

# Digital Textile Printing 2004

Vince Cahill, VCE Solutions

Hitoshi Ujiie, Philadelphia University

IS&T NIP 20, Salt Lake City, UT



# 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: USSPI: Fast T-Jet & Fast T-Jet Jombo
- 2004: Kornit: 930 & 931

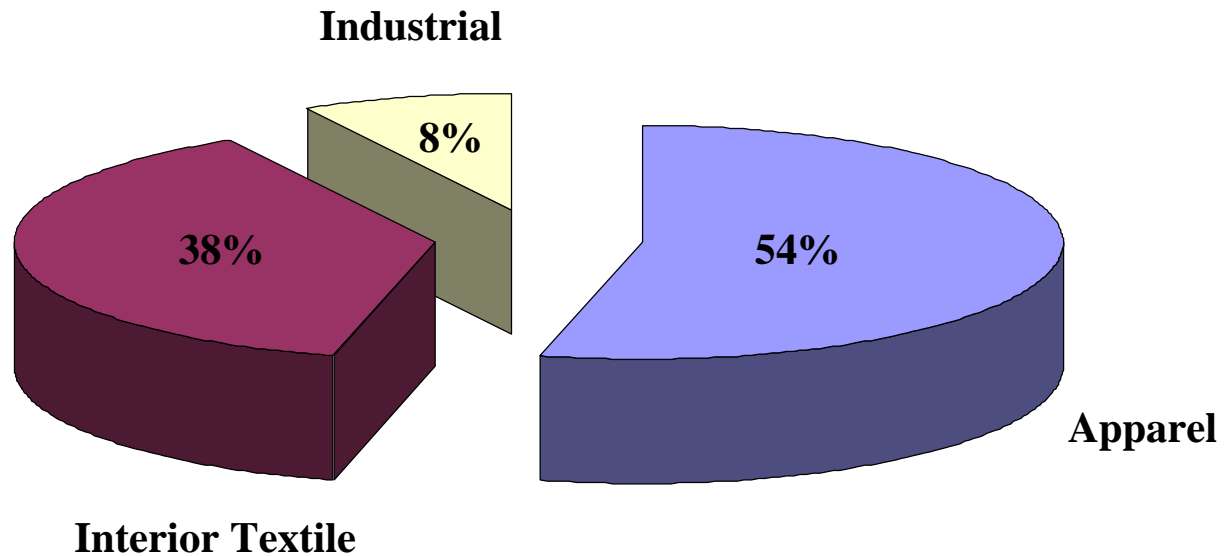
# Related Developments

- 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



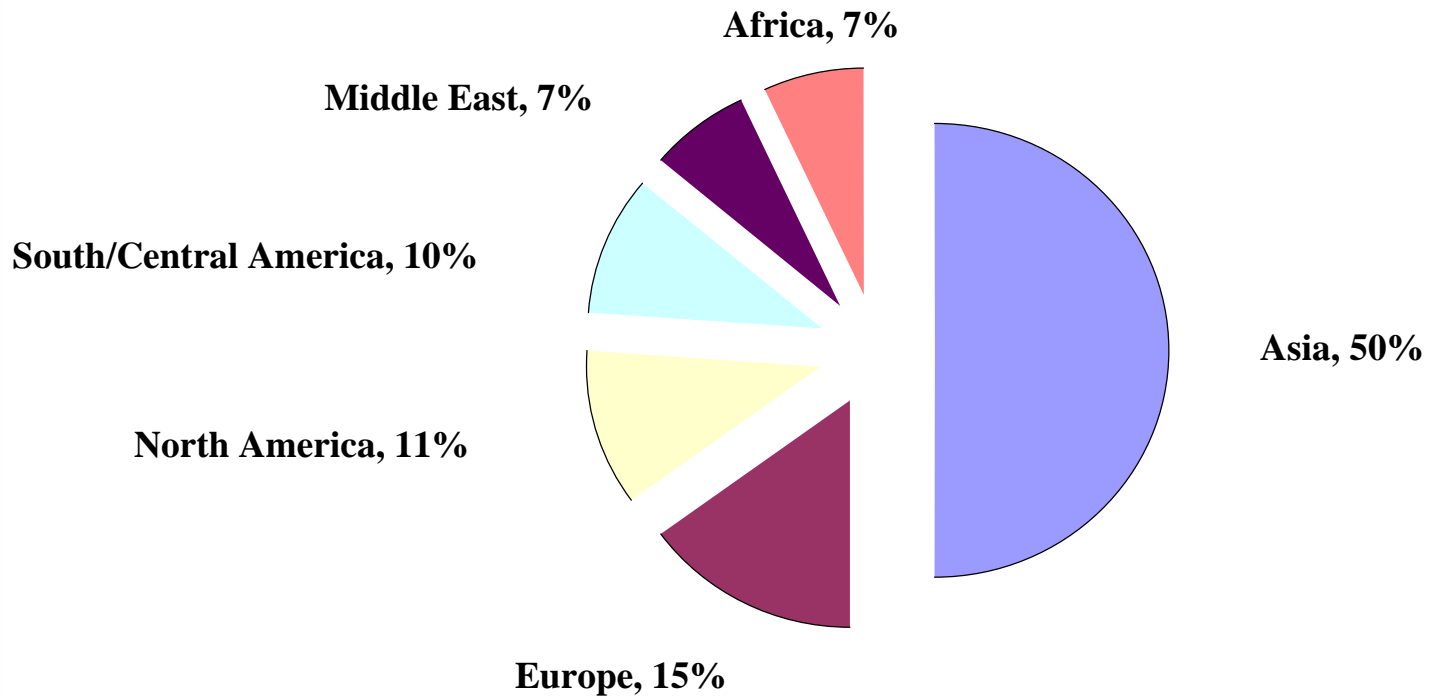
**>30 billion m<sup>2</sup> printer per year**

**>\$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



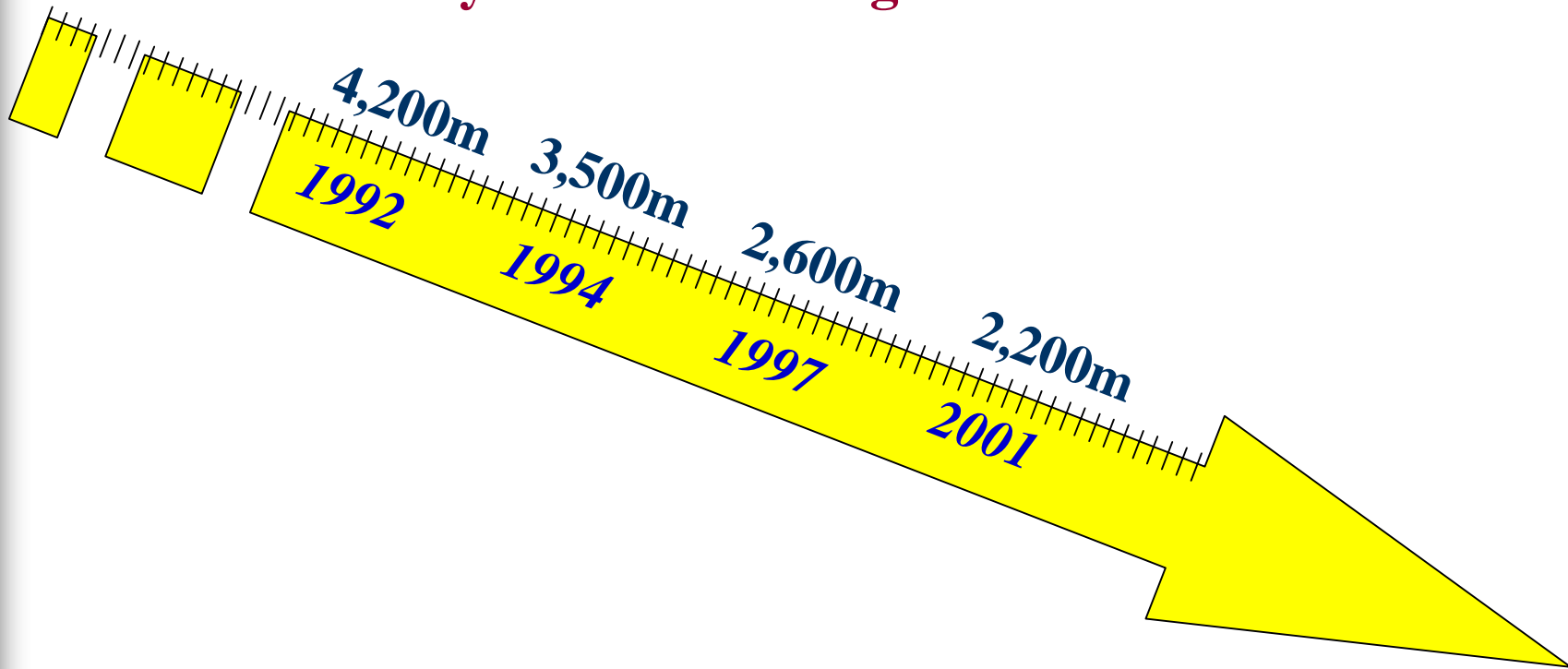
Source: Stork Textile Printing Group, *Developments in the textile printing industry*, 2002

# 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

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

# MD Colorspan Display Maker XII



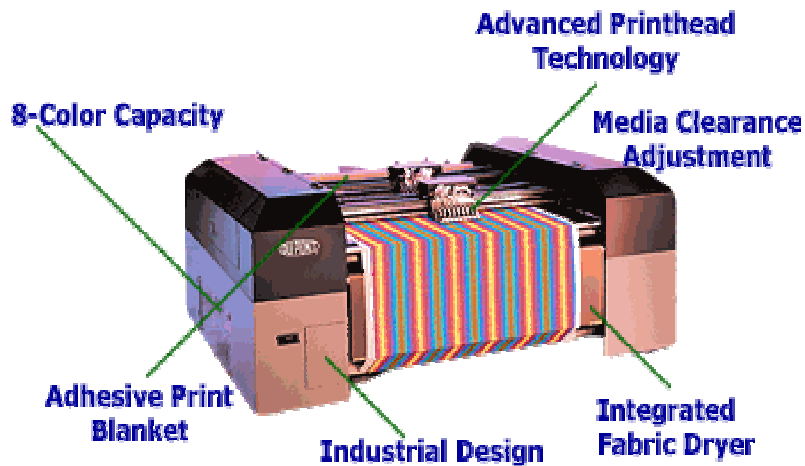
- Fabrijet XII
- TIJ
- Fiber reactive dyes
- 12 print heads
- Media index stores parameters for up to 50 fabrics

# Mimaki TX2

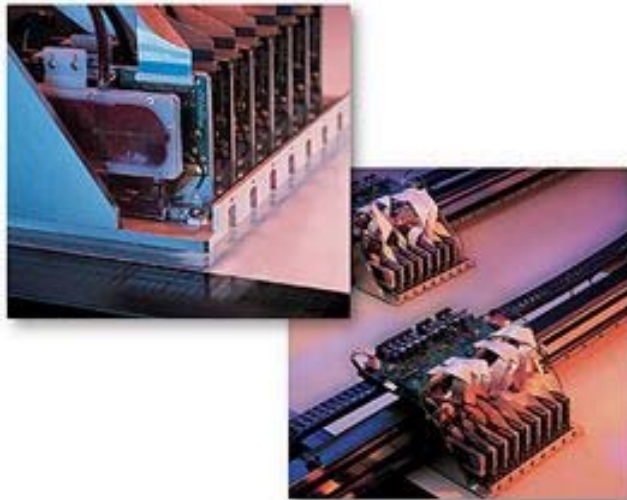
- TX2 –160 (\$32K), -250 (\$50K) – 70 yards.
- TX3 – 300 yards, elastomeric fabrics
- 8 Epson PIJ printheads, 16 ink channels, 8x2
- Acid, reactive, disperse dyes. Pigment inks?
- 308 ft<sup>2</sup>/hr
- 720 dpi-360 dpi
- Head adjusts to 7 mm
- Choice for samples fine printing



# Dupont Artistri 2020



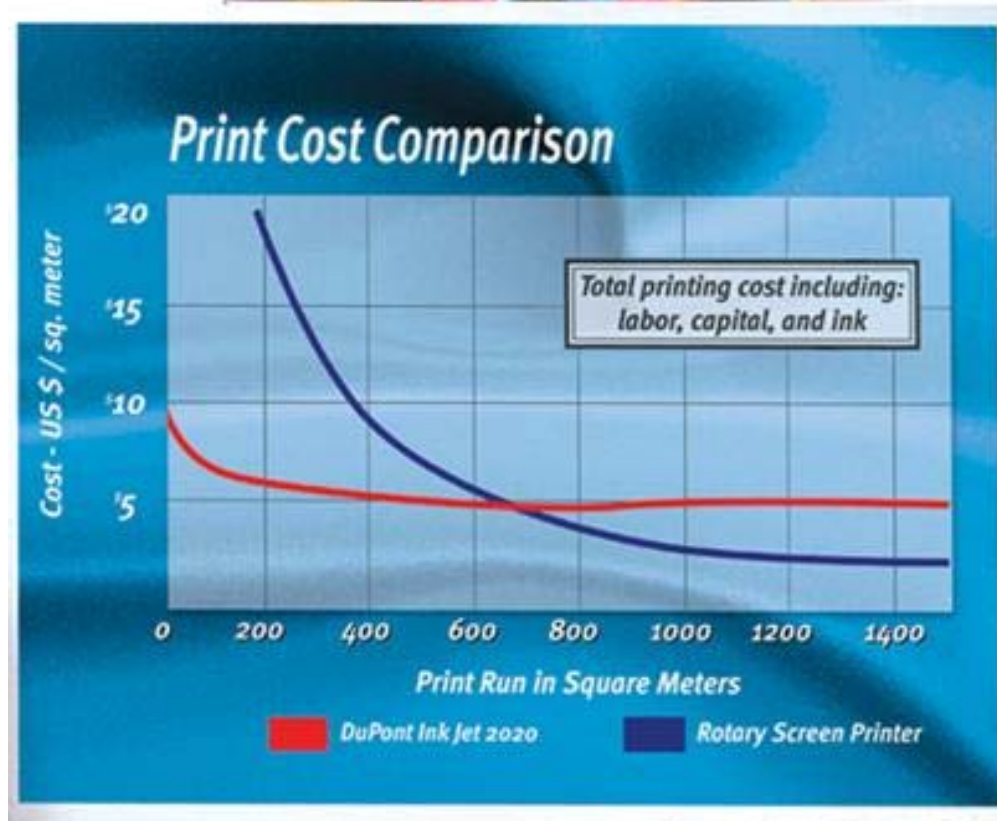
- \$185K
- 16 Seiko printheads, 8 per gantry
- 8 color pigment, acid, reactive, disperse dye
- 10 mm clearance
- Adhesive blanket
- 1.8 m max print width
- Color control/workflow



# 2020 Resolution/Speed

Resolution dpi	Standard m <sup>2</sup> /hr	Interlacing m <sup>2</sup> /hr	Excellent m <sup>2</sup> /hr
360	52	45	30
540	35	30	20
720	26	22	15

# 2020 vs. Rotary Screen Printing



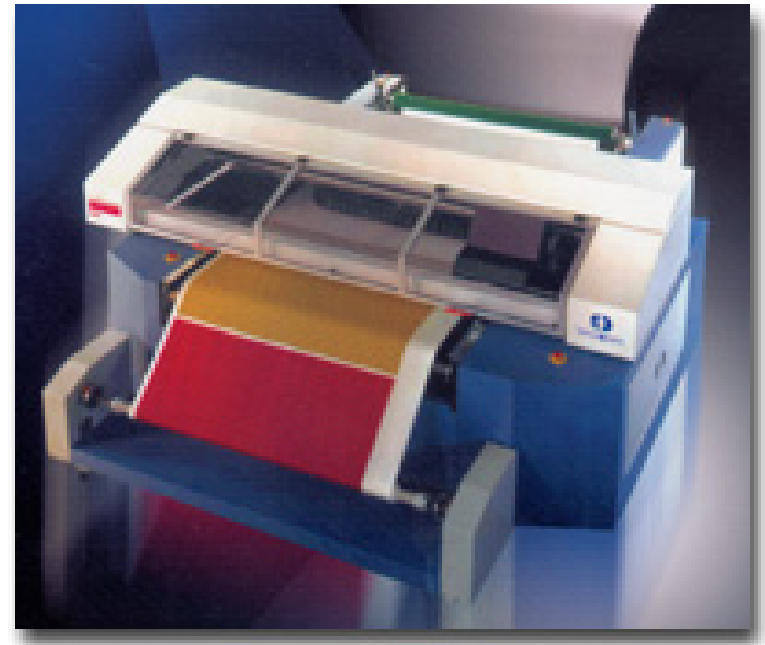
# Leggett & Platt Virtu

- 36-72 Spectra S-class heads
- 1500 ft<sup>2</sup> 4-color 300 dpi;  
275-325 ft<sup>2</sup> 6-color 600 dpi  
(1,900 ft<sup>2</sup>)
- 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 m<sup>2</sup>/hr speed (35kHz)
- Fiber reactive & acid dye sets
- Hot air blower dryer
- Blanket washing



REGGIANI MACCHINE



Ciba



# Zimmer Chromotex Flatjet

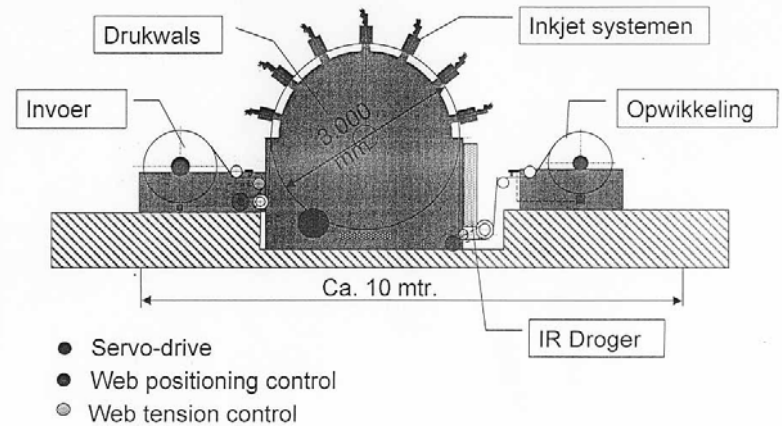


- “Flatjet” printheads
- Inexpensive mini spray guns
- Enables use of inexpensive inks
- Enables large ink volumes and digital dying
- Printing cationic dye on acrylic at ITMA 2003
- \$300k

# Osiris

- \$3 million
- Imaje CIJ
- Over 1000 linear meters/hr

## Technical concept



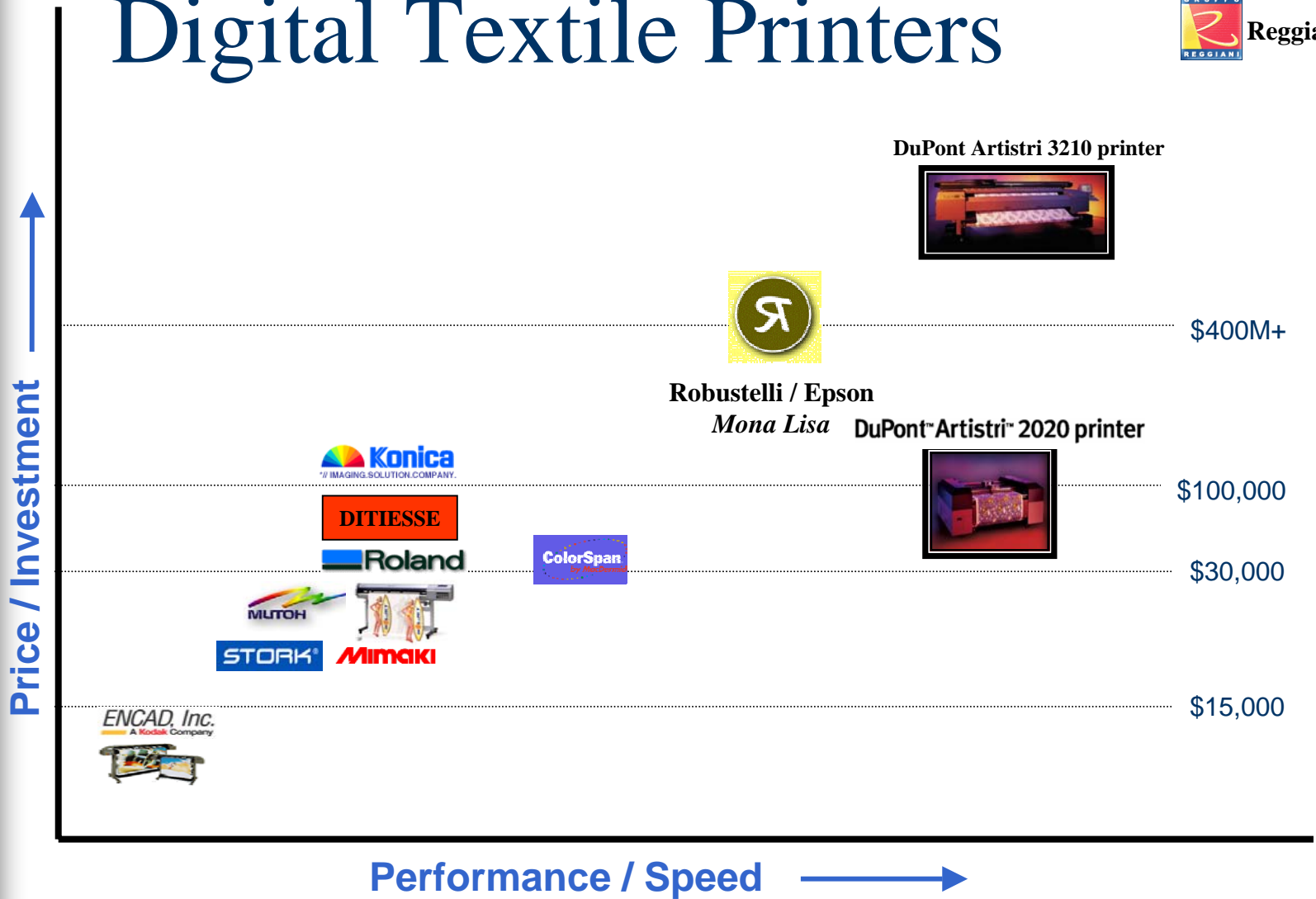
# Other Inkjet Printers

- 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



# Electrostatic Sublimation

- 3M Scotchprint 2000
- 1900 ft<sup>2</sup>/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

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

# 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



**U.S. Screen Printing Institute  
Booth 2519**

# 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
- Crock fastness, ISO 105 X12: 2-3.
- 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

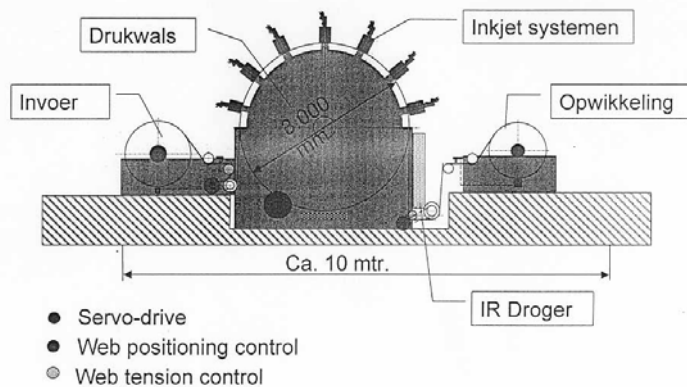
## ■ Imaje-Osiris

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

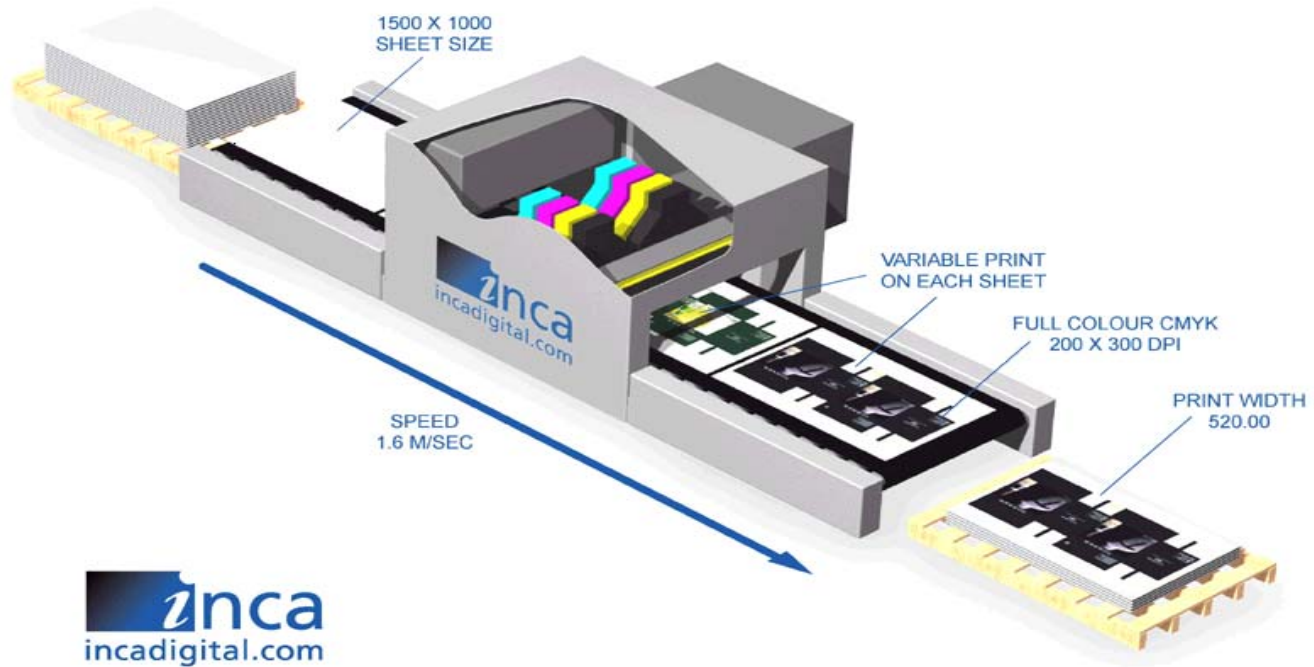
## ■ Inca Digital's FastJet

- 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 3,000m<sup>2</sup>/hr; 1.6 m<sup>2</sup>/sec
- 200x300 dpi minimum
- Variable data

Technical concept



# Inca FastJet



**znca**  
incadigital.com

# 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

Vince Cahill

VCE Solutions

Email: [vince@vcesolutions.com](mailto:vince@vcesolutions.com)

Phone: 717-762-9196

Hitoshi Ujiie

Philadelphia University STMT

Philadelphia, PA 19047

Email: [ujiieh@philau.edu](mailto:ujiieh@philau.edu)

