

# 11<sup>TH</sup> NORDIC ARM CONFERENCE



**Do you need total Control 24/7**

Presented by: Gary Lategan



**The answer is surely**

**YES**

**We need 24/7 control**

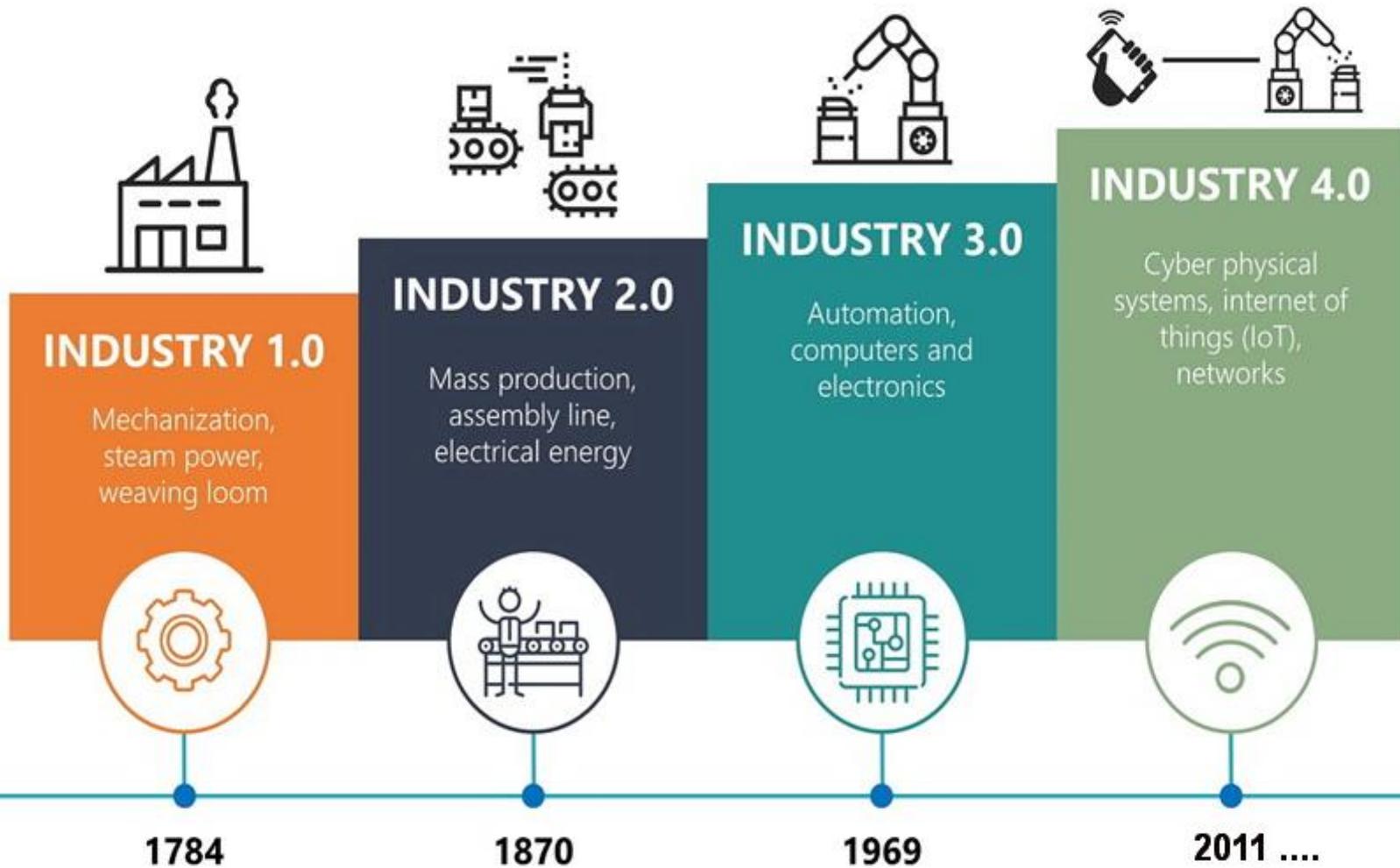
**So why do we not have it?**

**Where are we the  
Rotational Moulding  
Industry**

**With 24/7 Control  
& Industry 4.0**

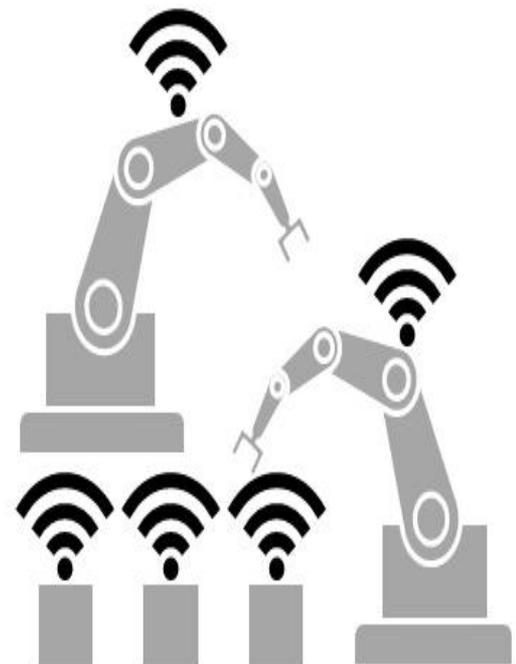
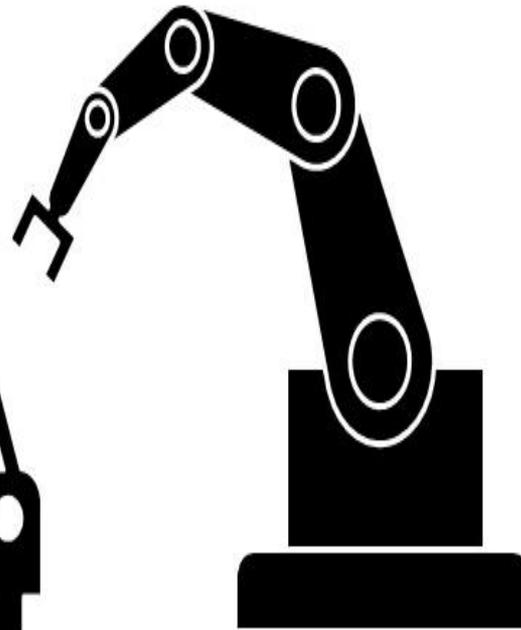
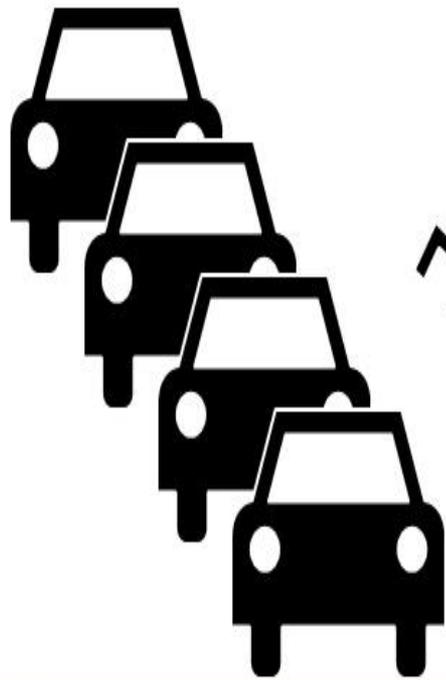
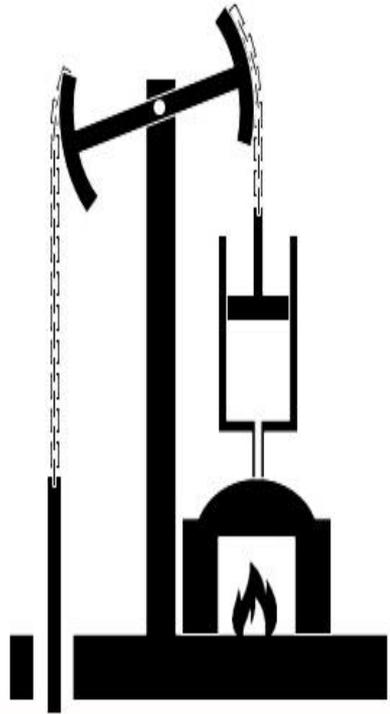
**??????**

# Industry 1.0 to 4.0



**In my opinion the  
Roto Moulding Process  
has a long way to go.**

**The following figure are my  
opinion and nothing more**



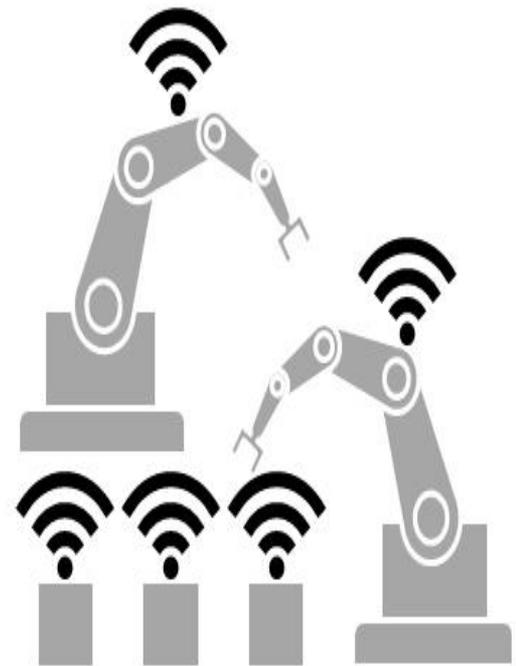
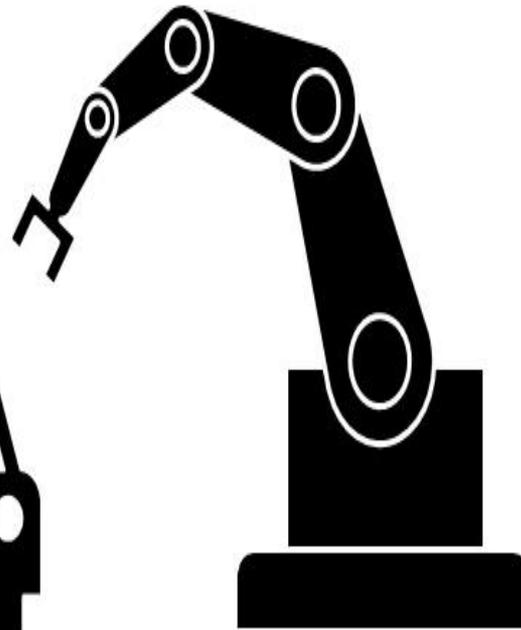
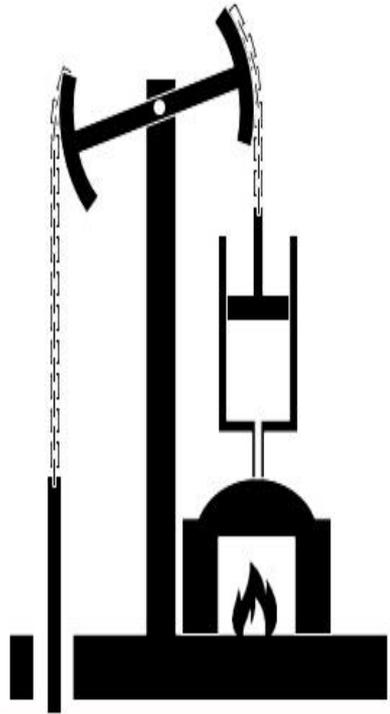
1.0

2.0

3.0

4.0

80%



1.0

2.0

3.0

4.0

80%

10%

8%

2%

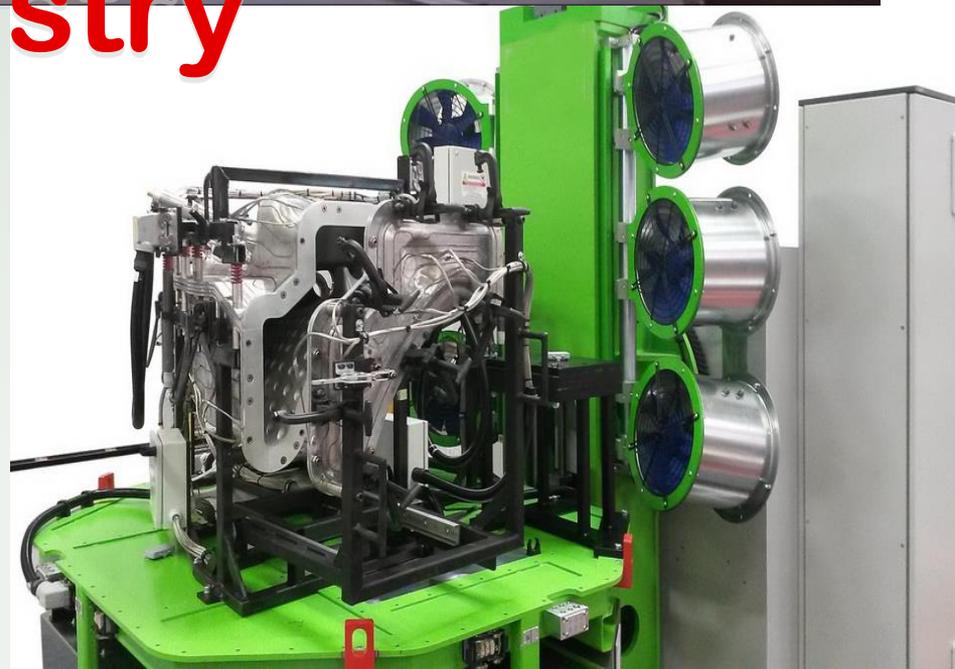
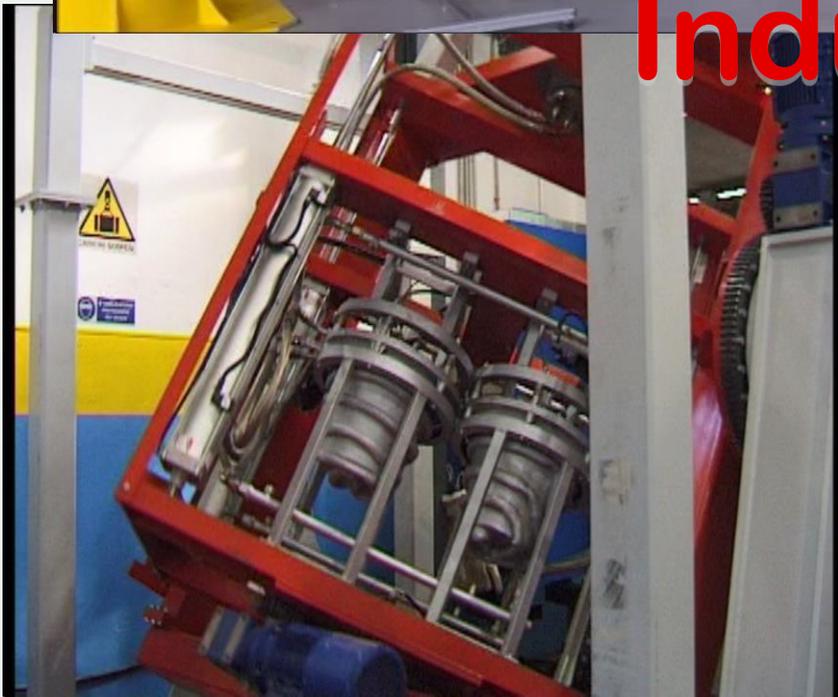
# **There are some machines that are Industry 4.0**

**Persico Leonardo 2004  
& Smart Machine 2014**

**Plastigi & AMS  
RoboMould 2012**



**This is all great news for  
The Rotational Moulding  
Industry**



**But what about conventional  
Turret, Carousel & RXR**

**Queens University**

**Gave us RotoLog  
With the internal Air Trace**

# Queens University

## Prof. Roy Crawford

### Developed RotoLog 29 years ago!



# Queens University PCT 1991



**United States Patent**

**5,322,654**

**Crawford , et al.**

**June 21, 1994**

---

**Rotational moulding apparatus and process**

## **Abstract**

A rotational moulding apparatus includes a device (5) disposed inside the mould for measuring temperature. A processor (6) forming part of a feedback tool (7) enables real time monitoring and control of the moulding process. Identifiable points on the temperature time moulding characteristic are employed to control the operation of the apparatus to optimise the properties of the mouldings obtained.

---

**Inventors:** Crawford; Robert J. (Billsborough, GB), Nugent; Paul J. (Belfast, GB)

**Assignee:** The Queen's University of Belfast (Belfast, GB)

**Appl. No.:** 07/847,105

**Filed:** June 4, 1992

**PCT Filed:** October 11, 1990

**PCT No.:** PCT/GB90/01569

**371 Date:** June 04, 1992

**102(e) Date:** June 04, 1992

**PCT Pub. No.:** WO91/05647

**PCT Pub. Date:** May 02, 1991

# We bought a RotoLog

In 1996 to improved our process  
and RotoLog helped us become  
world class



Winning the first  
ARMSA Rotation  
Moulding Award  
in 2000 & 2007

# We never looked back thanks to RotoLog

However we wanted full 24/7  
Production Process Control



# **RotoLog**

**was one of the biggest game changers  
in my Roto Moulding career**

**Helping us understand the process**

**but it was time to move forward**

**Roy granted us permission to**

**Develop an in house production Tool**



**This led to the birth of**

**TempLogger**

Temperature Monitoring and Control

**24/7 Process control system**

**TempLogger was built to**

**Control the machine's**

**heating, cooling**

**& demoulding cycle**

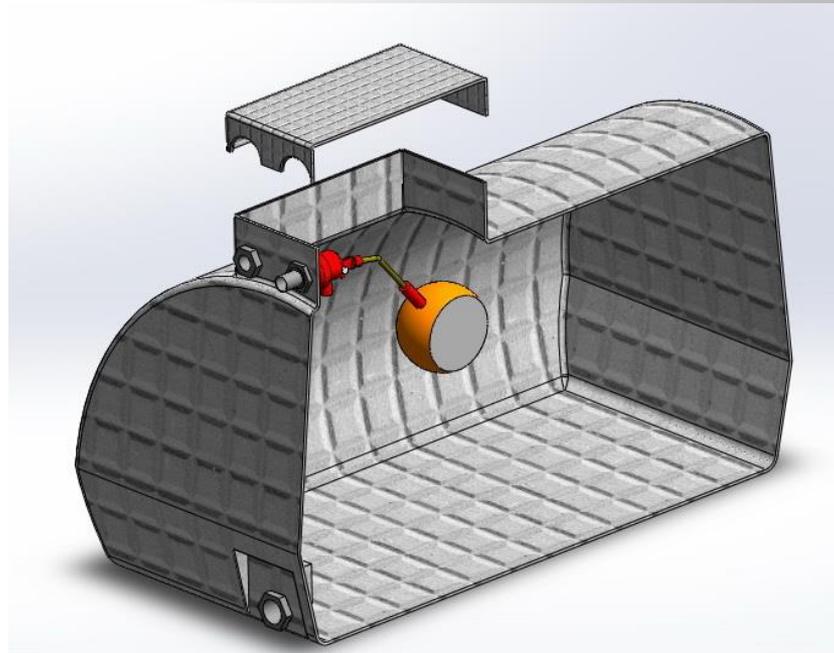
# Thanks to Process Control

We started producing Roto Moulded parts  
the world had never seen for some very  
special materials

At an “Advanced Roto Course” in the USA  
in 1994 our products were shown as  
“Amazing Products being produced  
somewhere in the world”

# Special Products

1999  
Sanitary  
ware  
Granite  
& Stone  
Finishes



1998  
Single  
Layer  
Closed  
Cell  
Foamed  
Tanks

1996 Multi  
Coloured  
Kayaks



# Thanks to Process Control

**We could control shrinkage  
Improve thin wall thickness for multi-layers**

**Learnt to understand the process  
An most importantly we were able to control  
every step of the moulding process**

**We called it “ PUSHING THE SLOPES”**

ARM 1

# 20001

Control panel section containing a red emergency stop button, a blue indicator light, a green indicator light, a black knob labeled 'SUBMERSE', and a black knob labeled 'OVER DOOR'.

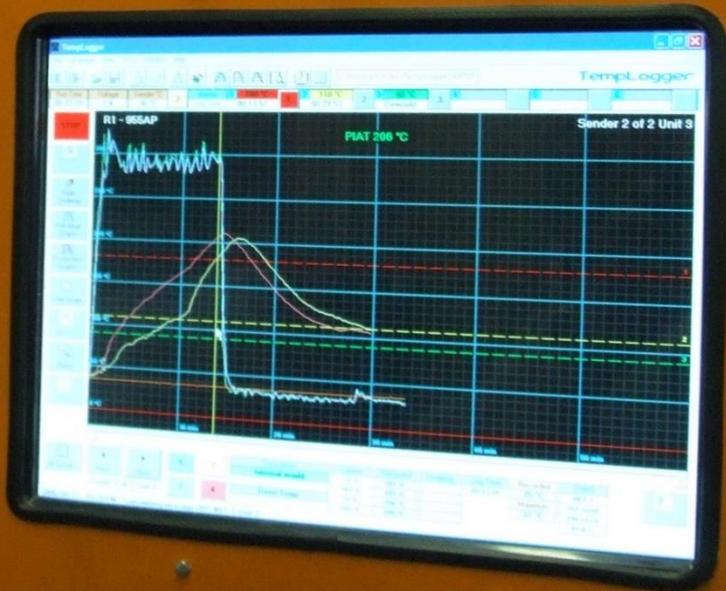
Control panel section containing a digital display showing '329' and '330', a circular analog gauge with '251' on its scale, and a control knob labeled 'CHILL TIME'.

Control panel section containing four indicator lights (yellow, yellow, yellow, black) and a black knob labeled 'CHARGE'.

Control panel section containing five black rotary switches labeled 'ARM 1' through 'ARM 5'.

Control panel section containing two black rotary switches.

Three indicator lights: a red one, a yellow one, and a green one.



In the years to follow many  
well know people in the  
industry visited our plant

2002



2003



# **Practical Aspects of Internal Air Temperature Measurement**

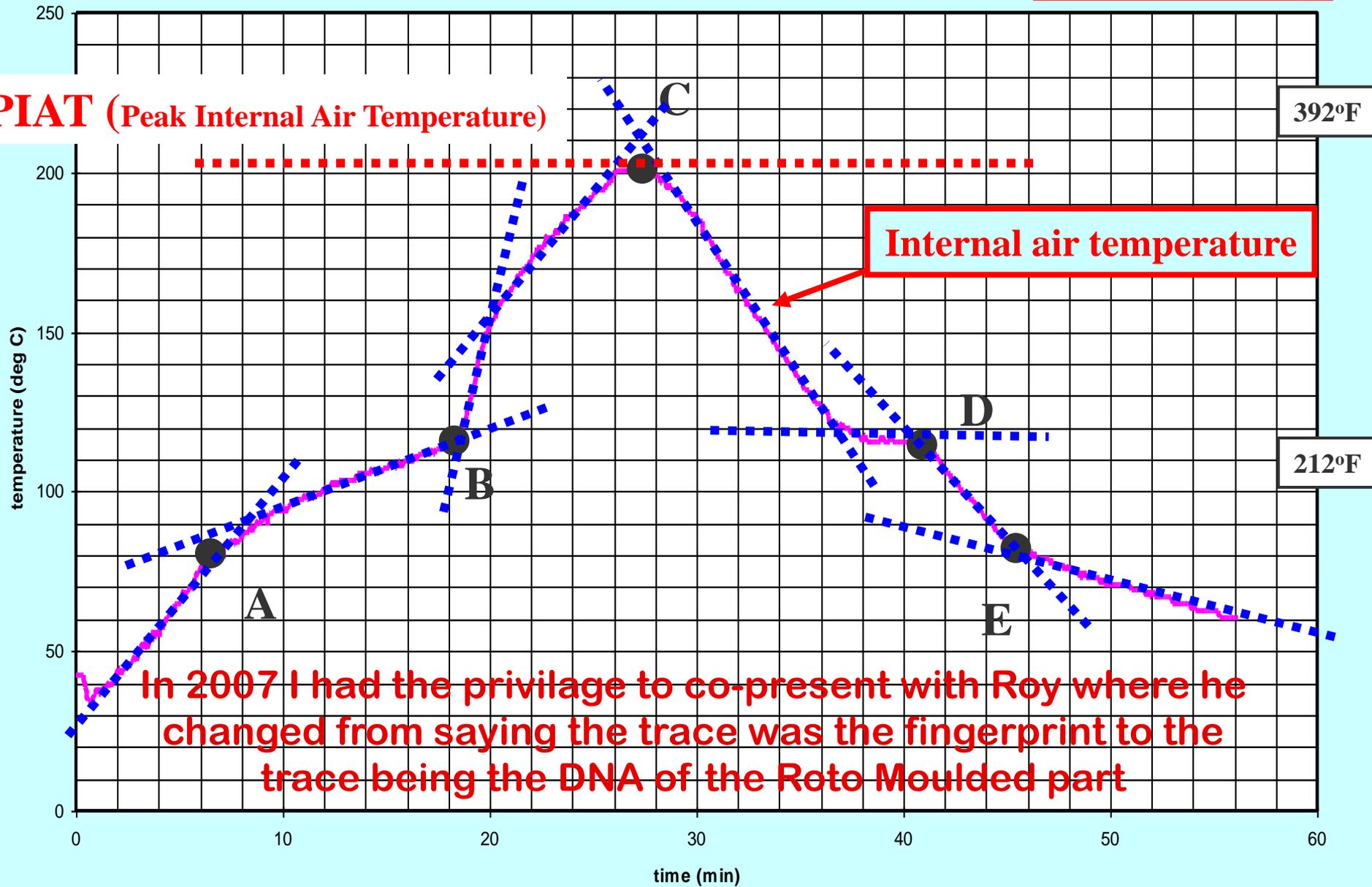
**Queenstown New Zealand 2007**

**Roy Crawford**  
University of Waikato

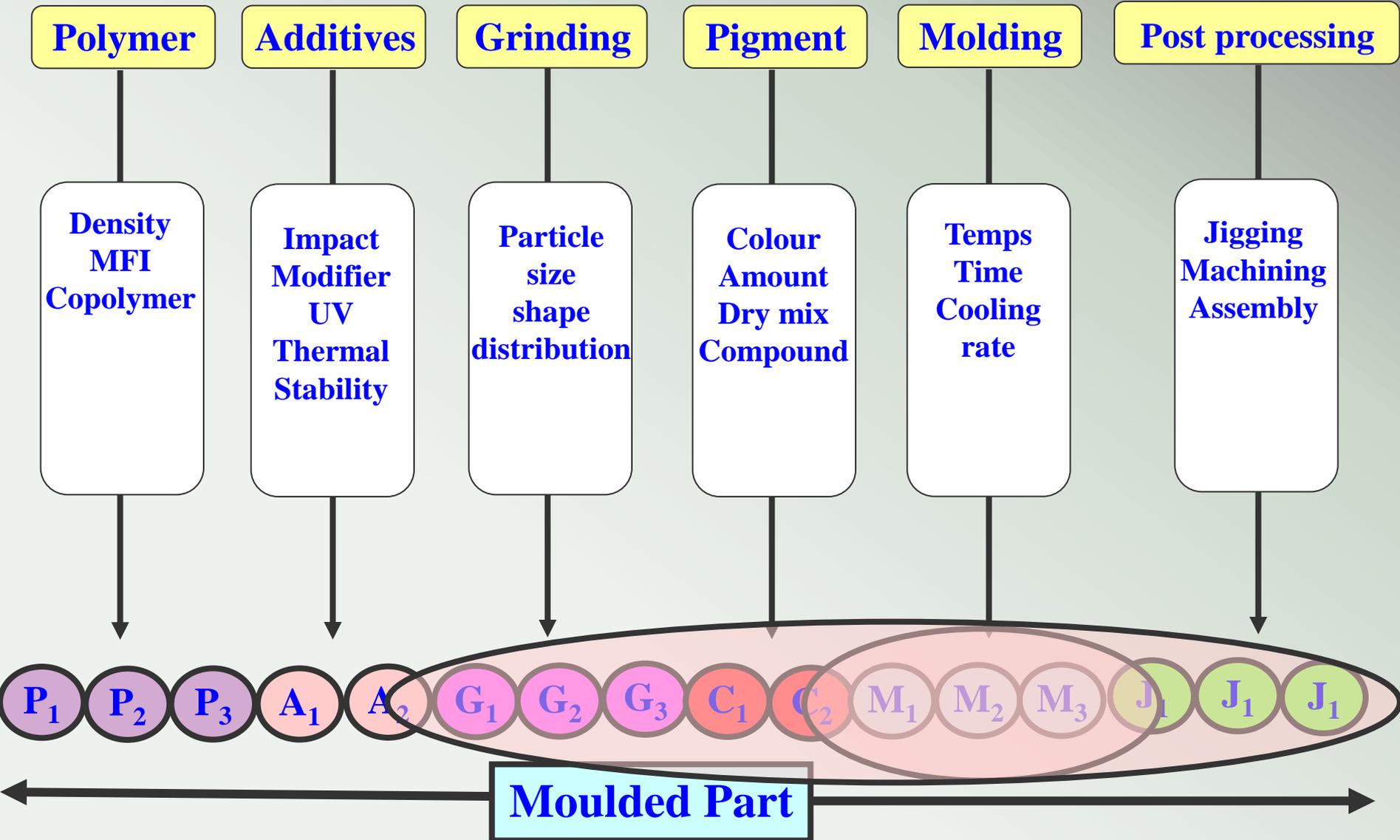
**Gary Lategan**  
Roto Solutions

# The DNA of Rotational Moulding

Roy Crawford  
University of Waikato



# The DNA of Rotomoulding



# Taking all these steps and adding them to TempLogger

Helped us understand many common  
Problems experience in moulding process

Helped us simplify and  
control every step and improve it

So basically all we did was

**Measure**

**Control**

**Improve**

Linking all to the  
internal air graph

Run Time	Voltage	Sender	1	Alarms	1	180 °C	1	2	110 °C	2	3	85 °C	3	4	5	6
0:44:20	8,50	41 °C		Log Time		0:14:40			0:30:50			0:38:30				



041111-10H20-P007

**Product Details**

Search:

**Description**

P001 - Guard hut with seat  
 P002 - Round toilet hut  
 P003 - 1000 litre water tank  
 P004 - 500 litre horizontal tank  
 P005 - Large dog kennel  
**P006 - 60 litre oval drum**  
 P007 - Rectangular bin  
 P008 - Hand basin  
 P009 - 2000 litre Digester  
 P010 - Test mould

Product Code	Description
P006	60 litre oval drum

Shot Weight	Wall Thickness	Material	MFI	Density	Colour	Mesh Size	Bulk Density	Dry Flow
1	30,00	5,00	Plastic LLDPE	0,2	0,000	Black	0,350	0,000
2								
3								
4								
5								

Recipe	Alarm Settings and Descriptions								
A	1	180 °C	1	2	110 °C	2	3	85 °C	3
B	Oven off		Cooling off		Demould				
C									
D	4		5		6				
T									

**Machine Details**

Available Machines	Compatible Machines
M1 M2	M3

1

Back    Next

Sender 1 of 1

1	2
3	4

Description	Current	Recorded	Underlay	Log Time	Recorded	COMS
Internal mould	43 °C					NET 1
Breather pipe middle	51 °C				Maximum	266 sent
Breather pipe begin	45 °C				43 °C	222 recd
Oven temperature	39 °C					83,5 %

Machine Details

Close

50 min

Exit

Run Time	Voltage	Sender	Alarms	1	2	3	4	5	6
0:44:20	8.50	41 °C	Log Time	180 °C 0:14:40	110 °C 0:30:50	85 °C 0:38:30			



**Product Details**

Search:

**Product Details**

Product Code	Description
P006	60 litre oval drum

**Description**

P001 - Guard hut with seat  
P002  
P003  
P004  
P005  
**P006**  
P007  
P008  
P009  
P010

**Recipe Alarms**

Recipe	Channel	1	2	3	4
B	Description	Internal mould	Internal mould	Internal mould	Oven temperature

**ALARMS**

Alarms	1	2	3	4	5	6
Temperature	180	110	85			
Description	Oven off	Cooling off	Demould			
Relay No	1	2	3			
Delay mm:ss	00:00	00:00	00:00			
Timer mm:ss	16:00	16:00	10:00			

**Alarm settings**

Alarms	1	2	3	4	5	6
Log Time	Oven off	Cooling off	Demould			

**Available Machines**

M1  
M2

**Compatible Machines**

M3

1

Back Next

Sender 1 of 1

	1	2	3	4	Description	Current	Recorded	Underlay	Log Time	Recorded	COMS
					Internal mould	43 °C				Maximum	266 sent
					Breather pipe middle	51 °C				43 °C	222 recd
					Breather pipe begin	45 °C					83,5 %
					Oven temperature	39 °C					



<b>Machine Details</b> Machine Name: <input type="text" value="M1"/> <span style="float: right;">+</span> Description: <input type="text" value="3 station carousel with gas oven"/> <span style="float: right;">Add</span> <span style="float: right;">X</span> <span style="float: right;">Delete</span>		<b>Mould details</b> Material - Mould: <input type="text" value="Aluminium Cast"/> <span style="float: right;">+</span> Weight - Mould (Kg): <input type="text"/> Thickness - Mould (mm): <input type="text"/> Thickness - Flange (mm): <input type="text"/> Material - Flanges: <input type="text" value="Mild steel"/> <span style="float: right;">Add</span> Weight - Frame (Kg): <input type="text"/> Mould Finish - Internal: <input type="text"/> Mould Finish - External: <input type="text"/> <span style="float: right;">X</span> <span style="float: right;">Delete</span>																																																	
<b>Products</b> <a href="#">Select a Product from the list to display the Recipe Details</a> P001 - Guard hut with seat P002 - Round toilet hut P003 - 1000 litre water tank P004 - 500 litre horizontal tank P005 - Large dog kennel <b>P006 - 60 litre oval drum</b> P007 - Rectangular bin P008 - Hand basin P009 - 2000 litre Digester P010 - Test mould		<b>Recipe Details</b> <b>Machine Arm Settings</b> <table border="1"> <thead> <tr> <th>STEP 1</th> <th>STEP 2</th> <th>STEP 3</th> <th>STEP 4</th> <th>STEP 5</th> <th>STEP 6</th> <th>STEP 7</th> <th>STEP 8</th> </tr> </thead> <tbody> <tr> <td colspan="8">Major Axis Speed (rpm)</td> </tr> <tr> <td colspan="8">Minor Axis Speed (rpm)</td> </tr> <tr> <td colspan="8">Ratio (Major : Minor)</td> </tr> <tr> <td colspan="8">Forward Rotation Time (mins)</td> </tr> <tr> <td colspan="8">Reverse Rotation Time (mins)</td> </tr> </tbody> </table> <b>Oven Cycle</b> Oven Temperature Setting °C: <input type="text"/> Oven Time (mins): <input type="text"/> <b>TempLogger System</b> Internal Air Temperature °C: <input type="text"/> <b>Cooling Cycle</b> Cooling Delay Time (mins): <input type="text"/> Cooling Fans Time (mins): <input type="text"/> Water Delay Time (mins): <input type="text"/> Water Time (mins): <input type="text"/> <b>Demoulding Cycle</b> Remove Inserts (mins): <input type="text"/> Demoulding Time (mins): <input type="text"/> <b>Total Cycle Time (mins)</b>		STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	Major Axis Speed (rpm)								Minor Axis Speed (rpm)								Ratio (Major : Minor)								Forward Rotation Time (mins)								Reverse Rotation Time (mins)							
STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8																																												
Major Axis Speed (rpm)																																																			
Minor Axis Speed (rpm)																																																			
Ratio (Major : Minor)																																																			
Forward Rotation Time (mins)																																																			
Reverse Rotation Time (mins)																																																			

+ Add  
X Delete  
 Products  
 Close

**Now we were able to**

**Monitor and Control**

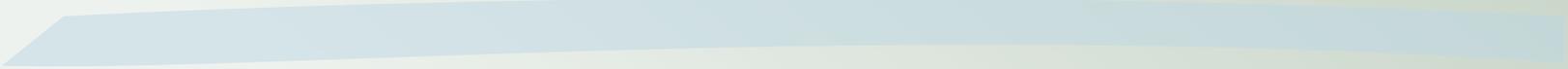
**what was happening**

**in the mould**

**PIAT is a must  
but we can control  
almost everything  
Like Density, Impact,  
Warpage and more...**

**Using Internal  
Temperature Control**

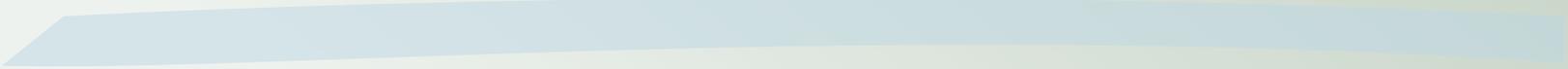
**Internal Temperature  
Control is like  
having eyes in the mould**



**Helps repeat the same  
quality every cycle**

# Temperature Measuring

Operators can see what is happening  
real time & can make adjustments  
preventing rejects



They learn to understand what is  
actually happening in the mould

Takes the guesswork out of moulding

# Understanding the heating curve and how to use it for



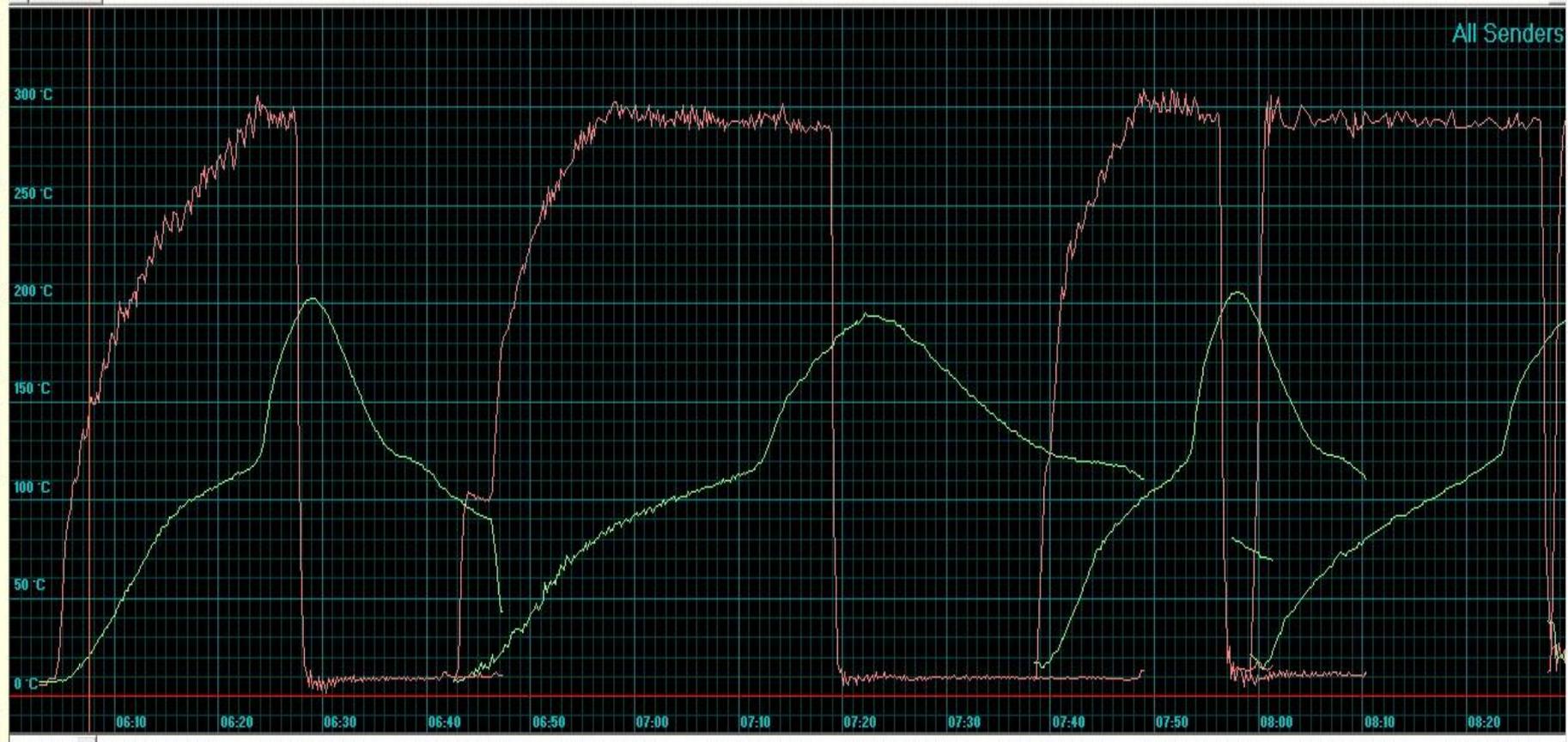
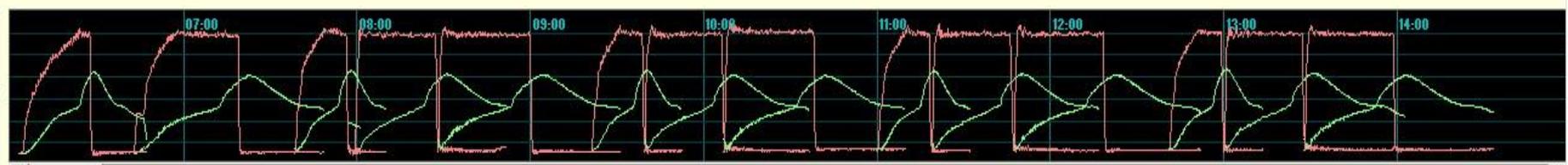
# Using Temperature Monitoring and Control

We could measure  
our gas consumption,  
products produced daily  
Materials converted

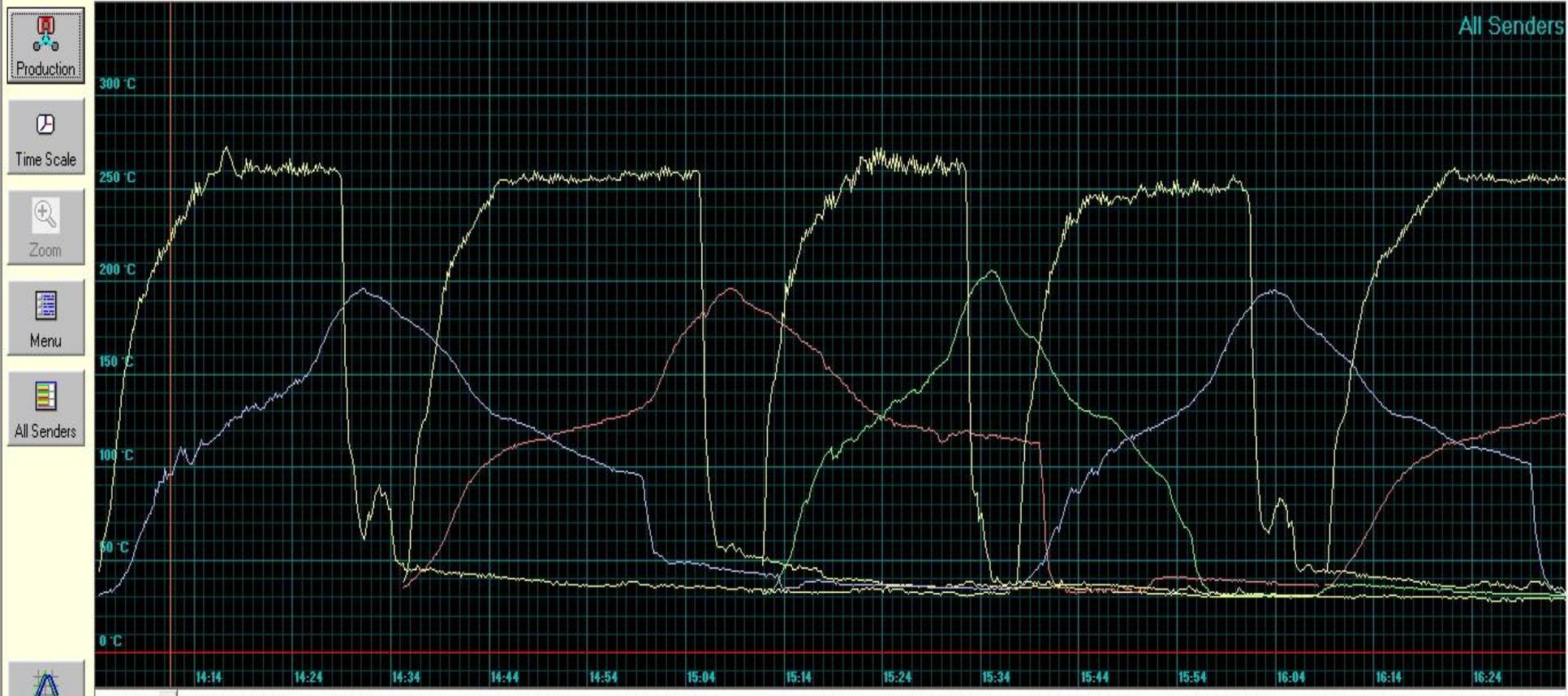
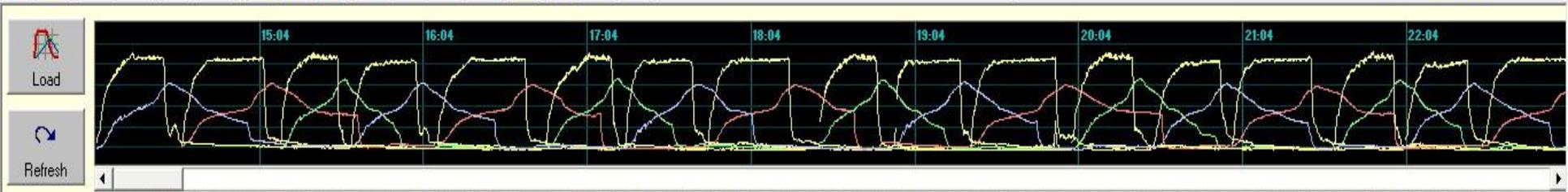
Record the entire production process

Maintain and monitor  
Burner Performance

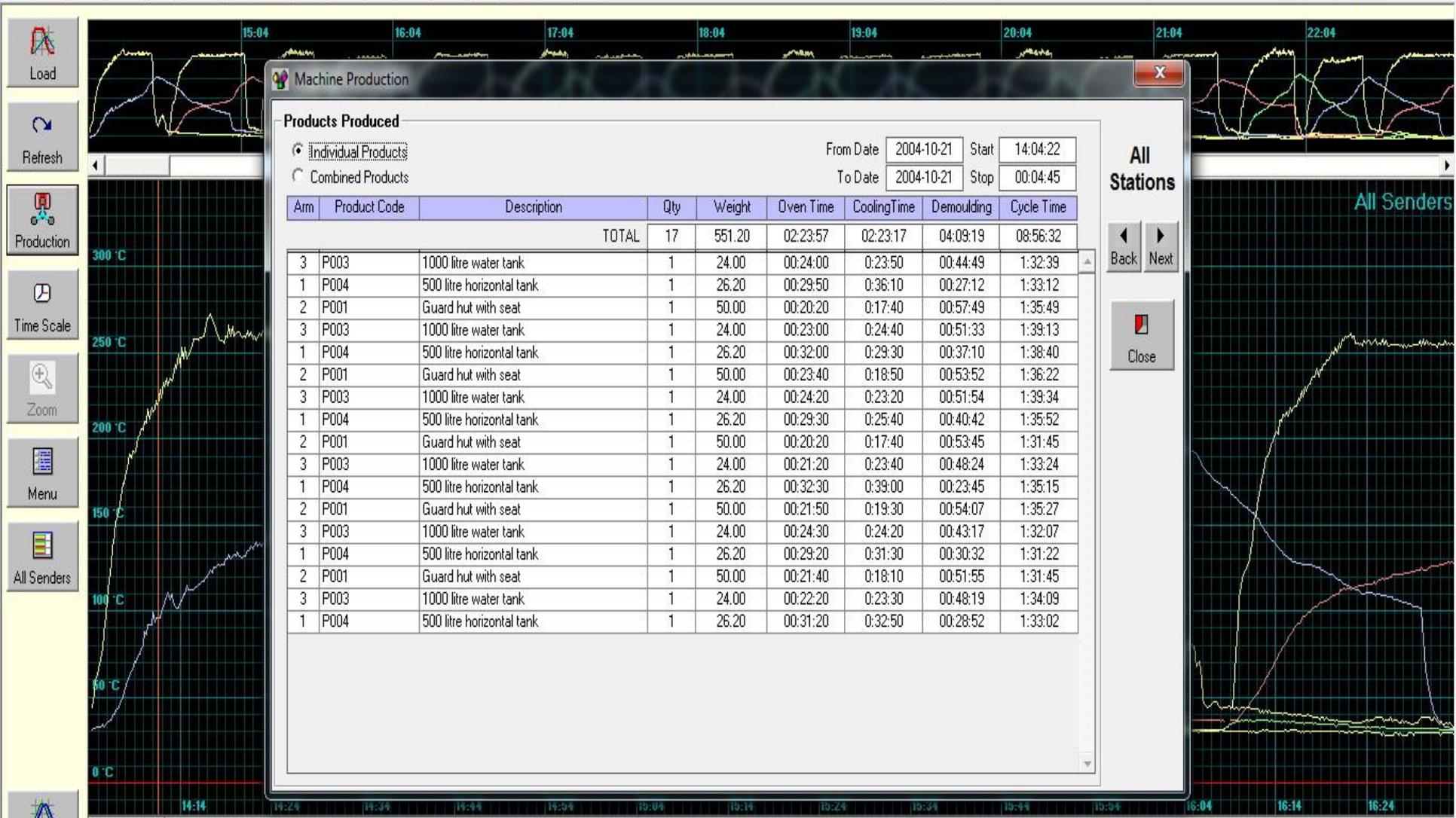
Load  
 Refresh  
 Production  
 Time Scale  
 Zoom  
 Menu  
 All Senders



	1	2	Description	Recorded	Log Time	Date	Sender
			VNUTORNA TEPLOTA			2013-03-19	
			STRED				
			DNO		Start time	Hours	
			PEC		06:00	9	



	1	2	Description	Recorded	Log Time	Date	Sender
			Internal mould			2004-10-21	
			Over temp				
			Internal mould		Start time	Hours	
			Internal mould		14:04	9	



Machine Production

Individual Products      From Date: 2004-10-21    Start: 14:04:22  
 Combined Products      To Date: 2004-10-21    Stop: 00:04:45

Arm	Product Code	Description	Qty	Weight	Oven Time	CoolingTime	Demoulding	Cycle Time
TOTAL			17	551.20	02:23:57	02:23:17	04:09:19	08:56:32
3	P003	1000 litre water tank	1	24.00	00:24:00	0:23:50	00:44:49	1:32:39
1	P004	500 litre horizontal tank	1	26.20	00:29:50	0:36:10	00:27:12	1:33:12
2	P001	Guard hut with seat	1	50.00	00:20:20	0:17:40	00:57:49	1:35:49
3	P003	1000 litre water tank	1	24.00	00:23:00	0:24:40	00:51:33	1:39:13
1	P004	500 litre horizontal tank	1	26.20	00:32:00	0:29:30	00:37:10	1:38:40
2	P001	Guard hut with seat	1	50.00	00:23:40	0:18:50	00:53:52	1:36:22
3	P003	1000 litre water tank	1	24.00	00:24:20	0:23:20	00:51:54	1:39:34
1	P004	500 litre horizontal tank	1	26.20	00:29:30	0:25:40	00:40:42	1:35:52
2	P001	Guard hut with seat	1	50.00	00:20:20	0:17:40	00:53:45	1:31:45
3	P003	1000 litre water tank	1	24.00	00:21:20	0:23:40	00:48:24	1:33:24
1	P004	500 litre horizontal tank	1	26.20	00:32:30	0:39:00	00:23:45	1:35:15
2	P001	Guard hut with seat	1	50.00	00:21:50	0:19:30	00:54:07	1:35:27
3	P003	1000 litre water tank	1	24.00	00:24:30	0:24:20	00:43:17	1:32:07
1	P004	500 litre horizontal tank	1	26.20	00:29:20	0:31:30	00:30:32	1:31:22
2	P001	Guard hut with seat	1	50.00	00:21:40	0:18:10	00:51:55	1:31:45
3	P003	1000 litre water tank	1	24.00	00:22:20	0:23:30	00:48:19	1:34:09
1	P004	500 litre horizontal tank	1	26.20	00:31:20	0:32:50	00:28:52	1:33:02

All Stations

Back Next

Close

1	2	Description	Recorded	Log Time	Date	Sender
		Internal mould			2004-10-21	
		Oven temp				
3	4	Description	Recorded	Log Time	Date	Sender
		Internal mould		14:04	9	

In Nordic-ARM we have  
3 moulders that have  
moved forward

Roto Moulding 24 / 7  
Process Control

Cipax - Motoral - Partnerplast





## Recommendation

We are thrilled with the reliability and performance of our **TempLogger's**

We use them 100% of the time, and cannot produce without **TempLogger** as it drives the cycle of the machines.

Kind regards

Garth Galloway CEO

Galloway International

So what are you waiting for  
become an Industry 4.0 leader  
in the Roto World with



# TempLogger

Temperature Monitoring and Control

24 / 7 Process Control



Want to know more about

**Roto Moulding 24 / 7**  
**Process Control**

Or our services please do not  
hesitate to contact me



# TempLogger

Temperature Monitoring and Control

Thanks for your attention!



# TempLogger

Temperature Monitoring and Control



**Gary Lategan**

**+27 82 8883180**

**[gary@rotosolutions.co.za](mailto:gary@rotosolutions.co.za)**

or visit our website



**[www.rotosolutions.co.za](http://www.rotosolutions.co.za)**

