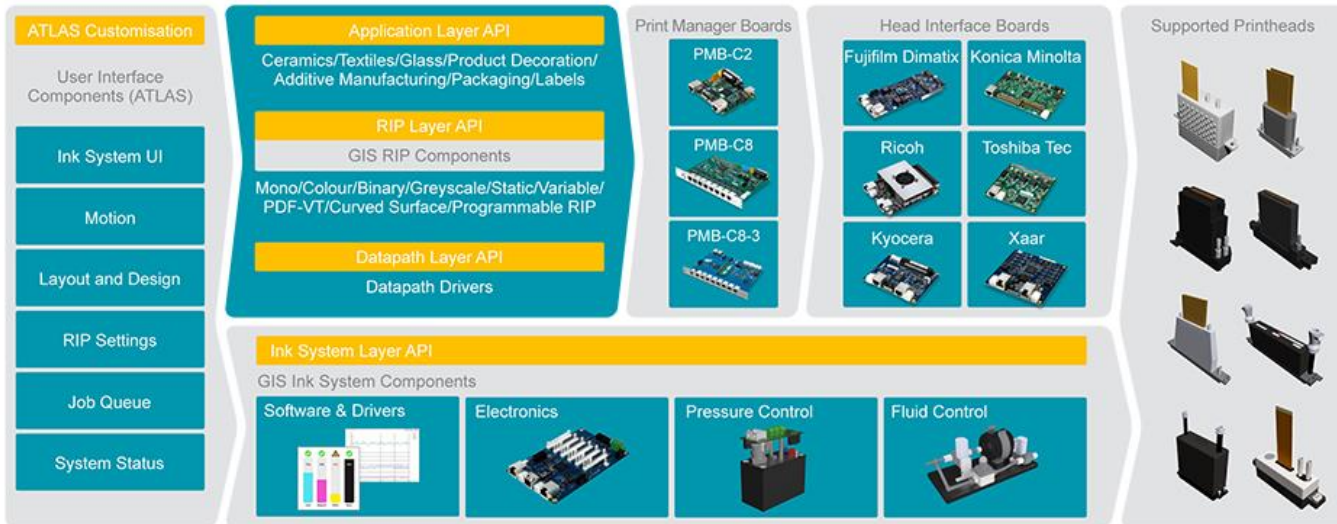# Inkjet Technology & Decorative Surfaces

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Global Inkjet Systems Ltd

TCM Decorative Surfaces Conference

December 2016

DECORATIVE
SURFACES **2016**
CONFERENCE

NORTH
TCM Phoenix, Arizona, U. S. A.
AMERICA **DECEMBER 5-7**

GLOBAL INKJET SYSTEMS
CONTROL | PERFORMANCE | INNOVATION

GIS – What We Do

- GIS products enable system builders to reduce development time and get products to market faster
- We provide powerful, flexible & adaptable integration tools to suit your system and application needs

Agenda

- **Printheads, inks & software enable applications**
  - Overview of latest industrial inkjet printheads
  - Trends in drop size, resolution & speed
  - Software innovations
- **Inkjet adoption in decorative surface applications**
  - Just a few system examples
    - Tile
    - Textile
    - Flooring
    - Laminate
    - Wallpaper/Wallcoverings

Manufacturer	Model	Type	Native Resolution (dpi)	Drop size
Epson PrecisionCore	TFP	25.4 mm piezo	720	1.5-32.5 pl
	MicroTFP	33.8 mm piezo	600	1.5-32.5 pl
Fujifilm	StarFire Series	64.96 mm piezo	400	12/30/65 pl
	Samba G3L	43 mm scalable piezo	1200	2 pl
HP	TU	108 mm thermal	1200	Not known
	HDNA		2400	Not known
Kodak	Stream	108 mm continuous	600	2.5 pl & 9 pl
	Ultrastream		600 x 1800	3.75 pl
Konica Minolta	KM1800i	75.5 mm piezo	600	3.5 pl
	ME130H	21.65 mm piezo	1200	3 pL
Kyocera	KJ4A-RH	108 mm piezo	600	3 pl
	KJ4B-YH	108 mm piezo	600	5 pl
	KJ4B-Z	112 mm piezo	1200	2 pl
Memjet	Pagewide	221 mm piezo	1600	1 pl
Panasonic	UH-HA800	56.3 mm piezo	360	3-30 pl
Ricoh	MH5440	54.1 mm piezo	600	7-35 pl
	MH5220	54.1 mm piezo	600	2.5 pl
Seiko SII	Printek 508	72 mm piezo	360	12 pl
	RC1536	108 mm piezo	360	13-100 pl
Toshiba Tec	CF1ou	53.7 mm piezo	300	6-42 pl
	CF3	53.7 mm piezo	600	(3.5 pl)?
Xaar	1003	70.5 mm piezo	360	6-42 pl
	5601 3p0	115 mm piezo	1200	3 pl

Table: NOT exhaustive – but representative summary

- **Printhead trends**
  - Smaller drops
  - Higher firing frequencies
  - Higher nozzle density
  - Wider heads
  - Scalable heads
  - Ink recirculation
  - MEMs manufacturing developments
    - Higher quality output
    - Higher speed output
    - High data rates to manage
    - Drop management strategies
      - Small drops/high speed
      - Printhead linearization
      - Nozzle out compensation
    - Registration/ substrate handling

TFP = Thin Film Piezo
HDNA = High Definition Nozzle Architecture
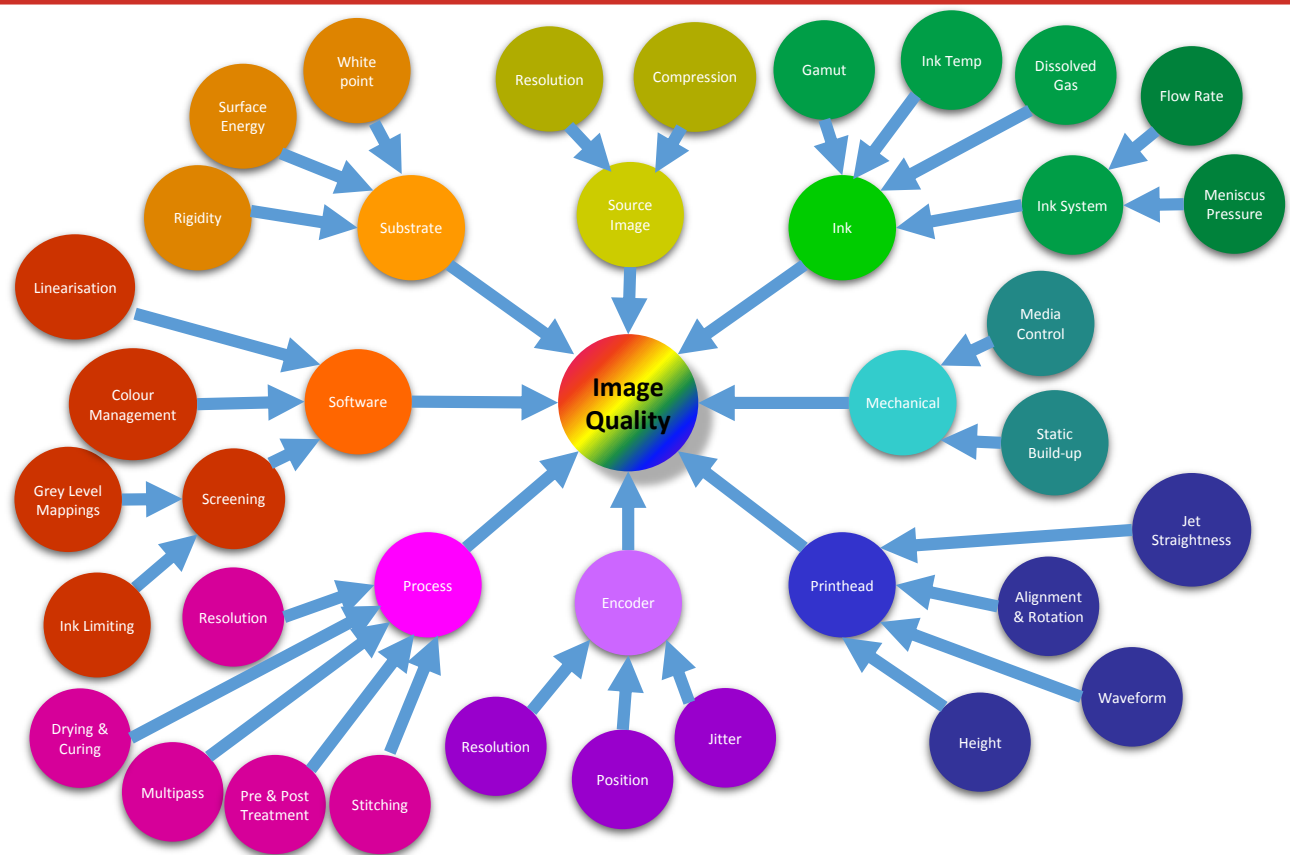Table: Courtesy of Sean Smyth (with additions from GIS)

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Piezo Printhead Developments

Some high resolution/small drop printhead examples

	Kyocera KJ4A-RH	Kyocera KJ4B-YH	Ricoh MH5220	Konica KM1800i	Kyocera KJ4B-Z	Fujifilm Samba G3	Xaar 5601 3p0
Nozzles	2656	2656	1280	1776	5120	2048	5601
Width (mm)	108	108	54	75	112	43	115
Resolution dpi	600	600	600	600 (1200 module)	1200	1200	1200
Grey levels (non zero)	3	3	4	7	3	3	7
Drop size pl	6	6	2.5	3.5	<2	2.4	3

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Many Challenges.......and Solutions

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Nozzle Out Compensation

- **Nozzle sizes are getting smaller**
 - More easily blocked
- **Large print bar arrays**
  - Many more nozzles
  - Higher probability of issues
- **Strategy 1 : Double Up - Redundancy**
  - Add second row of printheads per colour so when one nozzle fails another can be used
    - Expensive
- **Strategy 2 : Hide the problem**
  - Identify where a nozzle is faulty and spread the jetting responsibility to neighbouring nozzles and/or colours
    - Nozzle check pattern before print job
    - Inline with vision system
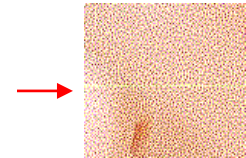
4 Level CMYK Magenta nozzle out on line 511
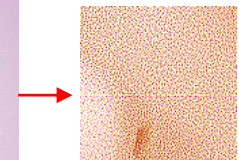
Single Channel Corrected

Nozzle Out Compensation

- **Many different strategies to share data between nozzles**
  - Image processing technology
    - Error diffusion screening & contone/grey level data modification
      - GIS believes most effective in contone data
    - Hide error in same colour plane to neighbouring nozzles
    - Hide error in other inks - in multi-ink backgrounds
      - If Cyan nozzle fails - could add a little black to hide white space
- **Works best in mid and light mid tones**
- **Helps disguise or make the missing nozzle less visible – less white space**
- **Clusters of nozzles much more difficult to hide than individual or isolated nozzles**
- **Substrate plays a part**
  - Technology works best where there is some dot gain
- **Numerous patents exist**

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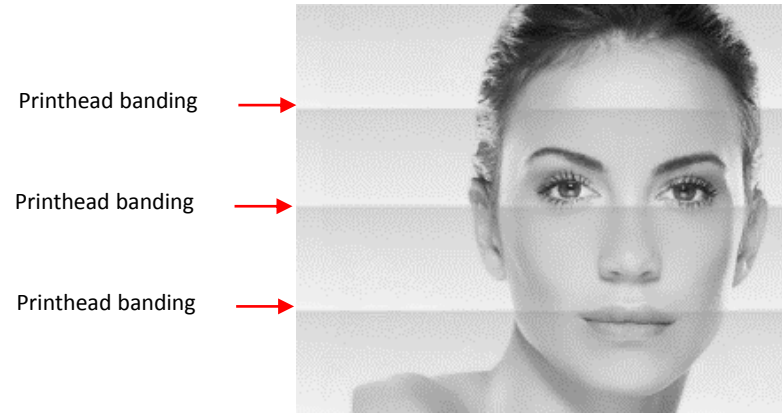CONTROL | PERFORMANCE | INNOVATION

Printhead Linearization

- **Small amount of non-linearity in their drop volume across the length of head creates challenges**
  - Stitching printheads without visible joins
  - Printing large areas of solids/flat colours
- **Causes of drop volume inconsistency**
  - Printhead manufacturing issue
    - Ejection of drops may not be constant along the piezo
  - Ink system
    - Temperature variation can affect ink viscosity and therefore drop volume
  - Piezo activity
    - Heavy use of some sections of printhead can result in areas of warming and changes in volume
  - Electronics
    - Damaged or degraded electronics may affect drop volume
  - Printhead position
    - System architecture may require heads to be angled creating slight pressure gradient which may affect drop volume

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Printhead Linearization

Printhead banding

Printhead banding

Printhead banding

Linearized printhead

- **Possible solutions:-**
  - Electrical per nozzle trimming
  - ASIC trimming
  - Bank trimming
  - Screened (error diffusion) data modification
  - Contone data modification

Inkjet Presses Today

- 4,000 – 20,000 nozzles
- Narrow width
- 300 - 600dpi native
- 10 – 100m pixels/sec

- 100,000 nozzles
- Medium width
- Up to 600dpi native
- 100m – 1bn pixels/sec

- >500,000 nozzles
- Wide width >1.5m
- 1200dpi native
- ~18 bn pixels/sec

System Size, Resolution , Data Rate and Productivity (Uptime)

Ceramic Tiles

Glaze x 2   Decoration & Effects x 6   Glaze x 2

System Ceramics – Diversa

Launched Tecnargilla 2014

Fujifilm StarFire & Polaris heads

Up to 70m/min
Up to 16 heads per bar
Potentially 100's heads per system
 - Glazes
- Decoration
- Gloss effects
- Matt effects
- Metallic effects

4 SMALTI 360dpi   16 COLORI 200dpi   8 COLORI 400dpi   4 SMALTI 360dpi   2 POLVERI + 2 SMALTI 360dpi

Textiles

SPG Prints – Pike

Launched ITMA 2015

Fujifilm Samba G3L printheads

1200dpi x 1200dpi
1.85m wide
Up to 40m/min
6-9 print stations
43 printheads per bar
2-10pl drop size

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Barberan (E)

- **Design & manufacture high precision machines for doors, boards, furniture, flooring, profiles, drawer sides, marble, stone, glass etc.**
- **Jetmaster 840 - 105 – 1260**
  - 210mm to 1890mm
  - CMYK + LC + LM or O + V
  - KM printheads
  - UV inks

from roll to roll

for PVC panels

up to 630 mm

panels up to 1890 mm

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Cefla Finishing (I)

- **Acquired >60% Jet-Set(I)**
  - Pixart Plot
  - Pixart Single Pass
    - Xaar 1003
    - UV inks

Hymmen (D)

- **Technology for large volume production of board materials – surface finishing of board (MDF etc.) or roll materials**
- **Digital printing lines since 2008 – series of Jupiter (JPT) systems**

- **JPT W 1400 for laminate**
  - 25-50m/min
  - 2.17mm wide
  - CMYK
  - UV LED inks
  - Xaar 1003 printheads
  - 45gsm paper for dry pressing process

- **JPT WS 230/550 for edge banding**
  - 10-50m/min
  - Up to 540mm wide
  - CMYK (Light colours possible)
  - UV LED inks
  - Xaar 1003 printheads
  - ABS, PVC or PP

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Wemhöner Surface Technologies (D)

- Produces machines and systems for upgrading of wood based panels
  - Product range includes digital and direct printing systems, lacquering lines, lightweight panel systems, throughfeed press lines, special plants and special press lines

- **MasterDigital - part of MasterLine range**
  - Surface finishing of MDF, particle board or other flat materials
  - Décor paper
  - Multipass XY roll to roll/flatbed
  - 600dpi
  - 24 heads per system typically
  - Up to 6 colours – CMYK ++
    - Have own special red for furniture
  - Up to 790m2/hr

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KBA & Interprint (D)

- **KBA RotaJet168**
 - Printing décor paper
  - Up to 150m/min
  - 1.68m wide
  - 600dpi
  - CMYK
  - Water based inks
  - Processes 2.2 terabyte/sec

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Palis & Schattdecor (D)

- **Schattdecor has had inkjet strategy since 2009**
- **Collaboration 2013 between Schattdecor, Padaluma (Palis Digital) & Rotodecor**
  - Joint development of Palis 2250 for décor paper printing
    - 2250mm width
    - 75-150m/min
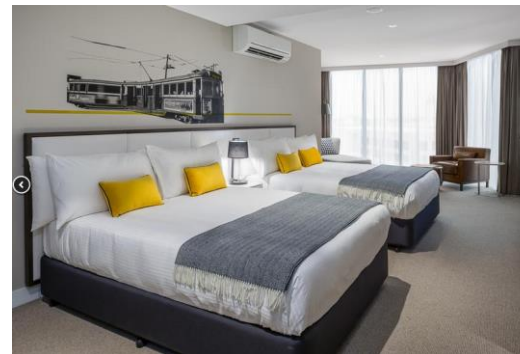   - Designed to print with pigments identical to those used in rotogravure printing

Palis 750

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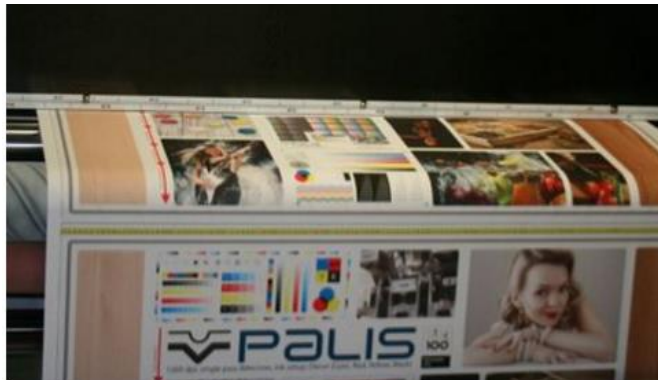
Zeescape (AUS)
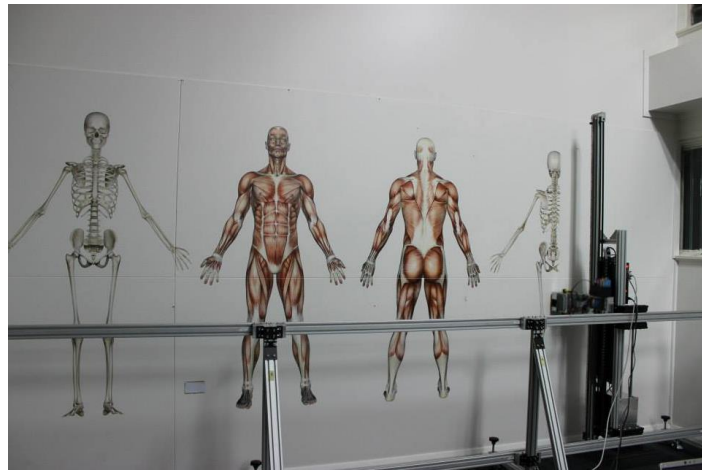
- **Direct to wall printer using inkjet**
  - CMYK
  - Portable system
  - Residential, commercial, hotels etc
  - Franchise business

Summary

- **Inkjet entering more industrial/manufacturing/volume production applications**
  - Typically not a direct replacement for analog technologies – but enlarging the application space and creating new markets and new capabilities
  - Large (>1m wide) print bars becoming commonplace
  - Technologies now exist to overcome many application challenges - driving the acceleration of inkjet adoption in production

Formica Envision

North American Plywood

Juicy Walls

Image source: company web sites & InfoTrends

Thank you

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