Digital Textile Printing 2004

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Agenda

- Historical Review
- Digital Textile Printing:
  - Wide Format Direct
  - Wide Format Indirect
  - Inkjet T-shirt Printers
  - Single Pass Printing
- Where do we go from here?
Historical Review Direct Print

- 1975: Milliken-Millitron carpet printer
- 1976: Zimmer-Carpet printer
- 1990: Seiren-Parallel processing
- 1993: Embleme-Water UV direct T-shirt
- 1996: Perfecta/Zund-Flatbed
- 1996: Canon Bubble Jet textile printer
- 1997: Rhome Revolution-Direct T-shirt
- 1998: Encad and Mimaki-Textile proofing
Historical Review Direct Print (cont.)

- 2001: L&P-UV-curable textile
- 2001: Dupont Artistri 3210
- 2002: Mimaki-GP 0604
October 2003 - October 2004

- 2003: Mimaki TX 3
- 2003: Dupont Artistri  2020
- 2003: L&P UV-cure dye
- 2003: Robustelli Mona Lisa
- 2003: Reggiani DReAM
- 2003: Zimmer Chromotex
- 2004: Kornit: 930 & 931
Related Developments

- Inca Digital – FastJet single pass
- Spectra - M class piezo MEMS
- Spectra – Water tolerant AAA PIJ
- Xaar – Omnidot 760
- Picojet 256 all stainless PIJ
- Samsung – MEMS print head
- BASF – Pigmented binder-less ink
Indirect Digital Textile Printing

- 1974-Roy DeVries Sublimation Transfer Method
- 1978-Donald Hare T-Shirt Decoration
- 1982-Crompton & Knowles Inkjet Sublimation
- 1988-RPL-QLT Inkjet Sublimation
- 1991-Sawgrass First Patent Filed
- 1994-Fotoware-Canon Inkjet Transfer Paper
- 1999-Hanes Soft Link
Worldwide Textile Printing

- Industrial
  - 38%
  - 8%

- Apparel
  - 54%

Interior Textile

- >30 billion m² printer per year
- >$165 billion per year all textile printing
- >$1.6 billion per year digital textile printing

Source: Stork Textile Printing Group, *Developments in the textile printing industry*, 2002
Textile Printing Distribution

- Asia, 50%
- Europe, 15%
- North America, 11%
- South/Central America, 10%
- Middle East, 7%
- Africa, 7%

Source: Stork Textile Printing Group, Developments in the textile printing industry, 2002
Textile Printing Trends

- Decreasing production run lengths
- Demand for greater design variety
- Demand for shorter production cycles
- Demand for reduced inventory risk
- Growth of Asian print production, decline in US print production
- Increase in shipping time from China
Shorter Print Runs

Rotary Screen Printing - Worldwide

Source: Stork Textile Printing Group, *The Textile Printing Process*
Analogue vs. Digital

- Analog textile printing is growing at 1%/year worldwide
- Digital textile production has been growing at about 13% worldwide
- About 70 Dupont Artistri 2020’s sold
- 12 Reggiani DReAM printers sold
Digital Textile Printers

- Colorsnap DisplayMaker XII
- Mimaki TX2 & TX 3
- Dupont Artistri 2020
- Leggett & Platt UV-dye
- Robustelli Mona Lisa
- Reggiani DReAM
- Zimmer Chromotex
- Imaje-Osiris
MD Colorsan Display Maker XII

- Fabrijet XII
- TIJ
- Fiber reactive dyes
- 12 print heads
- Media index stores parameters for up to 50 fabrics
Mimaki TX2

- TX2 – 160 ($32K), -250 ($50K) – 70 yards.
- TX3 – 300 yards, elastomeric fabrics
- 8 Epson PIJ printheads, 16 ink channels, 8x2
- Acid, reactive, disperse dyes. Pigment inks?
- 308 ft²/hr
- 720 dpi-360 dpi
- Head adjusts to 7 mm
- Choice for samples fine printing
Dupont Artistri 2020

- $185K
- 16 Seiko printheads, 8 per gantry
- 8 color pigment, acid, reactive, disperse dye
- 10 mm clearance
- Adhesive blanket
- 1.8 m max print width
- Color control/workflow
## 2020 Resolution/Speed

<table>
<thead>
<tr>
<th>Resolution dpi</th>
<th>Standard m²/hr</th>
<th>Interlacing m²/hr</th>
<th>Excellent m²/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>360</td>
<td>52</td>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>540</td>
<td>35</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>720</td>
<td>26</td>
<td>22</td>
<td>15</td>
</tr>
</tbody>
</table>
2020 vs. Rotary Screen Printing

![Print Cost Comparison Chart](chart.png)

- **Print Cost Comparison**

  - **Cost - US $/sq. meter**
  - **Print Run in Square Meters**

  - **Total printing cost including: labor, capital, and ink**

  - **DuPont Ink Jet 2020**
  - **Rotary Screen Printer**

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VCE Solutions
Leggett & Platt Virtu

- 36-72 Spectra S-class heads
- 1500 ft² 4-color 300 dpi; 275-325 ft² 6-color 600 dpi (1,900 ft²)
- RS, MT, TX
- Liquid cooled UV curing
- 5 liter ink containers
- RS = 2.5 m wide
- $580K complete to $700K
- UV-cure disperse dye inks
Robustelli Mona Lisa

- 3 Epson printheads per color 180-720 dpi
- FOR.TEX - Genesta™ AC comprises 11 colors of reactive ink for use on cottons; and Genesta RE includes 10 colors of acid ink for use on wool, silk and nylon.
- $400K
Reggiani DReAM

- Aprion Magic PIJ
- 7-512 nozzle heads/color
- 600 dpi
- $750K 6 colors
- 155 cm print width
- 150 m2/hr speed (35kHz)
- Fiber reactive & acid dye sets
- Hot air blower dyer
- Blanket washing
Zimmer Chromotex Flatjet

- “Flatjet” printheads
- Inexpensive mini spray guns
- Enables use of inexpensive inks
- Enables large ink volumes and digital dying
- Printing cationic dye on acrylic at ITMA 2003
- $300k
Osiris

- $3 million
- Imaje CIJ
- Over 1000 linear meters/hr
Other Inkjet Printers

- Mutoh – Falcon Plus to Falcon II
- Agfa Grand Sherpa
- Roland – HiFi Jet Pro
- Epson – Stylus Pro 7600-10600
- HP – 5000-5500
- Kodak Encad – Nova Jet & Textile Systems
- Canon – Wide Format Bubble Jets
Mutoh Falcon
Digital Textile Printers

Performance / Speed

Price / Investment

Reggiani

DuPont Artistri 3210 printer

Robustelli / Epson

Mona Lisa

DuPont Artistri 2020 printer

DuPont

$400M+

$100,000

$30,000

$15,000

ENCAD, Inc.

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VCE Solutions
Electrostatic Sublimation

- 3M Scotchprint 2000
- 1900 ft²/hr
- 400 dpi
- Beta Color-BMT
- Hilord
- Production business model
Applications

- Fashion apparel and accessories for women, men and children
- Sports and swimwear
- Home textiles: curtains, sheets, towels, table settings, furniture upholstery

- Automotive and transportation upholstery
- Flags and banners
- Architectural textiles
- T-shirts and specialties
- Gaming covers
- Trans-dermal dosing
Direct T-shirt Printing

- U.S. Screen Printing Institute
  - 24” Fast T-Jet Jumbo
  - 12” Fast T-Jet

- Mimaki
  - GP-1810 with a 73.2” image area
  - GP-604 with a 24” image area.

- Kornit
  - Kornit 930
  - Kornit 931
# Direct Inkjet T-shirt Printers

<table>
<thead>
<tr>
<th>Printer</th>
<th>Print Width</th>
<th>White</th>
<th>DPI</th>
<th>Prints/hr</th>
<th>Price</th>
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<tbody>
<tr>
<td>Kornit 930</td>
<td>0.4-0.5m Standard</td>
<td>Capable</td>
<td>450-630</td>
<td>200</td>
<td>$95K</td>
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<tr>
<td></td>
<td>0.5-0.7m Optional</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kornit 931</td>
<td>0.4-0.5m Standard</td>
<td>Capable</td>
<td>450-630</td>
<td>350-400</td>
<td>$122K</td>
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<tr>
<td></td>
<td>0.5-0.7m Optional</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mimaki GP604</td>
<td>0.5m</td>
<td>No</td>
<td>360-720</td>
<td>24-30</td>
<td>$25K</td>
</tr>
<tr>
<td>Mimaki GP1810</td>
<td>1.01m</td>
<td>No</td>
<td>360-720</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USSPI Fast T-Jet</td>
<td>0.3m</td>
<td>No</td>
<td>360-720</td>
<td>30-40</td>
<td>$10K</td>
</tr>
<tr>
<td>USSPI Fast T-Jet Jumbo</td>
<td>0.6m</td>
<td>No</td>
<td>360-720</td>
<td>30-40</td>
<td>$24K</td>
</tr>
</tbody>
</table>
USSPI Fast T-Jet

- 12”-13” wide image
- About $10 K
- Based on Epson 2200
- Prints one shirt every 90 seconds
- Just under 30-40 shirts per hour
USSPI Fast T-Jet Jumbo

- 24” wide
- About $24K
- Epson 7600 based
- Prints one shirt every 90 seconds
- Just under 40 shirts per hour
Mimaki GP-604

- 720 dpi
- $25K
- 24 full-color shirts/hr
- Washable pigmented ink
- Multiple platen sizes
- RIP
- 130 mm height adjustment
Mimaki GP-1810

- Print area: 1870 x 1010 mm
- Acid, reactive, & disperse dye, textile pigment
- C,Y,M,K - 880 cc dye, 840 cc pigment
- Head height: 0-50mm
- 360 x 360 dpi - 2/4/8 pass, Uni/Bi direction
- 360 x 540 dpi - 3/6/12 pass, Uni/Bi direction
- 720 x 720 dpi - 4/8/16 pass, Uni/Bi direction
Kornit 930

- Kornit 930: $ 95,000
- Direct Piezo Inkjet
- Spectra 256 nozzles
- Speed for 4.7”x9.5”
  - Fast: 178 (200)
  - Normal: 148
  - Best: 127
  - Super: 109
Kornit 930, 931 Specifications

- Pigment solvent-based
- 4 CYMK colors
- Image Size:
  - Standard: 16” x 20”
  - Variable to 20” x 28”
- 450x450; 540x540; 630x630 dpi.
- Cotton, Cotton-Poly blends, Lycra, Viscose+
- 3-phase electricity
- Rigid & Flexible materials optional.
- Light fastness, ISO 105 B02: 5-6.
- Wash fastness, ISO 6330-2000: 3-4
- Onyx RIP
Kornit 931

- Kornit 931: $122,000
- Speed for 4.7”x9.5”
  - Fast: 295 (350-400)
  - Normal: 295
  - Best: 221
  - Super: 172
Single Pass

- **Imaje-Osiris**
  - $3 million
  - Arrays of Imaje CIJ
  - Over 1000 meters/hr

- **Inca Digital’s FastJet**
  - Arrays of Spectra PIJ DOD SL print heads
  - 75-78 picoliter drops
  - Single pass
  - Nordson UV cure
  - Substrates up to 7 mm thick, 520 mm print wide, 1,200 mm long
  - Up to 3,000 m²/hr; 1.6 m²/sec
  - 200x300 dpi minimum
  - Variable data
Inca FastJet
Flatjet

- “Flatjet” print heads
- Inexpensive mini spray guns
- Enables use of inexpensive inks
- Enables large ink volumes and digital dying
- Resolution adequate for T’s
- Use in combination with PIJ
Where do we go from here?

- Lower cost per nozzle
- Larger arrays of print heads
- Lower cost per print
- Multiple print head types
- White and light colored ink
- Radiation curing
- Complex solutions need time & money
Questions, Discussion…

Thank you

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