.

The first generation of the Prolocker System was developed 10 years ago. Today, Spincraft México is producing its third generation Prolocker System by working with Avantech on aluminum molds with different insert arrays that the product needed.

The Prolocker Systems are currently in México, Guatemala and Uruguay.

[spincraft.com.mx](http://spincraft.com.mx)  
[prolocker.mx](http://prolocker.mx)





The **TNC30DC** Rotomolding Machine is ideal for the production of multi-layer parts in a closed oven. State-of-the-art technology, full automation, high productivity, process control and standardization, cost savings and safety.

It works with **automatic weighing & feeding** material, **mold opening & closing** system, also has an automatic feeding system inside the oven, which allows the feeding of the 2nd layer automatically, with no need for the molds to come out to the loading station.



# FULLY AUTOMATED MACHINE



**COMMITTED TO INNOVATION,  
TECHNOLOGY AND QUALITY**

**ROTOLINE USA** | Kent, Ohio | Phone: 1 330 677 3223 | [rotousa@rotoline.com](mailto:rotousa@rotoline.com) | [www.rotoline.com](http://www.rotoline.com)

**ROTOLINE BRAZIL** | Chapecó, SC | Phone: 55 49 3324 5680 | [roto@rotoline.com](mailto:roto@rotoline.com) | [www.rotoline.com](http://www.rotoline.com)





# Getaway Hot Tubs

Your passport to relaxation.

Designed and rotomolded by Master Spas – USA

A high-end rotationally molded product that expanded their potential market.

Getaway Hot Tubs are the newest portable spa line offered from industry leader, Master Spas. Using rotationally molded technology has allowed Master Spas to introduce a more budget conscious product which in turn expanded their potential market to a demographic previously out of reach when compared to their existing acrylic hot tubs.

Always looking for growth opportunities, Master Spas analyzed the marketplace and changing consumer needs and decided now was the right time to invest in and develop a rotationally molded hot tub line. Their existing sales channel allowed for easy entry and sales they could count on now and grow more in the future. Master Spas executive team is deeply involved in the design process which is led by their Senior VP. The goal was to introduce a "high-end" rotationally molded product to the market to set themselves apart from the existing competition and this was achieved by drawing inspiration from existing acrylic hot tub models and carrying many of those concepts into the rotationally molded hot tubs.

Master Spas Getaway Hot Tubs start with a rotationally molded shell. To accomplish this Master Spas built a new manufacturing facility and purchased all the equipment needed for this new product line. Once the rotomolded shell is formed, it goes down a production line where it gets plumbed and equipped with an electronic control system and motor(s). After that, each Getaway Hot Tub goes through a unique quality control water test to ensure proper function and performance before getting packaged and

shipped to any one of Master Spas global network of specialty retailers.

This was an entirely new process for Master Spas so we had to start at the beginning and we wanted to make sure we were anticipating the expected growth we would have in this category. As a result, we went with the massive Ferry 4600HD – 4 arm machine.

The Stone Effect Polyethylene compound used by Master Spas to manufacture the Getaway Hot Tubs is a premium quality, custom-formulated material produced by Jerico Plastic Industries. The color, ultraviolet light stabilizer package, and the special multi mesh powder are formulated to provide an outdoor specific compound that has a unique combination of color stability, weatherability characteristics, impact resistance and molding qualities that will provide a long service life to the consumer in a wide range of ambient temperature usage.

The Stone Effect color compound is produced 100 % by Jerico in its own production facilities.

[masterspas.com](http://masterspas.com)





# Drift

Implementing style and function while utilizing recovered coastal plastic material from waterways and shorelines.

Designed by Matthew Flail in collaboration with Tenjam® – USA

Drift can be calm and quiet or it can be energetic and fun. The fluid design has no sharp corners or edges and looks light and airy, with construction that is very stable and robust.

Drift was initially conceptualized by Matthew Flail while studying furniture design, and resulted in an original prototype made by vacuum molding glued maple veneers into form. Mike Collins of Tenjam® spotted images posted online of the bent wood Flail prototype and assembled a team to convert the design into durable polyethylene through rotational molding. The team consisted of Matthew Flail, Tenjam, Avantech and Plasticraft.

Drift's cantilevered seat design required extensive load analysis to determine how the user's weight would transfer from the seat to the base with minimum flex. The design also required a thin-edge seat profile to maintain the visual appeal of the original bent plywood design. Multiple Drift units were also required to nest together for efficient shipping and compact storage at the customer site.

Drift can be calm and quiet or it can be energetic and fun. The fluid design has no sharp corners or edges and looks light and airy, with construction that is very stable and robust. Drift can take on the toughest indoor and outdoor environments, and the "active" forward seat angle promotes an upright seating posture to keep the legs slightly engaged. This is a great seat for up to 30 minute sitting sessions, and intentionally engineered so guests in high-traffic spaces won't get too comfortable and camp-out all day in areas where seating is limited. Drift keeps people active and moving, while the LLDPE material

and seamless construction allow for easy cleaning, thorough disinfecting, and quick drying.

Since launching this design, Drift is solving the issue of long sitting sessions in high-traffic spaces with limited seating. Drift is looking good while doing it, and can now be found in libraries, schools, restaurants, museums, and shopping centers.

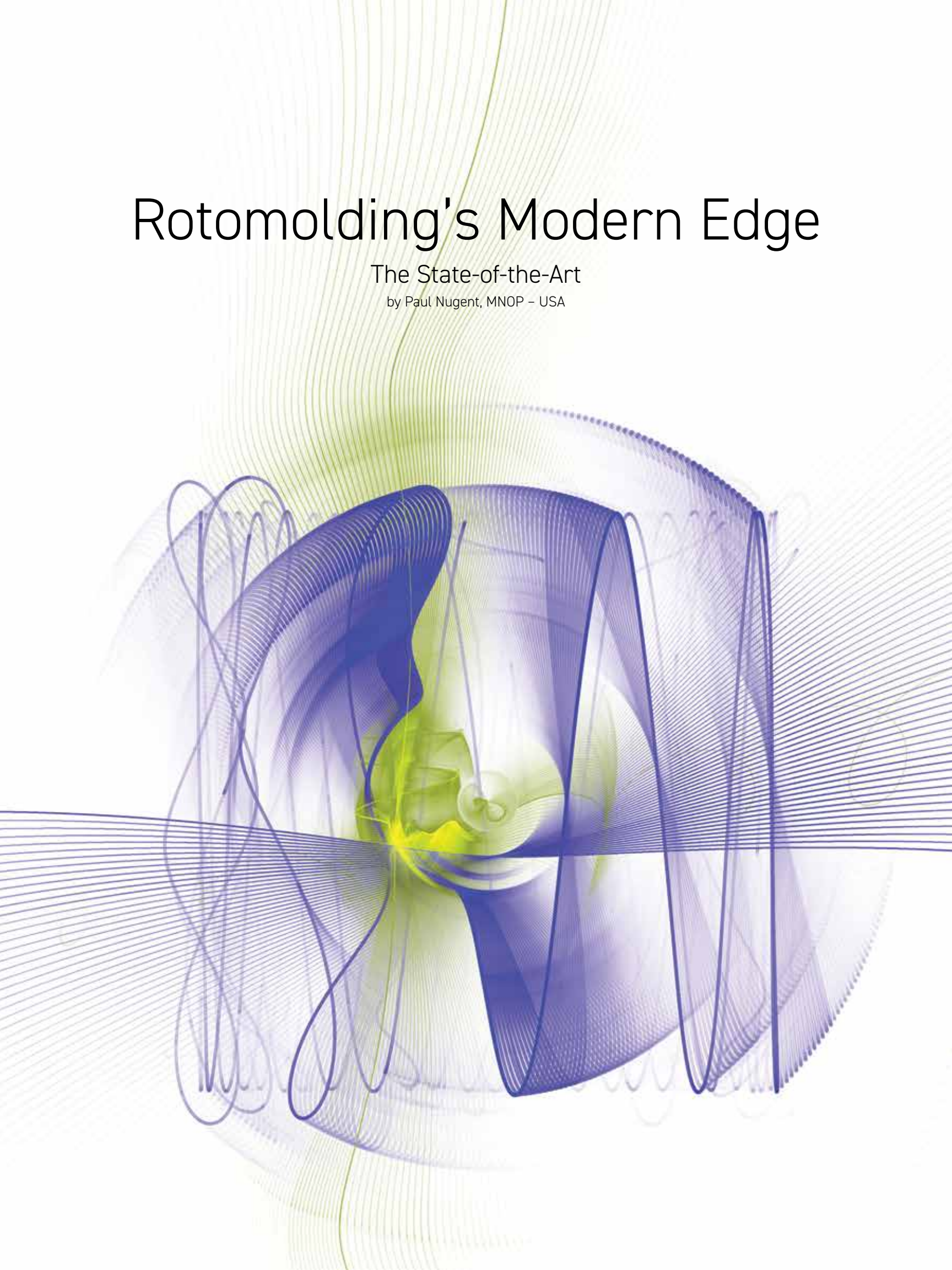
Tenjam is possibly the first company in the world incorporating Recovered Coastal Plastic (RCP) material into commercial grade furniture. RCP is plastic debris recovered from the waterways and shorelines, and is incorporated into every Drift unit made.

[tenjam.com](http://tenjam.com)

# Rotomolding's Modern Edge

The State-of-the-Art

by Paul Nugent, MNOP – USA





The rotational molding industry weaves a thread through an eclectic mix of industries worldwide. While they are all connected through the elements of the basic process, they are often completely unconnected in terms of application and final requirements: the flexibility and wide-ranging capability of rotomolding allows for varying size and complexity that is unmatched by any other plastic manufacturing process. Medical suppliers producing tiny implants using PVC have very different needs from fuel tank makers using crosslinked polyethylene but both are dependent on the relationship of ratios of rotation. Playball manufacturers and light globe makers aim for consistent wall thickness to meet very different customer requirements but both depend on uniformity of heat transfer. Kayak makers have high expectations for surface finish and appearance whereas chemical tank makers may be

focused on wall thickness and long-term performance but both are dependent on the physical and melt flow characteristics of the material they choose. All these manufacturers are part of the family of rotational molders but are separated by their specialties and it is this variety of specialty, coupled with a common entrepreneurial spirit, that makes the industry so vibrant.

As a niche process with only several thousand companies practicing worldwide, rotational molders often find themselves separated by product or by geography. Although well-established in older markets such as Europe, North America and Australia, rotomolders can be found in almost every country around the globe, often following a similar pattern of development in new territories. There is a range of typical products that act as seeds for these new markets: water tanks, road barriers, pallets and children's toys, for example. Moving beyond this range requires a combination of factors including the development of more advanced molding capabilities as well as access to industrial and/or commercial markets which demand plastic components. As a result, the global concentration of the most sophisticated rotomolders is driven by the industrial heartlands of Europe and North America whereas areas such as the Middle East and Africa are hampered by the lack of regional industrial bases. The major growth of rotational molding is therefore most often seen in smaller companies as evidenced by the explosive growth in molder numbers in China, India and Brazil in recent years. Although wide, this base remains at the lower end of sophistication with relatively few companies managing to differentiate themselves in terms of quality, innovation or strong marketing abilities. However, the technology of the process is advancing and modern communication allows even the most remote operation to benefit from new insights and developments. A review of the current state-of-the-art shows that the industry is moving

Kuki Chair designed by Zaha Hadid for Sawaya & Moroni



forward and there are new developments in understanding the process, machines, molds and materials.

### Process Fundamentals

The essential elements of rotational molding have remained unchanged since its inception: transformation of a polymer in free-flowing powder or liquid form into a uniformly distributed hollow shape using controlled multi-axis rotation and uniform heating and cooling. Indeed, many molders operate with the same set of control and operational parameters today as their pioneering predecessors did in the 1950s. What has changed for those with a more modern approach is the understanding of the process and material transitions in the process, how to monitor them and ultimately how to control them.

Temperature control systems based on air temperature inside the mold or using scanned mold surface temperatures are now readily available as both machine based options and after-market add-ons. Even the most basic molding operation can benefit from the insight provided as the data provides visual indications of the transition of the molding material from free flowing to solid, the level of cure attained and the cooling regime to which it was subjected. For more advanced molders, the ability to 'see' inside the mold is absolutely essential in order to be able to streamline operations and improve part quality. Materials or parts requiring close control such as foaming, multi-layer construction, cross-linked polyethylene, reactive liquid systems, engineering grades or rotolining processes are best controlled with live data from the mold. Temperature data from the mold can also be used on a macro basis to adjust the overall process for changes in ambient conditions or operator-driven issues: rotomolding is heavily dependent on the factory environment for cooling rates and the design of machines employing concurrent processes can multiply small demolding station delays into multi-cycle



losses. These changes and losses can now be compensated for automatically by the machine as it monitors the effect directly at the mold either internally or, more conveniently, at the external surface. Direct use of temperature data has now also been supplemented by derivative analysis including measurement of the area under the internal temperature profile during key stages of the process, the slope and duration of the curve during fusion and cure and rates of cooling during the initial molten cooling stage. The next step forward may be to reintroduce camera based systems, first tested in the 1980s, for monitoring transitions and troubleshooting problem areas from inside the mold.

Lighting by COSMO

### Machinery

Lean manufacturing principles were embodied in the first 'continuous rotomolding' machines produced by the McNeil Corporation in the 1960s (more commonly referred to as carousel style). Simultaneous heating, cooling and mold servicing stations allowed for relatively efficient use of space and labor. Since then this format for high-volume rotomolding has not changed much in principle – the main developments have been in the quality of machine construction, heat transfer performance and controls.

A broad selection of other machine styles have been developed for a range of products: shuttle machines for large parts or those with long service times, rock-and-roll ovens for long parts such as kayaks, single station clam shell machines for limited space and multi-

arm, multi-station shuttle machines for high volume production. Automated machines with direct in-mold heating systems have been applied to complex parts which require close control of wall thickness, multiple layers or for high-volumes. And while complete cycle automation from mold filling through to part extraction has been shown to be possible, cost and complexity typically limits its wide application for short-run production. For long-run high-volume production, multi-station carousel machines cannot be outpaced but for short-run custom products, a flexible machine design with quick change molds has proven to be the most suitable.

The industry is often labeled as inefficient in energy terms due to the primary heating method being direct gas heating. As a result, there is constant pressure for energy saving even though the cost component for energy in the process is typically low. Innovations such as electrical heating have been used in instances where pricing is economic for an entire convection oven or in a more focused manner in directly heating molds through slip-rings. Energy recovery from motors, heat-exchangers on oven exhaust gases and high-speed recirculation systems have made modern machines incrementally more efficient. Even solar power has been shown to be feasible and may be practical for remote regions but has yet to be demonstrated for mainstream use, especially at night. Infrared systems developed in France are effective in rapid heating but controlling uniformity on complex surfaces has proven challenging. And in the ultimate cross-over process, molders in the past have used molten eutectic salt-spray systems – messy but with fast conductive heating rates.

Rotational molding generates a lot of energy as arms full of molds move in and out of constantly opening and closing ovens and as a result, air conditioned rotomolding plants are rare. Cooling for the process remains heavily dependent on ambient conditions around the machine which means that cycles vary considerably by region and season. Most cooling cycles are a combination of high-speed air fans with intermittent use of fine water sprays or mists producing cooling rates which have been empirically pushed close to limits for controlled shrinkage of polyethylene parts. As molders look for an edge, internal cooling using air circulation or even fine water mist can help move the process towards a more balanced cooling rate through the wall of the molded part, thereby reducing warpage and distortion. An interesting development by automatic machine makers has shown the benefits of mounting cooling fans close to the surface of the mold on the arm of the machine

Tanks for the Chemical Industry





– shorter distances create more effective heat transfer rates and the system can therefore use smaller fans to greater effect.

Hot factories make difficult work environments and molders are wise to focus on operator work conditions. Cooling systems for personnel, powder handling systems for direct dispensing of powder into the molds, safe platform designs and systems for making mold opening and part handling safer and easier all pay dividends in worker longevity and attitude.

### **Molds**

At the core of the process, rotational molds are thin, hollow shells. They operate within the dichotomy of needing to be thin for fast heat transfer but also needing to be thick enough for durability: it is a delicate balancing act which can teeter between excessive maintenance needs on the one hand and excessive weight and slow cycles on the other.

Mold technology varies greatly around the globe with sheet metal molds being the most common for simple shapes. However, for many applications cast aluminum and nowadays, increasingly more common, machined aluminum molds are an ideal balance for cost, appearance and final part quality. The cost conscious rotomolder often drives the choice of mold construction to its lowest level but a quick review of the benefits of building a higher initial quality mold over the lifecycle of a product can often pay dividends in terms of customer acceptance (and therefore sales). Where the application allows, rotational molds can now be made with multi-zonal heating for wall thickness control, robotic arms can be programmed to rotate outside the standard, fixed biaxial ratios and the future may even hold real-time in-mold part wall thickness monitoring during the cycle. Specialized molders use composite construction for prototyping or short-run production, ceramic or rubber forms for liquid molding at room temperature and even electroformed copper or nickel molds for high speed cycles. Molders



have much to be grateful for as mold-makers have proven to be one of the most innovative group of suppliers for the rotomolding industry, particularly in Europe.

Tractors for the Agriculture Industry

### **Material Changes**

Polyethylene continues to be the dominant material used for rotational molding and is readily available in most markets around the world, although quality and suitability for the process do vary. Despite its inherent suitability for the process and the wide range of applications for which it is ideal, there remains a constant demand for new grades outside the current palette. Suppliers have responded over the years with a range of alternatives but commercial demand has been limited and the ability of typical molders to employ special material handling steps or more complex process controls for engineering materials has meant that molders continue to use a group of materials which perform in a similar fashion to polyethylene (nylon, polycarbonate, polypropylene and several fluoropolymers, for example). The process of transforming polyethylene powder into a solid melt under the action of heat and rotation essentially defines the modern rotomolding process: research by leading universities has shown the essential rheology and material properties which are critical in making a grade suitable for rotational molding. Unfortunately, the majority of non-polyethylene materials do not flow well under the low-shear conditions present inside a typical rotational mold meaning that the expansion of the rotomolding palette has been stubbornly slow despite

flurries of activity in the 1960s and late 1990s.

Major material suppliers have committed resources to the process at various times but the fragmented nature of the industry, geographically and by end-use, has meant that the economic justification for the considerable effort to develop materials has often been limited. However, there are exceptions and most often it is the middle tier of compounders and distributors who have been innovative with small batch production of specialist grades. Blends and alloys using polyethylene as a base have proven successful for a number of developments as have sugar-based polymers; ethanol derived from sugar-cane can be used to produce polyethylene in essence the same as oil based versions but sugar can also be used to produce stiff polylactic acid (PLA) based materials too. Demand for increased temperature and stiffness has led to revitalized work in polypropylene; permeation and temperature resistance continues to drive demand for nylon. Even the format of the

material – powder, micro-pellet, mini-pellet, liquid – can be used to solve specific product requirements. However, the ultimate goal of a scratch resistant, stiff, easy to mold, low-cost general-purpose resin (effectively the ABS grail) remains elusive. The search continues.

But the search for solutions cannot be one-sided. Molders must understand that new grades of material will require new approaches. To expect everything to look-like, mold-like and cost-like polyethylene yet perform at another level is unrealistic. Higher performance materials in any other plastics industry command higher prices due to improved properties and benefits – rotomolders must therefore expect to implement new ways of handling materials, designing molds and controlling the process to suit these new, enhanced properties. A joint approach between molders and material developers (and even end-users) offers the best path to cracking the code.

#### **Moving Forward**

The global rotational molding industry is dominated by a wide base of entry-level molders, constantly growing as the process continues to attract entrepreneurs, while established regions such as the US and Europe have remained relatively stable for several decades. The commercial and technical progress of this entry-level group is greatly affected by their location: regional demand for simple products drives molders to the lowest level for competition while OEM end-users drive innovation and differentiation. The ability to respond to such OEM demands depends on technical ability and available technology: machinery and molds are already available to handle the most complex of rotomolded parts but it will be new materials that will be most likely to take the process to a new level. Support your local compounders and distributors – they may be the key to your future.

[paulnugent.com](http://paulnugent.com)

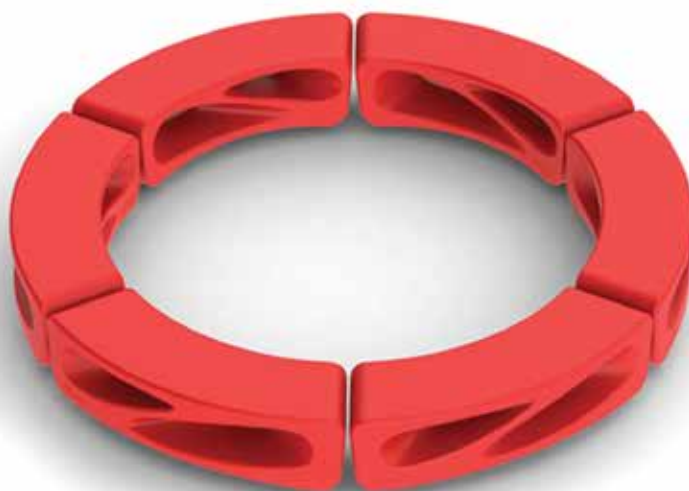
Floating Pontoons for the Recreation Industry



# Designing with Rotational Moulding

A process with a lot of strengths and possibilities

by Satish Gokhale, Design Directions Pvt. Ltd. - India





There are several processes for transforming plastic granules into plastic parts. Choosing an appropriate material and converting process depends on the application, end use, life expectancy, volume of production and many more parameters.

One of the processes is rotational moulding which is a low cost alternative to other processes with high product profile. Unfortunately, it is a comparatively lesser known plastic moulding process to designers and engineers. This process has a lot of strengths and possibilities.

Rotational moulding scores over several other processes due to its strengths:

- Low Tooling Cost
- High Design Flexibility
- Simple Tool Modification
- Wall Thickness Variability
- Seamless Hollow Parts
- No Internal Stresses
- Multi-Functionality
- Multi-layers Possibilities
- Fast Realization Time
- No or Minimal Production Waste
- Size Range - LARGE to Small Parts
- Design Flexibility & Freedom
- Complex Shapes & Contours
- Easy to Mould-in Inserts & Undercuts, In-Mould Graphics
- Consolidation of Parts
- Conversions
- Lower quantity production runs justified

Globally the rotational moulding industry is predominantly dominated by water storage and septic tank manufacturers. It is a myth that rotational moulding is way down in the spectrum of plastic processing. Of late some rotational moulders have started to look at custom products beyond water storage and septic tanks. Through design thinking, it is possible to open up new markets for applying the advantages of rotational moulding and add value to the product.

Irrespective of the process, design has to make sense on two levels. First - the emotional level of appealing directly to the customer's instincts and aspirations; and second - the technical level of designing new products which can be manufactured

and marketed successfully. When different manufacturers are competing with several identical products with the same intent of use and same specifications, the design is the only differentiating factor. A well designed product will create that WOW effect and also trigger sales. A well designed product will always stand out in the crowd.

Creating new rotationally moulded product is never a linear process. This is also true with most other manufacturing processes. Designers and engineers have to think out of the box and not limit themselves to predefined production rules - in fact they need to challenge with innovative technical solutions. Designers need to set new standards for the rotational moulding industry. A good design is a result of integration and dialogue between industrial designers, mould makers, resin suppliers and rotational moulders.

Both the client and designer/engineers should look for opportunities, have courage, take risks along the way and make good use of the opportunities the rotational moulding process offers. Designers should not just convert products made from different processes and materials blindly to rotational moulding, but should use the unique advantage the rotational moulding process offers - that of creating seamless hollow and large parts and that too with less initial money outflow.

Further to this the designers should also look at reducing the number of parts/components in assemblies or sub-assemblies by way of integrating different functionalities based on the product being designed and its intended use or function. This will lead to new and original designs and eventually add value.

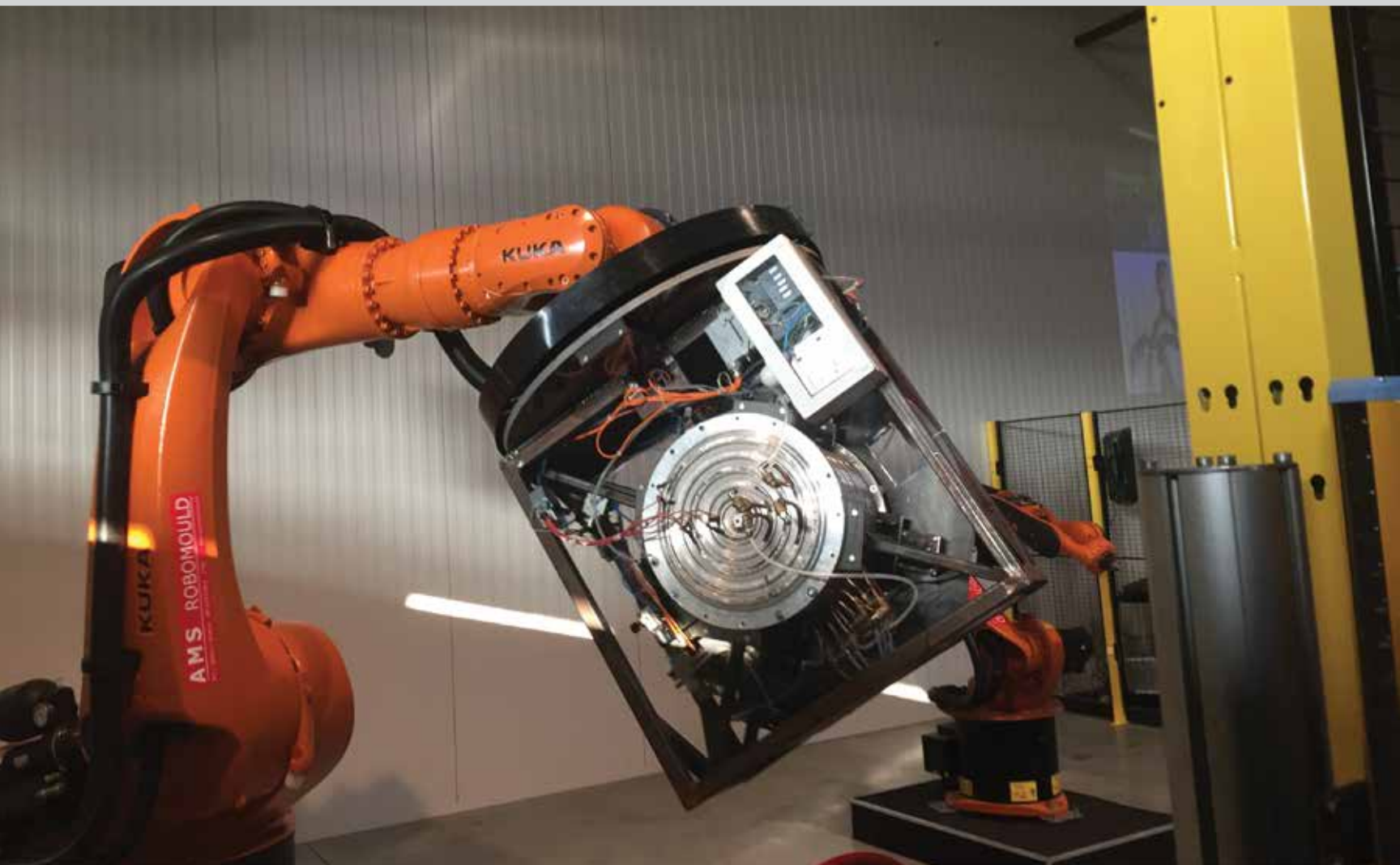
Creating a product using rotational moulding technology means establishing a balanced synthesis between form and function. Design should not be just formal, but a fusion of an integrated solution, formed together with the necessary degree of practicality of the product. Good design will always lead to good business.

designdirections.net  
sereno.co.in

# Designing for the Future

Rotational Moulding offers Infinite design opportunities  
for designers and OEM's worldwide.

by Martin Spencer, Unique Roto - UK





Rotational Moulding has always provided a freedom for designers that is not available in other moulding processes. The production of complex one-piece products that can avoid or minimise post moulding operations, where one moulding can replace many components that would be required using other manufacturing processes. Rotational Moulding has offered designers access to complex shapes and curves that can be used to create intricate industrial parts or beautiful aesthetic parts. However, a wider use of the process has been restrained by the fact that rotational moulding takes place inside an oven so control and operation of mould accessories has always been complex, the cycle times are quite long compared to other plastic processes and the choice of materials has been limited, primarily to various grades of Polyethylene.

I am pleased to say the world of rotational moulding is changing which is opening up infinite design opportunities for designers and OEM's worldwide. Traditional machinery can now be supplied with control systems operating from the polymer or air temperature inside the tool, heat resistant pneumatics can now be used to operate clamping systems and other accessories on the tools. Loading and demoulding can be semi-automated all adding to the consistency of quality of the mouldings. But perhaps the biggest step forward is technology that does not require an oven at all. Machinery

that uses oil or electrical heating of the tools opens up previously unimagined horizons for designers of rotationally moulded products.

Now available are various systems for rotational moulding without ovens. There are specifically designed machines to use either oil or electric heating. In addition, there are systems designed to mould using standard automotive type robots. By removing the necessity of moulds travelling into an oven then all sorts of monitoring and additional equipment can be added to the tools to facilitate more complex moulding at controlled temperatures. Moulds can now have temperature zones that means mouldings with variable thicknesses in different areas can be produced and accurately controlled. The air pressure within the tool can be accurately controlled either increasing the pressure, creating vacuums or using inert gas to help process critical materials. These new technologies also allow much higher temperatures to be used for processing critical engineering polymers. These new machines/robots can be calibrated to specific tooling during set up then shipped ready to produce. This allows OEM's to produce identical parts with assured quality at or near their plants anywhere the world. New tools can be calibrated at the toolmaker then shipped with the appropriate software downloaded remotely ready for perfect products first cycle and every cycle.

(Top-Bottom - page 52) Persico "SMART" machine with electrically heated tool. (Persico)

AMS Rotomould adapted robot used for Rotational Moulding. (AMS Robomould)

(Top - page 53) A complex moulding in PA6 with multiple inserts and very tight tolerances. (Persico)



Tooling technology in the rotational moulding industry is also advancing rapidly. The wide use of CNC machined tools allows tight tolerances and the accurate control of surface finish. Laser etching can be used for fine decorative finishes along with mirror finish. More complex inserts and loose parts are possible.

**How does this change the way designers can think of the Rotational Moulding process?**

**Wall thickness can be accurately controlled.**

- Products that require thin walls to tolerances are possible.
- Products that require additional thickness in specific areas are possible and practical.
- Multi-layer products with thin layers for barrier or other uses are possible and practical.

**A much wider range of polymers can be processed.**

- The use of pressure and vacuum inside the tools allow the removal of bubbles in transparent polymers such as polycarbonate.
- The use of inert atmospheres inside tools minimises oxidation allowing the easier and practical processing of nylons and ABS.
- The higher temperatures that are possible allow the processing of some engineering polymers such as PEEK.
- The use of Micropellet technology has removed the need for all materials to be ground to a fine powder. Removing some of the cost from processing unusual polymers/.
- I have seen all the following successfully rotationally moulded and I am sure much more is possible and the list of materials will continue to expand. ABS, Nylon 6, Nylon 12, Polypropylene, PVC, PLA, PVA, PVDF, PEEK, ETFE, Polycarbonate, Polyurethane, TPE's

**Complex decorative parts with tight tolerances are now a possibility.**

- CNC tooling mean very complex tooling with high quality finishes including a high mirror finish are possible
- Machined porosity free tooling facilitates the use of laser etching for complex surface finishes with very fine detail.



- CNC tools allow for very accurate parting line detail and provide the possibility of consistent high tolerance parts.

Complex electrically heated tool mounted for moulding using multiple heating zones each with separate temperature control. (Persico)

**Large production runs with low or no labour content as possible.**

- The introduction of automation and robots to the rotomoulding production floor is minimising labour and thus increasing the processes competitiveness against other plastic processes.
- Faster heating and cooling cycles of electrically and oil heated tooling allow the possibility of much higher production capacity from each tool.

All those that are involved in the design and development of plastic parts or the redesign of parts converting from other materials need to take another look at Rotational moulding. The technology is advancing at great speed and previous perceptions of what is possible no longer apply. Embrace the process and the new possibilities these new developments are opening up for products that can lead the field both in aesthetic design and practicality.

uniqueroto.com

# Experience the Look of Stone

Jerico's complete line of aesthetic compounding materials provides a natural granite or stone look for your molded spa products.

Our **Stone Effect** specialty color compounds lend themselves well to outdoor applications like hot tubs, lawn and garden accessories and patio furniture.

Choose from one of our popular **Stone Effect** colors or explore modifications to obtain different color intensities using our line of **Stone Effect Color Concentrates**. We work with you to achieve the desired color and design, while keeping costs competitive.



Add  
Depth and  
Appeal with  
**Stone Effect**  
Color  
Compounds.

**(330) 408-9220**

**JericoPlastic.com**



**Jerico Plastic  
Industries, Inc.**

*Family-Owned and  
Operated Since 1997*

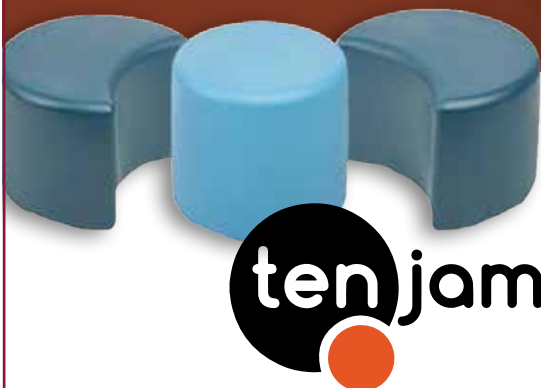
*Committed to Excellence  
in Rotational Molding*

Phone: (330) 334-5244  
Fax: (330) 334-9123

JericoPlastic.com  
info@jericoplastic.com



# THINK. CREATE. ADVANCE.

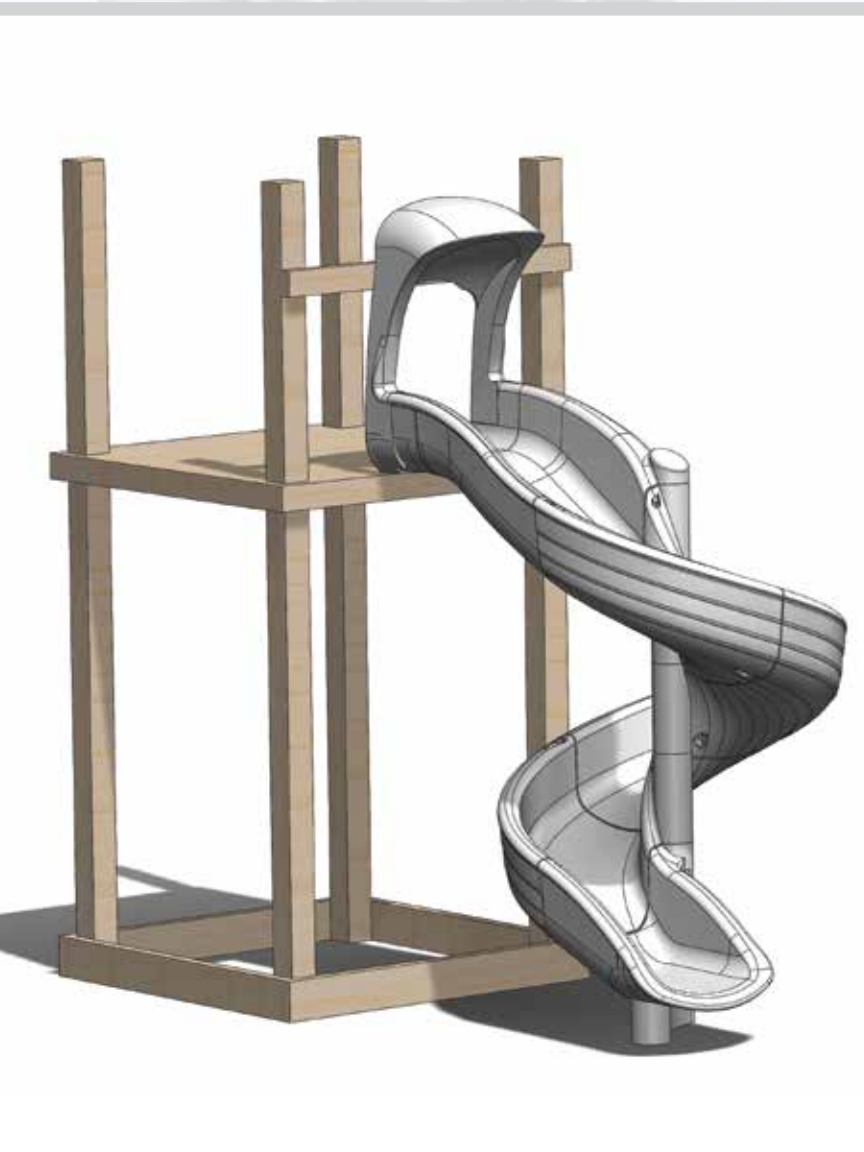
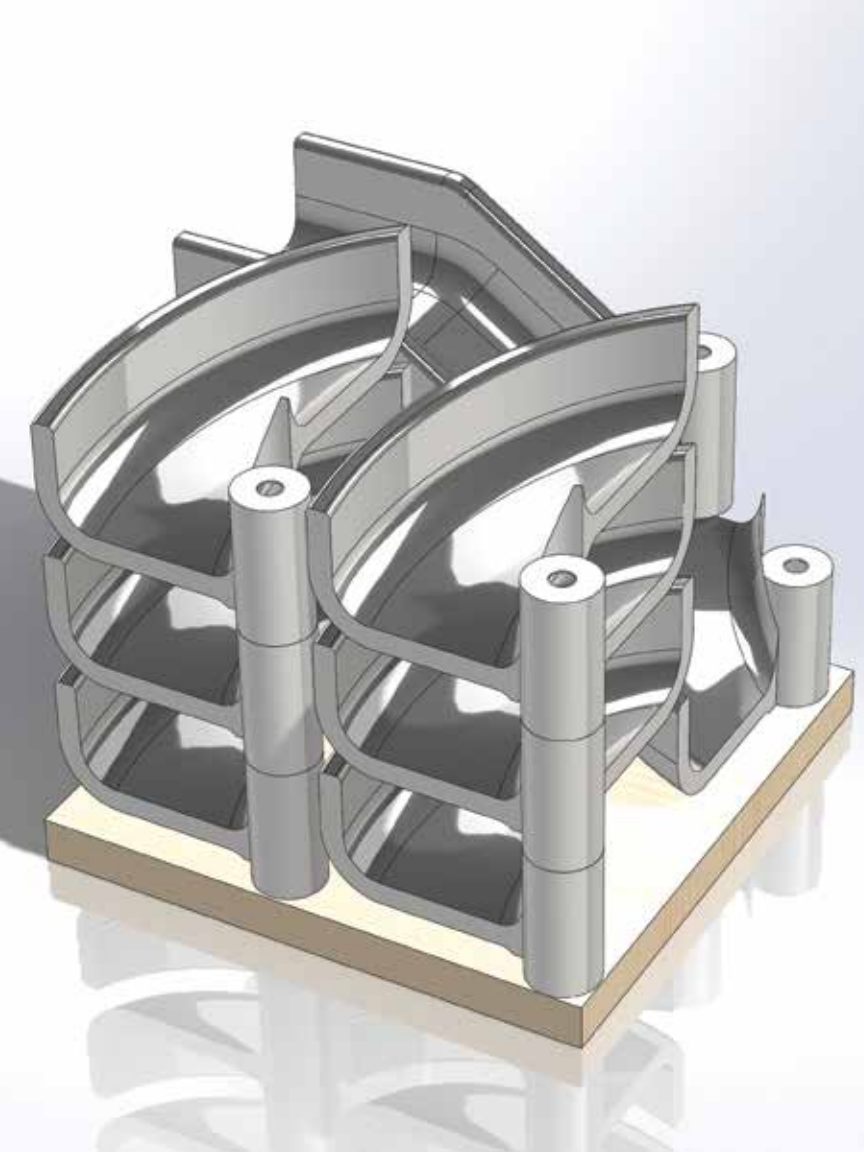


Innovative materials.  
Cool, geometric shapes.  
A broad spectrum of  
colors. Avantech and  
Tenjam team-up to bring  
the FIRM and DuraFLEX  
rotomolded product lines  
to market.

**avantech**  
Think. Create. Advance.

[avantech.com](http://avantech.com) (218) 828-0110







# Solid Designs with Rotational Molding

A marketing advantage based on cost, appearance and function.

by Michael Paloian, Integrated Design Systems, Inc. – USA

Although rotational molding could be traced back to ancient Egypt for slurry casting of pottery, the technology wasn't applied to plastics until the 1940's and 1950's during which time it was used to mold dolls in PVC. A decade later in the 1960's the Engel process, which originated in Europe, was applied to molding LDPE for large hollow containers. This application and material set a trend for the industry which has become the foundation for the industry to this day. Polyethylene resins continue to constitute more than 90% of all the material specified for rotational molding and containers still represent the majority of resin consumed in applications. Despite these stigmas, rotational molding markets have diversified based on thousands of innovative applications that penetrated virtually every industry. In addition, innovative entrepreneurs have experimented with numerous plastics and exciting designs which has further increased the popularity of the process. So what is so unique about rotational molding? Let's answer this question from a designer's perspective.

The completely unique benefit of rotational molding is the creation of large, complex parts that can be molded as finished fully functional items. Rotational molding provides designers with the ability to design complete three dimensional forms in one piece. There is no other plastics process that can boast this claim. Unfortunately rotational molding is one of the best kept secrets for the majority of designers and has thus not enjoyed the popularity of injection molding, blow molding or vacuum

forming within the design community. As more designers discover the benefits of this process, new applications will be identified, further advancing the industry. When I was in college more than 40 years ago studying plastics engineering, I was introduced to rotational molding as a process used to mold tanks. That's all I knew about the process until twenty years later when I was desperately trying to solve a design problem and discovered rotational molding as the perfect answer to my dilemma. Since that moment, I've designed countless rotationally molded products ranging from collapsible pallets to chairs and even rickshaws.

There are three pathways for the industry to advance, grow and remain profitable. The first is improving processing technology which will lead to better quality and efficiency. The second is offering designers a wider selection of plastic materials. This is a chronic problem for designers like me who would specify the process in many untapped markets like medical products, analytical products and structural applications. The third is innovative design. Creative ideas are transformed into products by skilled designers who know the application, end user, material and manufacturing process. Glenn Beall, Glenn Beall Plastics (original guru of rotational molding design) has repeatedly stated "it all starts with design", and he is 100% correct. The industry cannot expand into new markets without well designed products that cost effectively test the boundaries of the process. Products that are designed based on unorthodox parameters and perform in unexpected ways

are defined as innovative. These products are hailed as major successes, often setting new industry trends. Every product can be traced to one or more talented designers who creatively applied their knowledge and imagination.

Although creativity cannot be taught, good design can be learned through attaining knowledge of the application, process and materials. During my twenty plus years of designing rotationally molded parts, I've grown to appreciate the difficulties associated with designing a successful rotationally molded product. In the realm of plastic processing options, I'd rate rotational molding and injection molding as the two most challenging processes for a designer. Designs for each process are distinctly unique requiring specific knowledge related to understanding the process, molds and material properties. Design challenges pertaining to rotational molding range from accommodating wide tolerance variations and potential warpage to maximizing structural performance based on polyethylene. Product designers must understand the effects of tool choice and quality on aesthetics, tolerances and overall part quality. Designers that have a comprehensive understanding of the process, combined with a creative imagination, will have the vision to cost effectively consolidate parts, create artful forms or skillfully design highly structural products to replace steel, opening new markets for the industry.

One example of how the application of rotational molding to creative product design is represented with playground slides. The slide shown here was recently designed by our firm for King Swing last year. It is the only truly modular residential playground slide on the market, being offered in four sizes ranging from 5 feet to 9 feet high. Modularity afforded the manufacturer many benefits including low cost shipping and storage, flexibility in configuring many

Rotational molding provides designers with the ability to design complete three dimensional forms in one piece. There is no other plastics process that can boast this claim.

products from a few building blocks and economies of scale for tooling investment. This product truly exemplifies all benefits and challenges of the process within a highly sophisticated product.

Another product example demonstrating the cost effective application of rotational molding is represented by a car wash transaction kiosk recently designed by our firm and introduced by ICS at the beginning of this year. The one piece rotationally molded structure was designed to satisfy many challenging product requirements which included structural integrity, security against vandalism, severe weather conditions, ease of installation, ease of service, low cost and highly attractive. The original product was originally conceived as a sheet metal electronics box wrapped within a multi-piece thermoformed enclosure secured to a steel post base. The one piece rotationally molded design dramatically reduced cost, provided a one piece water tight structural enclosure within a highly attractive package.

These are only a few examples demonstrating how creative design combined with rotational molding will result in products that have a marketing advantage based on cost, appearance and function. All these features contribute to added product value which is what every consumer wants to maximize. So the next time you think of introducing a new rotationally molded product, think DESIGN! It's where it all begins!!

idsys.com

# Dram srl

SOLUTIONS FOR ROTATIONAL MOULDERS



DRAM IS THE SPICE OF ROTOMOULDING

CAS ENGINEERING

DRADER  
INJECTIWEED

LaPlastecnica



POWERCORE  
ELECTROPHONIC WEAVING SYSTEM



WIZ chemicals

info@dramsrl.com · www.dramsrl.com



## suc•cess [sək-'ses]

quality performance roto powders; high-UV color compounds; extended flex fatigue resistance; ultra-low-temperature toughness; high stiffness; combination of toughness and rigidity; high hardness and scratch resistance



A. Schulman Specialty Powders is your best choice to meet virtually any processing or performance need. Backed by 30 years of experience, we provide a full range of products – including all your Icorene® favorites.

A. Schulman is a leading global supplier of high-performance compounds, resins and masterbatches.

The rotomoulding division under the Specialty Powders unit collaborates with our other product families to provide resources that are used in a variety of end markets such as mobility, packaging, agriculture, building & construction and electrical & electronics.

**Our definition of success is helping you achieve yours.**



Customized high-performance engineered composites, thermoplastic compounds, resins and masterbatches.

[www.aschulman.com](http://www.aschulman.com)



ADVERTORIAL



# PP The Black Swan

by PSD Rotoworx - Australia



In the late 17th century it was presumed that black swans did not exist. All swans were white. Then European explorers found Western Australia and discovered the swans were black.

So became the Black Swan theory as a statement of impossibility. If you think something is impossible then in all likelihood it is possible and with hindsight you should not have been surprised.

It is the same with polymers for rotational molding. Everyone is of the belief that polyethylene is the only material to rotationally mold.

But this is not so. Polyethylene has widespread adoption for the rotational molding industry and with just cause. It is a forgiving material to mold, has good impact, takes additives for stabilization and improved weathering readily, and is well priced.

But there is a need for a polymer that meets technical requirements above those of polyethylene for a moderate price.

**Polypropylene surpasses polyethylene for stiffness, hardness, chemical resistance, creep deformation and heat resistance, but suffers from low impact at low temperatures.**

The reason for the brittleness of polypropylene is related to its glass transition temperature T<sub>g</sub>. This is the temperature at which the amorphous phase assumes a glass-like state and is unable to undergo plastic deformation. Polypropylene with a T<sub>g</sub> around 0°C (32°F) therefore has a tendency to be brittle at low temperatures, while polyethylene with a T<sub>g</sub> at -85°C (-120°F) shows high ductility.

The other disadvantage of polypropylene is that it is more difficult to pulverize into a fine powder. Polypropylene is more sensitive to heat and becomes sticky and aggregates in the mill while being pulverized. This is why many polypropylenes are cryogenically pulverized. This is a costly process.

PSD Rotoworx, an Australian company, identified the attributes of polypropylene for

rotational molding and set about to address its shortcomings. They recognised the need to find an optimum balance of performance and processability in an impact-modified polypropylene that could be pulverized at ambient conditions and be acceptably priced. It also had to process in conventional machinery and sinter with good surfaces.

This necessitated a focused attack in three areas. Develop the optimum formulation, solve the problem of ambient grinding and determine the correct molding parameters.

There is no reactor grade polypropylene that is suitable for rotational molding that meets the requirements for industrial components. Such a polypropylene grade for rotational molding needs to be reformulated and compounded.

PSD Rotoworx used their extensive knowledge of polyolefins to achieve a polypropylene compound that met this criteria. Extensive testing was required on both material compound and rotationally molded parts to demonstrate this.

Some of the testing that was performed was as follows;

#### **Material Tests**

- MFR
- Tensile – stress, strain & modulus
- Impact – Charpy & ARM
- FNCT & ESCR
- Creep
- Temperature – HDT
- Hardness

#### **Molded Part Tests**

- Ring Stiffness
- Vacuum
- Pipe Pressure
- Pallet Deformation
- ARM Impact
- Scratch Resistance

Understanding the stiffness versus impact disparity between polypropylene and polyethylene drove PSD Rotoworx to find a balance between these two important properties for their polypropylene compound.

For the targeted applications like chemical storage and Infrastructure (especially underground), polypropylene's inherent attributes of stiffness, high hardness, good ESCR and excellent creep resistance led the way.

And for under the bonnet applications in automotive, the high heat performance which is vastly superior to polyethylene has already seen polypropylene dominate this market.

For furniture and also transport and construction panels the requirements are for high stiffness together with good gloss and scratch resistance. Polypropylene wins out compared to polyethylene.

Next was to ambient grind to give an acceptable particle size distribution that would mold well. Using conventional pulverizers, PSD Rotoworx have developed a special disc design and minor machinery modifications that make this possible.

Output is not at polyethylene rates but neither does it need to be. Particle Size Distribution does not match that for polyethylene, but again neither does it need to.

PSD Rotoworx ambient grind technology allows for their polypropylene compound to be pulverized to powder with far greater ease and at a fraction of the cost of cryogenic grinding.

It also allows, under PSD Rotoworx direction, for it's customers to reprocess any polypropylene scrap or rework back into powder. This has previously not been possible for the rotational molder.

Polypropylene behaves very differently to polyethylene when heated under non-shear conditions. Reactor polypropylene does not sinter as easy as polyethylene. And poor sintering results in poor impact.

PSD Rotoworx polypropylene compound overcomes these issues – when molded correctly.

Compared to polyethylene, PSD Rotoworx's polypropylene requires a higher PIAT. How is this achieved? By using a hotter oven and cooking in the oven for a longer time.

While factors such as mold construction and part design need to be taken into account, typically this polypropylene needs an oven temperature of 300C (570°F) to achieve a PIAT of 230°C (450°F). In those instances where PIAT is not measured a peak external mold wall temperature of about 240°C (465°F) is recommended. And a little longer curing time by around 10% over polyethylene.

However, the crystallization temperature of polypropylene is a lot higher than polyethylene, so the product solidifies earlier in the mold during cooling. Meaning, it can be demolded earlier.

The shrinkage of polypropylene is also lower than polyethylene – ~1.5% compared with ~3%. However, experience has shown that mold release is not needed and in fact discouraged when molding this polypropylene.

To optimize processing and produce parts with excellent gloss and minimal pin holes it has been proven that the use of a Supavent® – type venting system is a preferred method. (Details can be found via [laplastecnica.co.nz/products](http://laplastecnica.co.nz/products))

**So now we have a competitively priced polypropylene compound that molds well and produces parts showing high stiffness with good impact, and all the other inherent attributes of polypropylene like high heat, better creep, good chemical resistance and improved gloss and scratch resistance.**

And like the European explorers back in the 17th century, current day rotational molders can now have their Black Swan moment.

Mold some PSD Rotoworx polypropylene and see first-hand the product advantages and new markets it can open for your business.

[psdrotoworx.com](http://psdrotoworx.com)



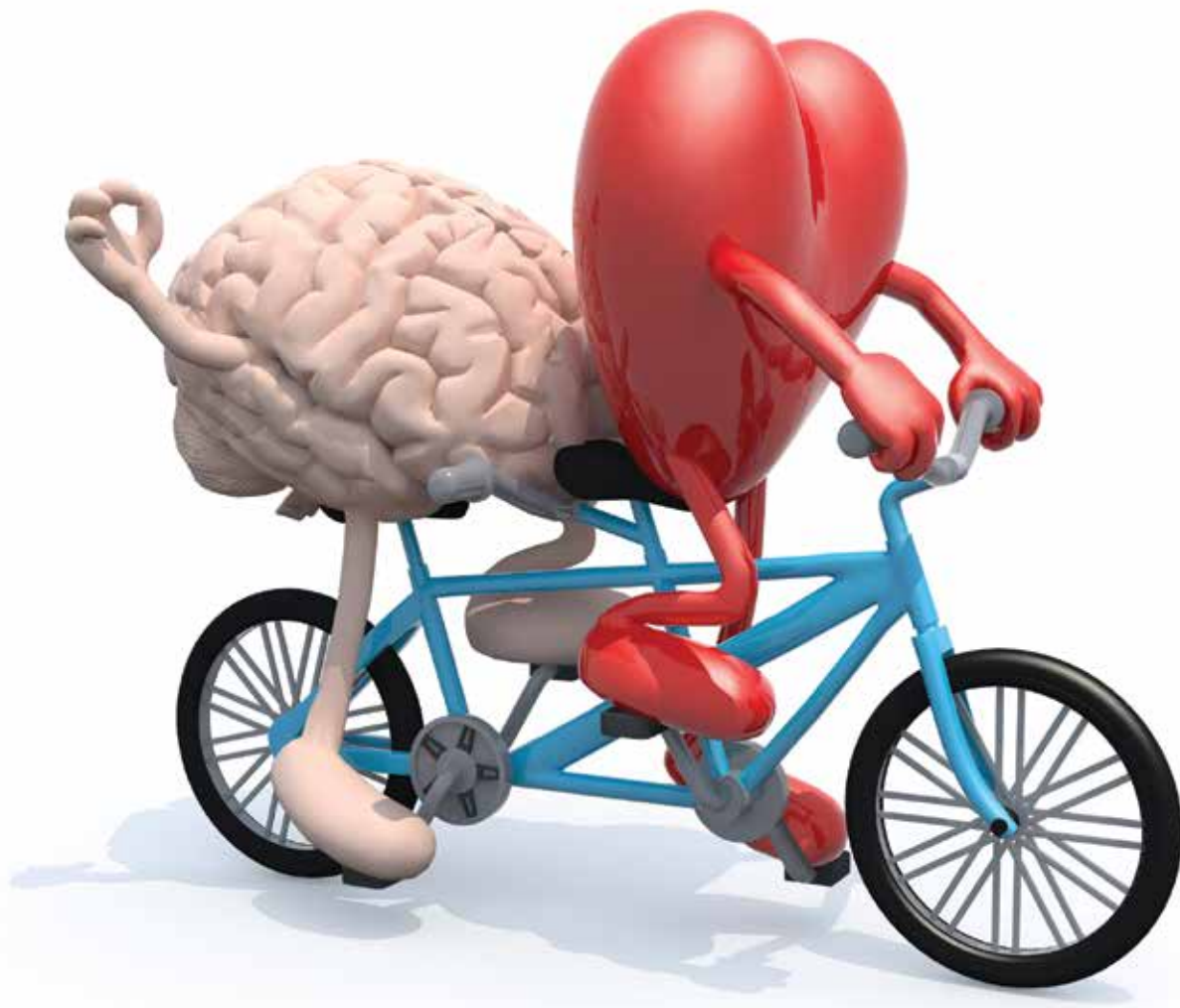


# Rotational Moulding Product Showcase.

## 2018 ARMO Rotational Moulding Showcase

What is your product Story?

Product innovation requires internal collaboration.



If you are interested in having your product innovation featured in the 2018 ARMO Rotational Moulding Product Showcase, send your products and information to [info@armo-global.org](mailto:info@armo-global.org)





# Want your Rotomolding Plant to be on Top?

by Harry Covington, Ferry Industries, Inc. – USA

## Here are key ingredients

We all aspire to be the best – to be on top – and more often than not achieving that goal in manufacturing requires a selection of people, processes and first-class equipment. Ferry Industries offers a range of first-class equipment geared to take your operation to the top.

## High-Intensity Mixers

For rotationally molded products made in a range of colors with pigments and additives to granite textures, Ferry PlasMec High-Intensity Mixers offer an outstanding technical solution to the question of which system to use for mixing.

Ferry PlasMec High-Intensity Mixers advantages include:

- Fast mixing cycles—approximately 8 minutes per cycle
- Available batch sizes from 100 to 1,000 lbs.
- Repeatable results by use of carefully measured components and exiting at a pre-set temperature
- Less labor for material handling
- The use of concentrates yields better dispersion of the color onto the resin
- Powder granules lose their “tails” and roll better in the mold
- More homogeneous mixture

## Powder-Dispensing Systems

One of the more wasteful and costly

operations in a rotational molding plant is the handling of the plastic material, whether the problem is removal from silos, feeding a pulverizer or discharging powder into a mixer. Most often the messiest, slowest and most mistake-prone problem is dispensing powder directly into the molds on the arm of a machine. To help solve these issues, Ferry and Wittman-Canada teamed up to offer their RotoLoad powder-dispensing system, specifically designed for rotomolders.

Applications:

- You can fill mixers with multiple ingredients from holding bins
- You can direct-fill molds using overhead dispensers or floor-mounted dispensers

## Advantages

- Accuracy – tolerances within ounces
- Reduced spillage means a cleaner plant and less loss
- Faster cycles
- Reduced manpower
- Repeatability

## Rotational Molding Machines

Ferry produced its first rotational molding machine in 1983 -- and since that time has produced more than 1,000 machines, located in 60+ countries.

Ferry RotoSpeed™ Machines comprise 45 standard machine models:

- Independent-Arm Machines
- Fixed-Arm Turret Machines

L-R (page 64):  
 Ferry Quintax E5510 Enclosed CNC Router  
 Ferry Quintax Q555D CNC Router  
 Ferry PlasMec Hi Intensity Mixer  
 Ferry RotoCure 7 Management Systems  
 RotoLoad Dispensing Unit  
 Ferry Operator Work Platform  
 Ferry RotoSpeed Shuttle



- In-Line Shuttle Machines
- Giant Heavy-Duty Shuttle Machines
- Rocking-Oven Machines
- Lab Machines

**In fact, in 1984, Ferry developed the first 4-arm/5-station independent-arm machine. That development stands as the single most important change in the rotational mold machinery industry. What did it do?**

- It allowed completely different process cycles arm to arm
- It allowed a "resting" station in the system, or more process stations if the system is expanded to 6 or 7 stations
- It allowed for significantly higher weight capacities for each of the arms on the machine
- It allowed for larger mold swing capacities
- It allowed reversing of arms from oven or cooler in process without disturbing the other arms in the system

Today, Ferry's Independent-Arm Machines allow mold swing capabilities up to 240" (6000mm) and weight capabilities up to 10,000 lbs. (4545 kg) per arm.

For large-scale tank production, Ferry has engineered heavy-duty shuttles to accommodate weights of 14,000 lbs. (6400 kg) with mold swings as large as 272" (6900 mm).

A list of Ferry "firsts" includes the development of the 4-arm/5-station independent arm machine, but other firsts include:

- Multiple passage internal air (2 & 3 passages)
- Use of PC/PLC system to manage the machine and the process
- Integration of Infrared Thermometry<sup>1</sup> with Ferry's RotoCure 7™ System Control to continuously control the molding process – and recent enhancements allow events to occur during both the oven and the cooling cycles.

The RotoCure 7™ System Control provides for setting up process control for the machine, providing process trending, generating reports and annunciating machine



fault and the ability to have remote monitors and remote access for troubleshooting.

Ferry RotoSpeed RS4600 Ind Arm

Contemporary Ferry machines offer:

- 3- or 4-arm capability with high weight-carrying capacity
- RotoCure 7 as a standard operating system
- Use of internal mediums through up to 3 passages
- Efficient use of energy - fast oven recovery
- Available heat exchangers to recuperate up to 25% of energy
- Multi-layer molding capabilities
- Ethernet access for remote troubleshooting and software updates
- Total process management with Infrared Thermometry, RotoLog and 493k systems
- Report generation for the process management systems
- Integrated operator work platform systems
- Integrated powder dispensing systems

The Ferry RotoSpeed™ product line is focused on improving value for the customer through accessibility for communication to the machine and from generation of reports, improved use of energy and the improvement of processing speeds to enable our customers to produce more products at faster speeds.

### Operator Work Platforms

Safety has to be the primary focus in any manufacturing operation. The Ferry Automated Work Platform range provides a safe work environment that enables your team to improve productivity while maintaining the security of a safe plant.

- Ferry's Platforms move in and out with electric gear-motor power
- The platform deck covers the entire space for the mold swing
- A "roll-over" gate automatically positions itself on the backside of the spider to prevent operators from falling off the platform. Before the platform is retracted, the gate is returned to the rest position, which prevents operators from falling when the platform is "out"
- Operators have a full 360-degree access to the molds on the spider/arm
- Safety controls prevent the arm from rotating on either axis (arm & plate) and the carriage is prevented from indexing while the platform and the rollover gate are in place
- Ferry's platforms help quicken turnaround at the load/unload stations
- Operator fatigue is reduced
- Platforms can be enhanced with hose reels, tool boxes, product chutes for discharge and other user features

### Automated Trimming Machines

Trimming of rotational molding parts is sometimes from the Dark Ages – hand trimming with awkward tools and fixtures – but in some cases, that is the only way

to do the task. In recent years automated trimming for rotational molding has been accomplished through the application of high-speed CNC routers and high-speed CNC robotic work cells.

Ferry's Quintax™ high-speed CNC routers are used in the rotational molding industry as well as in aerospace and general plastics industries.

The Quintax routers are available in three configurations:

- An open chassis single- or double-table machine
- A closed chassis system with a full metal enclosure and automated entry doors

### A gantry style for unusually large and long parts – typically aircraft parts

The use of high-speed CNC routers in the rotational molding industry requires that the users provide adequate fixtures to hold the large parts and in many cases part probing is necessary to manage the molding tolerances.

Advantages of high-speed CNC routers:

- Faster trimming cycles
- Repeatability of cycles
- Quality of the trimmed part
- Accuracy of the trimming
- Safety for the operators

1 Dr. Paul Nugent is the patent holder for IRT

Ferry Industries...When Performance Counts!

[ferryindustries.com](http://ferryindustries.com)

---

Ferry is expending a lot of energy to support its Aftermarket Business, i.e. spare parts and the updating and repair of older machines for its RotoSpeed product line. New systems and personnel have been added to reinforce the activity

Conversions could include:

- Additional or replacement arms and carriages
- New control updates to provide older machines with new operating systems
- Complete new control cabinets
- Conversion from DC to AC systems
- New gas trains or updates to older gas trains
- New ovens or cooling chamber
- Addition of IRT systems to older machines

# Reduction Pulverizing Systems

High-performance pulverizers for your individual needs.

by Maag / Reduction Engineering Scheer – Europe & USA

With the acquisition of Reduction Engineering Scheer Inc. in Kent, Ohio in October 2015, Maag Pump Systems AG has added pulverizers to the product portfolio that includes also gear pumps, pelletizing systems as well as filtration systems.

## **Long standing expertise in pulverizing technology**

Founded in 1992 Kent/Ohio based Reduction Engineering Inc. developed and manufactured its first pulverizers in close cooperation with local Rotational Molding companies with the aim of improving the available technology for pulverizing at that time. Constant development and improvements over time result in the current product portfolio with of four different types of pulverizers with different sizes. Up to now more than 800 Reduction Engineering pulverizers are in operation worldwide.

## **Local support – globally!**

A network of 16 Maag locations and more than 50 representations around the world are offering local support for existing and potential customers. Multiple installed machines at our technical centers in Kent, OH, Roanoke, VA, Grossostheim / Germany and Chonburi / Thailand are available for lab and/or production scale trial- and demonstration runs with customer materials. Local warehousing of the most common wear- and spare parts on these sites shorten delivery times at economical shipping rates. Special retrofit kits, which allow the use of the patented Disposable Discs on all existing pulverizers from Reduction Engineering built to date, are available from stock and can increase rates from 15-20% with reduced maintenance cost.





**Particle size distribution is a key factor for efficient Rotational Molding**

The structure of the powder, in particular the individual particle size distribution for the respective application, remains one of the key factors in Rotational Molding - besides the Peak Internal Air Temperature (PIAT), the rotational speed as well as heating and cooling times of the mold(s). The target is a maximum particle size of either 500 or 600µ and a specific distribution within this range based on the application. The finer fraction of the powder melts first on the hot mold surface and forms of a compact and smooth outer layer, whereas the coarser portion of the powder builds the supporting structure and defines the wall thickness of the finished part. The ratio between fine and coarse particles can be adapted for the particular application by adjusting the process parameters accordingly.

**Lean Design for maximum efficiency**

As simple as the general principle of an attrition mill appears to be, the details of the design of certain technical components

are crucial to the overall performance of the pulverizer itself.

The core component of the pulverizer is the mill chamber which is horizontally orientated to eliminate the influence of gravity on distribution of the pellets and powder inside the mill. The mill chamber holds two milling discs - the upper, stationary, and the rotating lower disc which is attached to a balanced flywheel and shaft assembly connected to the main drive via pulleys and V-belts. The motor is mounted next to the mill chamber and easy to maintain and service. The upper, stationary, disc is connected to the hinged lid of the mill chamber and can be cooled with chilled water if necessary. The gap between the rotating and stationary disc can easily be adjusted without opening the mill housing using Push- and Pull rods and checked through inspection ports at the side-wall of the mill. The raw material, mainly granules or regrind chips, is conveyed into the feed-hopper by a hopper loader or feed screw. From there, the material is transferred into the center of mill chamber through the inlet opening and the stationary disc by a vibratory feed-tray. The feed-rate is controlled by the PLC of the pulverizer and automatically adjusted depending on the temperature conditions in the mill and the motor load of the mill drive. The material passes centrifugally and evenly through the conical reducing gap between the milling discs and is progressively reduced to the desired size. After passing the discs the powder is conveyed out of the mill housing to a cyclone mounted on top of the mezzanine. An air blower performing the conveying also cools the mill by drawing ambient air into the system through the mill feed inlet. The powder is separated from the air inside the cyclone and then passes through a rotary valve into the sifter unit which has several screening decks depending on the capacity of the mill. "Good" material, passing the screen, is discharged whereas oversized material larger than the mesh size of the screen inserts gets fed back into the mill for re-processing.



The details of the design of certain technical components are crucial to the overall performance of the pulverizer itself.

**Patented Disposable Disc Technology for high performance and reduced operating cost**

In order to eliminate the time- and cost consuming re-sharpening process for pulverizer discs, Reduction Engineering has introduced the patented Disposable Disc system at the beginning of 2011. Instead sending off the discs after removal to be reground as normally the case in the past, Disposable Discs simply get replaced by new ones, thus saving costs for transport and grinding service. The discs are only 8 mm thick and weigh 6 kg. Compared to the discs previously used, which can weigh 25 kg or more each, transport costs are significantly reduced. Thus a set of disposable discs can be send quickly and effectively by parcel service if necessary. The low weight also improves handling during installation and removal and reduces conversion time about a third. The opening that passes through the center of the disc is 40% larger in the Disposable Disc design which results in a significantly higher air flow, which improves cooling of the milling chamber and results in increased throughput rates compared to conventional disc design. Special retrofit to convert existing Reduction Engineering pulverizers to the Disposable Disc technology are available for all machines built do date.

**Operator friendly control concept**

Flexibility and ease of operation were on the top of the agenda when developing the control concept. The PLC is equipped with a touch screen display which is more or less self-explaining and clearly shows



all necessary parameters as well as visualization of the process on the main operator page. Critical process parameters as well as minimum and maximum values of the integrated safety system are password protected and can only be changed by authorized employees. Teleservice and troubleshooting from a remote location is possible via an integrated Ethernet connection.

maag.com



**SAVE THE DATE**

**ARMO 2018 “Function Meets Design” to take place in historic Hamburg, Germany  
16th – 18th September**

ARMO 2018, the largest rotational moulding industry event for 2018, will take place in Hamburg, Germany from the 16th - 18th of September 2018. The event itself will take place at The University of Hamburg.

**Function Meets Design**

“Function Meets Design” has been selected as the central theme to be carried throughout the ARMO 2018 conference. The theme was chosen as it clearly depicts Central Europe’s rotational moulding industry, which is well-known for its technical and complicated products that also exhibit good design.

ARMO, through the support of its great sponsors for 2018, is preparing to host an outstanding conference complete with an ambitious education program of presentations, networking and social events and a large trade exhibition where suppliers will display their products and services before the industry.

The fun and networking events planned for the conference include a dinner in Hamburg’s historic warehouse district on Monday, 17th September. Attendees will take a scenic boat tour of Hamburg’s harbor and arrive right at the landing stage of the former Main Customs Office Hamburg for a memorable ARMO evening. There will also be a culinary barbeque with a mobile Barista and Gin High Ball Bar.

**Hamburg**

Hamburg, historically known as ‘The gateway to the world’, originated its role as the Centre for International Trade in the late 19th and early 20th centuries – which brought the city its great wealth. It is the city where a majority of German immigrants set off on their long journey to America.

The second largest city in Germany, The Hansestadt Hamburg is home to the largest German seaport and many other exciting attractions. Among the main attractions is the “Speicherstadt”, which has recently been named a UNESCO World Cultural Heritage. Hamburg was also recently, once again, rated as one of the world’s top ten cities in which to live.

**Travel & Access to Hamburg**

The central airport in Hamburg guarantees easy and comfortable access for international guests. The University of Hamburg, venue for ARMO 2018, is located just 10km from the airport and can be reached easily and quickly by car or public transportation.

There will be a unique opportunity for visitors to join Rototour 2018, a tour of local rotational moulding plants hosted by ARMA (Association of Rotational Moulders Australasia). The tour will take place prior to ARMO 2018 and registration is separate. To see the details and register for this exciting tour go to [rototour.com](http://rototour.com)

Join ARMO 2018 for quality education and training, and also for good company and historic scenery. ARMO is anticipating over 600 industry attendees for this exciting and high-value event. Attractive registration fees have been set to encourage multiple attendees per company.

More detailed information, both for visitors and exhibitors/sponsors can be found at: **[armo2018.com](http://armo2018.com)**.

**VISIT OUR WEBSITE & FOLLOW ARMO**

Be sure to keep up with the ARMO and its member associations via **[ARMO-GLOBAL.com](http://ARMO-GLOBAL.com)**

ALSO, Follow ARMO Global on Facebook, LinkedIn and Twitter!



# ARMO ANNOUNCEMENTS

## ARMO CALENDAR



**September 21-24, 2017**  
Anipac 50th Convención  
Morelia, Michoacan  
anipac.org.mx



**September 26-28, 2017**  
Rotoplas 2017 Global Exhibition  
Chicago, USA  
rotomolding.org/events



**January 19-21, 2018**  
StAR 2018 Annual Conference & Trade Show  
National Capital Region Delhi, India  
starasia.org



**February 6-7, 2018**  
Nordic ARM 10th Annual Conference  
Oslo, Sweden Area  
nordicarm.org



**March 14-15, 2018**  
ARMSA Rotation 2018  
The Farm in Pretoria, Gauteng  
armsa.co.za



**March 25-27, 2018**  
ARM Executive Forum  
Hyatt Grand Cypress, Orlando, FL  
rotomolding.org



**June 3-5, 2018**  
Rotomould 2018 Figi  
Fiji  
rotomouldconference.com.au



**September 7-18, 2018**  
Rototour 2018  
Italy/Germany/The Netherlands  
rototour.com



**September 16-18, 2018**  
ARMO International Conference  
Hamburg, Germany  
armo2018.com



## ARMO ANNUAL SHOWCASE

This publication is the first annual ARMO Rotational Moulding Showcase and we are already planning the 2018 Rotational Moulding ARMO Showcase. Do not miss this very special opportunity to promote the Rotational Moulding process around the world. Starting in October, we will begin reviewing products for the 2018 ARMO Product Rotational Moulding Showcase for consideration. To enter a product, please email [info@armo-global.com](mailto:info@armo-global.com). Submissions will be accepted beginning October 1, 2017 and must be received by June 1, 2018.

ARMO Rotational Moulding Showcase is an annual marketing publication by the Affiliation of Rotational Moulding Organizations (ARMO) published by JSJ Productions, Inc.

#### **ARMO Board of Directors**

Chairman & BPF Representative – Martin Spencer, Unique Roto martin@uniqueroto.com  
 Vice Chairman & ARMSA Representative – Wayne Wiid, Pioneer Plastics wayne@pioneerplastics.co.za  
 Past Chairman & ARM Representative – Bill Spenceley, Flexahopper Plastics bspenceley@flexahopper.com  
 AFR Representative – Philippe Goreaud, Promens France philippe.goreaud@rotomoulage.org  
 Anipac Representative – Horacio Lobo Zerterchie, Versaplas horaciolobo@negesa.com  
 ARMA Representative – Graeme Hall, Viscount Rotational Mouldings graeme.hall@viscount.com.au  
 Past Chairman & ARM-CE Representative – Oliver Wandres, MAUS ow@maus-gmbh.de  
 IT-RO Representative – Katia Zopetti, DRAM S.r.l. katia.zopetti@dram srl.com  
 Nordic ARM Representative – Ronny Ervik, Ultra Polymers Ronny.Ervik@ultrapolymers.com  
 'ROTOPOL' Representative – Dr. Marek Szostak, Poznan University of Technology Marek.Szostak@put.poznan.pl  
 RPC – CPPIA Representative – Peter (Yong Xing) Yan Zhejiang Ruitang Plastics peteryyx@163.com  
 Past Chairman & StAR Representative – Ravi Mehra, Norstar International MARAMEHRA@aol.com

#### **Publisher**

Publisher – JSJ Productions, Inc.  
 Chief Editor – Susan Gibson JSJ Productions, Inc. susan@jsjproductionsinc.com  
 Editor & Marketing Director – Jennifer Gibson JSJ Productions, Inc. jennifer@jsjproductionsinc.com  
 Designer – Anya Wilcox JSJ Productions, Inc. anya@jsjproductionsinc.com  
 Internet & Digital – Jason Cooper JSJ Production, Inc. jason@jsjproductionsinc.com  
 Distribution – Regina Rogers JSJ Productions, Inc. regina@jsjproductionsinc.com  
 Legal – Joseph V. Gibson, IV JSJ Productions, Inc. jvg@jsjproductionsinc.com

#### **Editorial Contributors**

Paul Nugent, MNOP paul@paulnugent.com  
 Satish Gokhale, Design Directions Pvt. Ltd satish@designdirectionsinc.com  
 Martin Spencer, Unique Roto martin@uniqueroto.com  
 Michael Paloian, Integrated Design Systems, Inc. paloian@idsys.com  
 PSD Rotoworx THumphreys@psdrotoworx.com  
 Ferry Industries sales@ferryindustries.com  
 Maag / Reduction Engineering Scheer info@maag.com

#### **Product Showcase / Photo Contributors**

Euro Tank Nord S.r.l. – Italy  
 Tulpi®-Seat – The Netherlands  
 Cemer – Turkey  
 Design Directions Pvt. Ltd – India  
 Euro Tank Nord – Italy  
 Versaplas – México  
 Swinburne University – Australia  
 OK Play Limited – India  
 Pioneer Plastics – South Africa  
 Spincraft – Mexico  
 Master Spas – USA  
 Tenjam – USA – Spain  
 BD Barcelona  
 Stefano Giovannoni – Italy  
 Bioquell – Europe & USA  
 SLIDE S.r.l. – Italy  
 KK Nag – India

#### **Inquiries**

info@armo-global.org / armo-global.org

#### **Reproduction**

All Copyrights belong to ARMO and in no part may this publication be reproduced or transferred through any digital or electronic means, photocopied or otherwise without the written consent of ARMO.

## SPONSORS & ADVERTISING

**59**

**A. Schulman USA & EUROPE**

3637 Ridgewood Rd.  
Fairlawn, OH 44333 USA  
330.666.3751  
info@aschulman.com  
aschulman.com

**55**

**Avantech**

7790 Hastings Rd.  
Baxter, MN 56425 USA  
218.828.0110  
tinnis@avantech.com  
avantech.com

**59**

**DRAM srl**

Via Brigatti 12  
20152 Milano  
Italy  
tel/fax +39 02 4597757  
cell +39 348 4454363  
dramsrl.com

**3**

**Ferry Industries, Inc.**

4445 Allen Rd.  
Stow, OH 44224-1093 USA  
330.920.9200  
sales@ferryindustries.com  
ferryindustries.com

**55**

**Jerico Plastic Industries, Inc.**

7970 Boneta Rd.  
Wadsorth, OH 44281 USA  
330.730.6314  
Minerva Plant: 330.868.4600  
steve@jericoplastic.com  
jericoplastic.com

**2**

**Maag / Reduction Engineering Scheer**

USA Headquarters  
235 Progress Blvd.  
Kent, OH 44240 USA  
1.800.844.2927 / 220.677.2225  
Maag.KEN.Info@maag.com  
maag.com

**Europe Headquarters**

Ostring 19  
63762 Grossostheim, Germany  
+49 6026503 354  
info@maag.com  
maag.com

**75 & 77**

**Orenda**

165 Steelcase Rd. East  
Markham, Ontario L3R 1G1, CANADA  
905.513.8043  
sales@orenda-automation.com  
orenda-automation.com

**76**

**PSD Rotoworx Pty Ltd.**

P.O. Box 885  
Chatswood NSW 2057  
Australia  
+612 9412 3255  
thumphries@psdrotoworx.com  
rotoworx.com

**9**

**Powder King, LLC**

41780 N. Vision Way  
Unit 120 Bldg. 2  
Anthem, AZ 85086 USA  
623.551.9897  
sales@powder-king.com  
powder-king.com

**38-39**

**Rotoline Equipamentos Industriais Ltda.**

Brasil Corporate Office  
Acesso Canários da Terra,  
Lote 01, Quadra 2524  
Bairro Seminário  
CEP: 89813-140 – CX Postal 160  
Chapecó – BRASIL  
55 49 3324 5680  
vendas@rotoline.com

**Rotoline USA**

Kent, OH USA  
sales@rotoline.com  
rotoline.com

For further information, contact  
ARMO at info@armo-global.org or  
go to armo-global.org.



**LOOKING FOR  
AN EDGE OVER THE  
COMPETITON?**

**Flip the page to see  
why our customers  
brag about owning  
the best pulverizer  
in the market.**



**orenda**

Celebrating 20 years of innovation!  
<http://www.orenda-pulverizers.com>

  
**airforce**™  
Technology by Orenda



# THE EARTH IS FLAT

No, it's not. But the world of rotational molding has been under this belief.

Polyethylene is NOT the only material to roto mold.

**NOW THERE IS A POLYPROPYLENE THAT WILL TURN YOUR WORLD UPSIDE DOWN.**

Be part of the future and contact us now so we can show you how our new technology **POLYPROPYLENE** meets the demands of the infrastructure, automotive, food & medical markets.



**ROTOWORX**  
[psdrotoworx.com](http://psdrotoworx.com)

For more information:  
[sales@psdrotoworx.com](mailto:sales@psdrotoworx.com)

# IMPROVE YOUR COMPETITIVE ADVANTAGE BY LEVERAGING OURS

The revolutionary and proven AirForce® mill technology by Orenda delivers superior production rates while lowering your operating costs. Combined with its ease of use, lower maintenance requirements, and extended disc life, the AirForce® mill system improves your bottom line while delivering optimal particle size distribution and morphology.

Please contact us for a demo and see why our claim is true: [sales@orenda-pulverizers.com](mailto:sales@orenda-pulverizers.com) or call us, North America: +1 905 513 8043 or Europe: + 30 231 079 5956

  
**airforce**™  
Technology by Orenda

 **orenda**

Celebrating 20 years of innovation!  
<http://www.orenda-pulverizers.com>







JSJ Productions, Inc.  
Publisher for ARMO LTD  
625 West Market Street  
Salinas, CA 93901

**PRINTED  
MATTER**

PRIORITY MAIL  
INTERNATIONAL  
U.S. POSTAGE PAID  
AUSTIN, TX  
PERMIT NO. 2515

