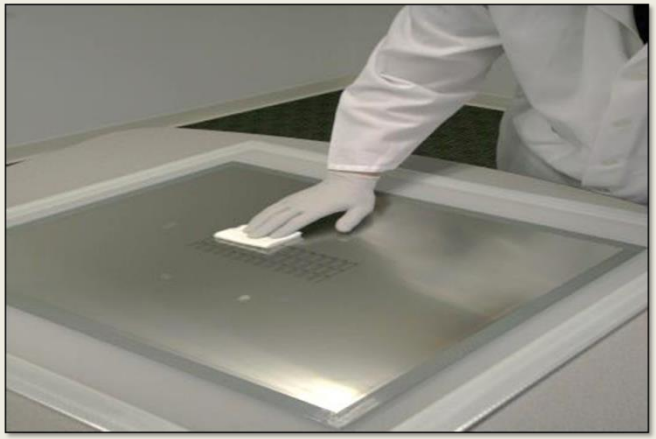
Case Study on NanoClear Implementation

”How nanocoating helped reduce SMT related defects by over 50% and increase throughput by over 20%.”



Presenters

Edward Hughes

- CEO of Aculon, producers of NanoClear® stencil nanocoating

Chrys Shea

- President of Shea Engineering Services, an independent consulting firm

Jimmy Crow

- Senior Project Engineer, Rauland (Division of AMETEK)

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Agenda

Today's Presentation

- Overview of NanoClear stencil nanocoating
- History and current users
- Case Study – SMT Improvement at Rauland
  Chrys Shea & Jimmy Crow
  - 3 key upgrades
  - Initial business case assumptions
  - Actual improvements – throughput & quality
  - Cost savings calculations
- Questions & Answers

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What are Stencil Nanocoatings?

Extremely thin flux-repellent films that are applied to the bottom side and aperture walls of stencils to:

- **Improve Quality**
  - Higher yields
  - Better transfer effectiveness
- **Boost Productivity**
  - Less underwiping
  - Less downtime for paper changes
- **Reduce Costs**
  - Less rework
  - Lower paper and solvent consumption

Nanoclear is a SAMP Coating
(Self-Assembling Monolayer Phosphonate)

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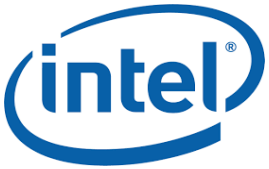
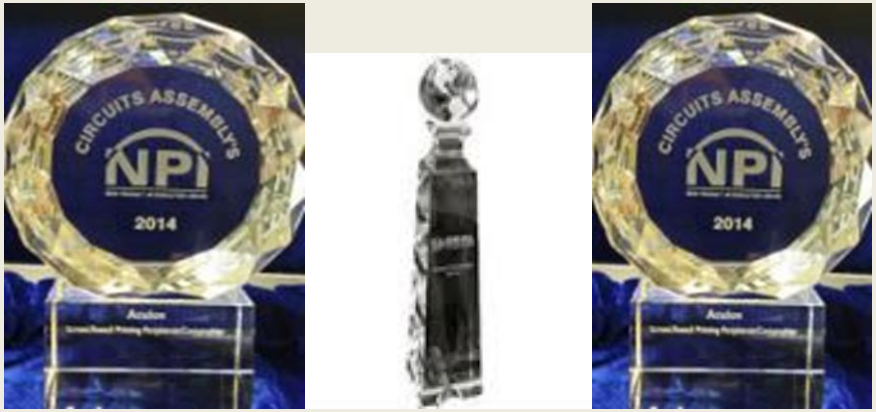
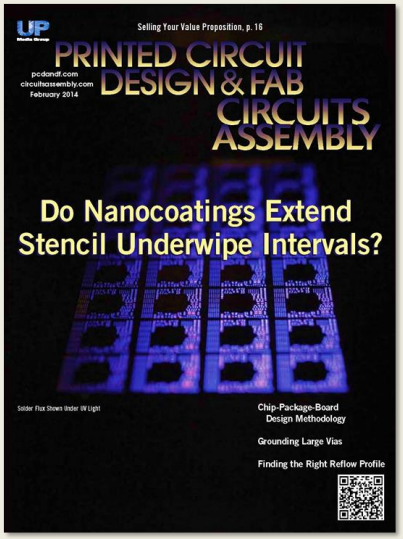
Users Include



Well Respected





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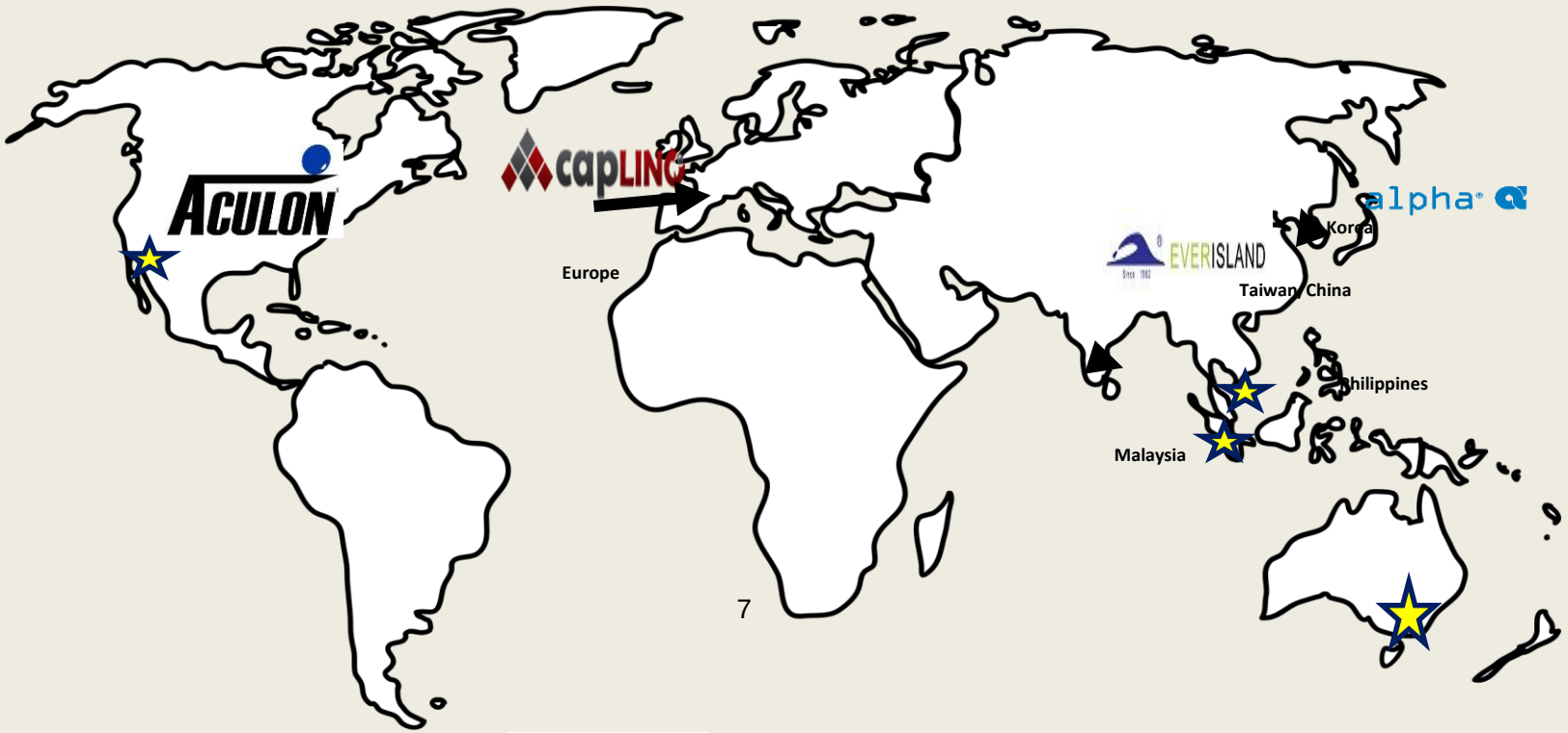
Distribution Partners



ASM Assembly Systems

Globally

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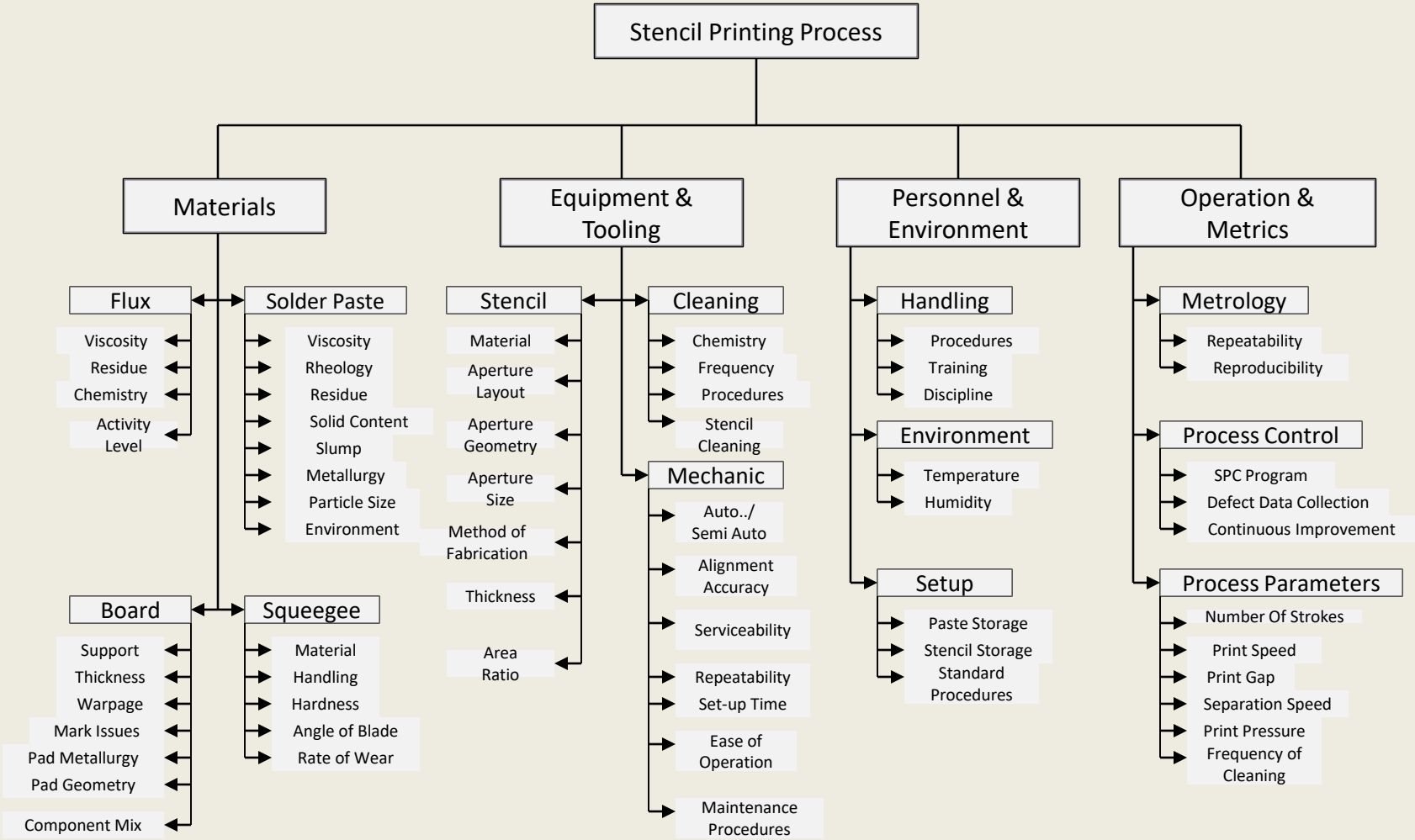
Rauland-AMETEK Case Study

Case Study : “How nanocoating helped reduce SMT related defects by over 50% and increase throughput by over 20%”

Featuring: Chrys Shea and Jimmy Crow

Identifying Best Practices



Stencil Printing Improvement Program

Multi-Disciplinary Approach:

1. Changed to use MicroCare Stencil Wipe
2. Changed Solvent Cleaner from IPA to Zestron Vigon UC160
   - Improved under side cleaning
3. Applied NanoClear to existing stencils
   - No need for new stencils
   - Reduced need cleaning (magic bullet for defect reduction and throughput improvements)

Part of overall screen printing process improvement project

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Stencil Wiping Improvement - Solvent Change: IPA to Zestron Vigon

Purpose:

- Vigon water-based cleaning agent is designed to remove solder paste residue from fine pitch stencil apertures in the SMT printer
- Water-based evaporates less slowly than IPA
- No flash point and evaporates residue
- Water-based, surfactant-free cleaner with excellent material compatibility on all wetted parts (stencils & printers
- No scaling or residue build up

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Stencil Wiping Improvement - Solvent Change: IPA to Zestron Vigon

Why is IPA problematic?

- The Alcohol can change the viscosity of the solder paste
- It also “De-Primes” the aperture (dries the wall)
  - Leading to insufficients and misprints on first print
- It also wastes paper on the roll because it is inefficient
- More line downtime for roll changeovers

Get Rid of the Alcohol and Printing Quality Improves While Costs Decline

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Stencil Wiping Improvement - SmartRoll to MicroWipe

- It's cloth, not paper
- 100% *synthetic* fiber has a bulkier, open structure
  - Extremely absorbent, can carry more solder paste, solvent
- The long, hard fibers are extremely strong
  - Better wiping, with no binders or glues to dissolve

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Stencil Wiping Improvement – MicroWipe

Purpose:

- Quality - Increased yield by better printing
- Increased throughput
  - ➢ More Boards Per Hour = More Revenue $$$
- Direct cost reduction (scrap, time, solder paste)
- Reduced roll usage and downtime for changeovers

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Stencil Wiping Improvement – MicroWipe

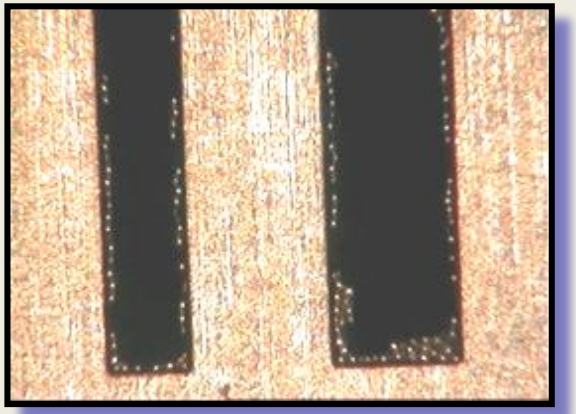
MicroWipe

DRY

20 prints before wipe

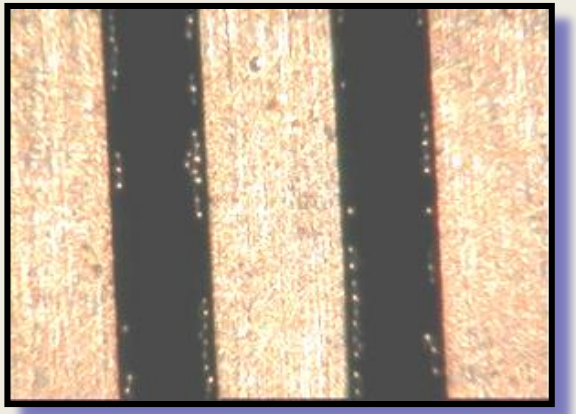
Sontara

IPA



Left: Wiped with MicroWipe Paper, dry

EXCELLENT results. No fibers, no excess solder paste, no bridging



Right: wiped with IPA and Sontara

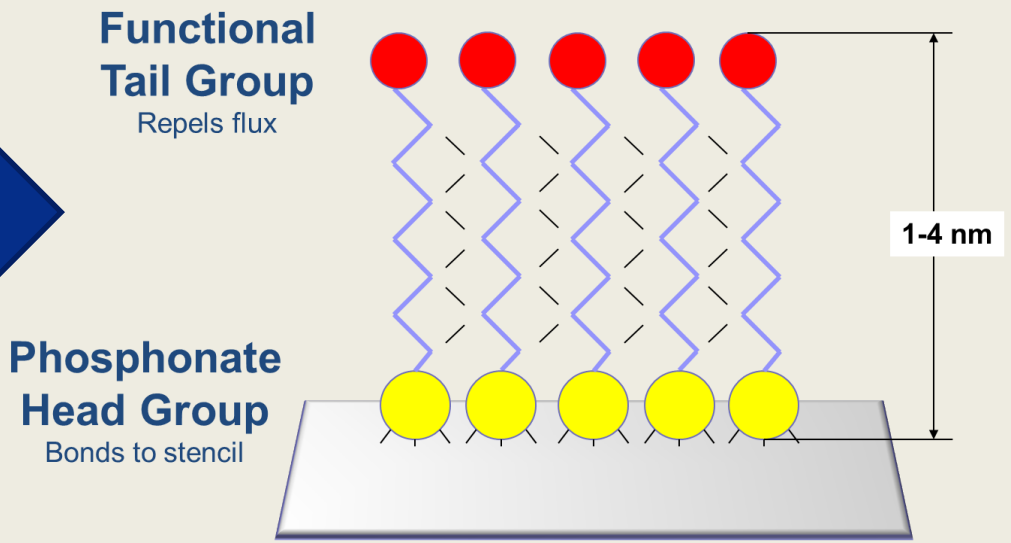
Problems: Excess solder paste, residual fibers, solder paste on bottom of stencil. Overall, unsatisfactory results.

Stencil Printing and Cleaning Improvement - NanoClear

Purpose:

- Increase yields and output on SMT assembly lines
- Improve print quality and reduce variation
- Decrease under stencil wipe frequency

NanoClear's SAMP Molecule
(Self-Assembling Monolayer Phosphonate)



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Implementing NanoClear, MicroWipe & Zestron Solvent

Assumptions:

Wipe every 5 cycles	to	Wipe every 25 cycles
Average Paste Application		27 Seconds
Average Under-wipe and Cleaning		54 Seconds
Bottle Neck Rate on Line 3		18 Seconds
Bottle Neck Rate on Line 4		22 Seconds
Bottle Neck Rate On Lines 1		40 Seconds
Bottle Neck Rate On Lines 2		40 Seconds

Began implementing this in April 2016 and had it complete by the end of July 2016 on All 4 Lines

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Projected Throughput Improvement

Effective Cycle Time (current)

- (5 * 27 second) + 54 seconds = 189 Seconds/ 5 Boards

OR

37 seconds/board

Effective Cycle Time (future, with fewer wipes)

(25 * 27 seconds) + 54 seconds = 729 seconds/25 Boards

OR

29 seconds/board

*Expect to see **22 Percent** Improvement In Throughput*

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Business Case –
Actual Throughput Improvement

From SMT OEE Calculator						
	May-16			Aug-16		
	Boards	Minutes	Bds/Min	Boards	Minutes	Bds/Min
Day 1	2462	1780	1.38	8182	1740	4.70
Day 2	3092	2260	1.37	5766	1748	3.30
Day 3	4979	1916	2.60	11822	2225	5.31
Day 4	7845	1793	4.38	6538	1833	3.57
Day 5	3317	1838	1.80	9148	2314	3.95
Day 6	3422	1799	1.90	4910	1986	2.47
Day 7	4715	1681	2.80	7466	1920	3.89
Day 8	2625	1896	1.38	7195	2122	3.39
Day 9	3159	800	3.95	6823	2077	3.29
Day 10	6333	2052	3.09	6068	2951	2.06
Day 11	5407	2284	2.37	8412	2499	3.37
Day 12	2723	1471	1.85	6934	1863	3.72
Day 13	4996	1691	2.95	10146	1716	5.91
Day 14	6027	1617	3.73	11295	1506	7.50
Day 15	6161	2218	2.78	6435	1596	4.03
Day 16	5279	1750	3.02	6124	2185	2.80
Day 17	3913	2513	1.56	5695	2425	2.35
Day 18	6819	1748	3.90	4430	2357	1.88
Day 19	5291	1525	3.47	6046	1624	3.72
Day 20	2373	1825	1.30	5016	2614	1.92
Day 21	6782	1823	3.72	6202	2230	2.78
Day 22	6741	1998	3.37	6585	2234	2.95
Day 23	5102	1738	2.94	9580	2107	4.55
Day 24	3753	1682	2.23	5987	1642	3.65
Day 25	3981	1609	2.47	4838	2223	2.18

Average Boards per Minute May 2016	2.7	3.6
Percent Increase In Board Production Rate		35%

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Throughput is Up!

What about Quality?

It is really possible to make it faster, cheaper AND better?

Let's see…

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Business Case –
Actual Quality Improvement

Between May 2016 and August 2016:

SMT defects **down 52%**

- *Per Koh Young Zenith AOI*

ATE defects **down 42%**

- *Expensive to repair and retest*

	Defects in SMT (OQR Report)					Defects in ATE (OQR Report)				
	Defects	# Bds	Defects/Bd*			Defects	# Bds	Defects/Bd*		
May	804	90000	0.89%			1503	49842	3.0%		
Aug	763	179772	0.42%			1753	100866	1.7%		

Reduction In Defects SMT	**52.49%**	**Reduction In Defects ATE**	**42.4%**

* Note that these are defects per assy, not dpmo

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Cost and Savings Payback Calculator

- Simple
- Customizable, no locked cells
- Works with any currency
- All calculations transparent
- Returns payback in # of prints PLUS extra uptime per year
- Available at www.aculon.com or www.sheaengineering.com

Business Case –
Operating Cost Savings Estimated

Cost of Simple Rework	
Time required, min`	4
Labor rate, per hour	23
Benefit rate, %	25
Overhead Rate, %	25
Cost of Simple Rework	$ 2.30

Cost of Wiper Paper	
Cost per roll	20
Length of roll, m	10
Advance per wiper pass, mm	5
# of wiper passes in cycle	3
Cost of Paper per Wipe Cycle	$ 0.03

Cost of Complex Rework	
Time required, min`	60
Labor rate, per hour	23
Benefit rate, %	25
Overhead Rate, %	25
Cost of Complex Rework	$ 34.50

Cost of Wiper Solvent	
Cost of solvent container	30
Capacity of solvent container, liter	4
Volume of solvent used on each wipe, ml	2
# of solvent passes in wipe cycle	1
Cost of Solvent per Wipe Cycle	$ 0.02

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Business Case –
Operating Cost Savings Estimated

Quality	
Current First Pass Yield, %	80
Projected First Pass Yield, %	99
% Improvement	19%
% of defects requiring simple rework	90
% of defects requiring complex rework	10

Savings in Yield Improvement, per print $ 1.05

Productivity	
Current Wipe Frequency	5
Projected Wipe Frequency	24
% Reduction	79%

Savings in under wipe consumables, per print $ 0.007

Cost Reduction	
Cost of simple rework	$ 2.30
Cost of complex rework	$ 34.50
Cost of wiper paper, per wipe cycle	$ 0.03
Cost of solvent, per wipe cycle	$ 0.02

Modify cost information on the "Cost Calculator" tab

Payback Period	
Savings per print	$ 1.06
Cost of Nanoclear	$ 25.00
Cost of Application	$ 20.00
Payback - # of Prints	43

Annual Savings per SMT Line	
# of prints per hour	90
# of production hours per week	80
# of paper roll changes per week	12
Time to change wiper roll, minutes	5
Annual Cost Reduction	$ 395,338

>>> PLUS <<<

Additional Prodution Uptime, hours per year	52
Additional PCBs assembled per year	4680

Note: Annual cost reduction based on 4 lines and all stencils coated with NanoClear at a total investment of under $5000.

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For Best Results with NanoClear

- Clean debris from stencil apertures (even brand new stencils have debris)
- Use softer wipes, such as MicroCare MicroWipe, DEK EcoRoll or HyperClean
- Incorporate an appropriate under wiper solder paste solvent; not IPA
- Wipe less frequently
- Do not soak stencils in cleaner overnight
- Periodically check stencil with dyne pen to confirm activity

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Summary

NanoClear® The #1 NanoCoating Globally

- Not just for fine pitch stencils
- Easy to calculate benefits:
  - Improved Quality
  - Boost productivity
  - Reduced Costs
- Coats the aperture walls
- Techniques to enhance durability – Soft wipes & clean better!
- Continue to innovate to meet customer demand
- Available locally on a global basis

NanoClear enables a higher quality, more cost-effective stencil print process

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For More Information

Presentation

- Will be emailed to all attendees

Videos

- Introduction & Instruction Videos

For NanoClear free samples

- Contact Mario Gattuso **gattuso@aculon.com**

To download Cost Calculator Workbook

- NanoClear Cost of Ownership Calculator

To order NanoClear

- Shopping Cart

For questions and volume quotes for NanoClear

- Contact Mario Gattuso **gattuso@aculon.com**

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Questions?

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