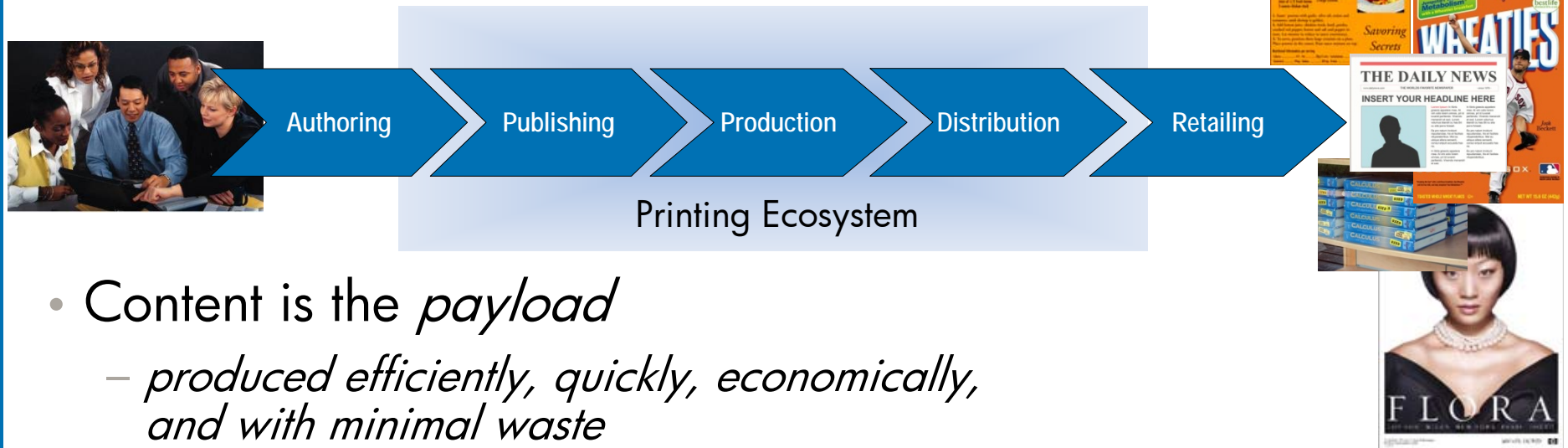# Disrupting the Printing Ecosystem

Glen Hopkins
Business Unit Manager,
Printing Technology Platforms

Delivering Printed Content to End-Users

- The *Value Chain* is the delivery vehicle for *Content*
  - from creation (Authoring) to consumption

Authoring → Publishing → Production → Distribution → Retailing
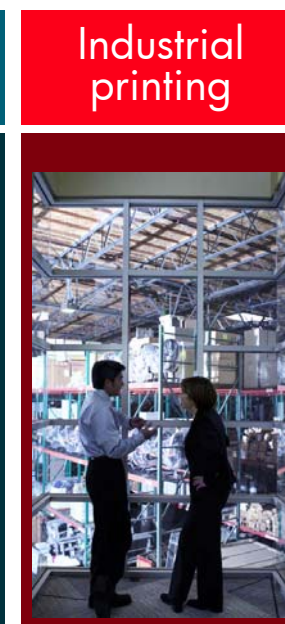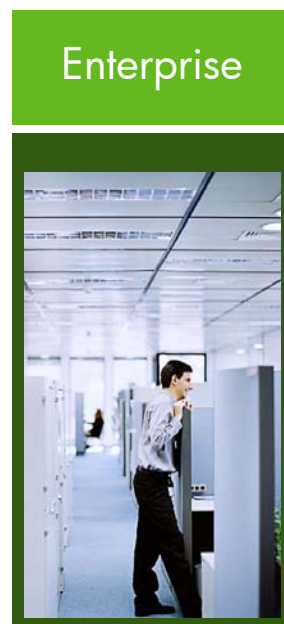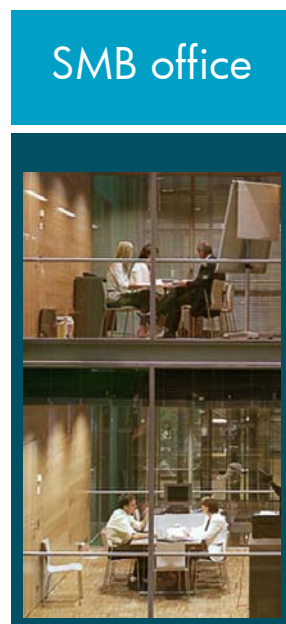
Printing Ecosystem

- Content is the *payload*
  - *produced efficiently, quickly, economically, and with minimal waste*
  - *delivered to the right consumer*
  - *delivered with the form and function appropriate to the application*

Printing Ecosystem

Publishing → Production → Distribution

Printing Ecosystem
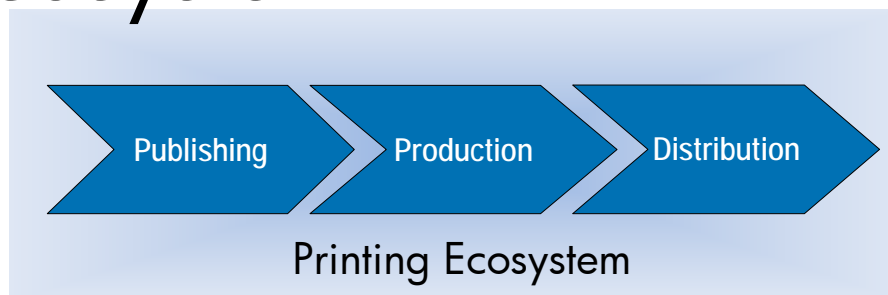
- HP products and services support the *Printing Ecosystem* at the heart of the Value Chain
- HP printing solutions cover a broad spectrum of markets and applications

| Home printing	SMB office	Enterprise	Retail application	Graphics	Industrial printing

Disrupting the Printing Ecosystem

- The first big disruption of the printing ecosystem (ca. 1450) was the Gutenberg Bible
  - this is the first known book printed with moveable metal type

- Each copy of the original Gutenberg Bible required the skins of 300 sheep.

- Today, due to low demand and a complicated manufacturing process, books made from sheep are expensive and hard to find.

Disrupting the Printing Ecosystem

Publishing → Production → Distribution

Printing Ecosystem
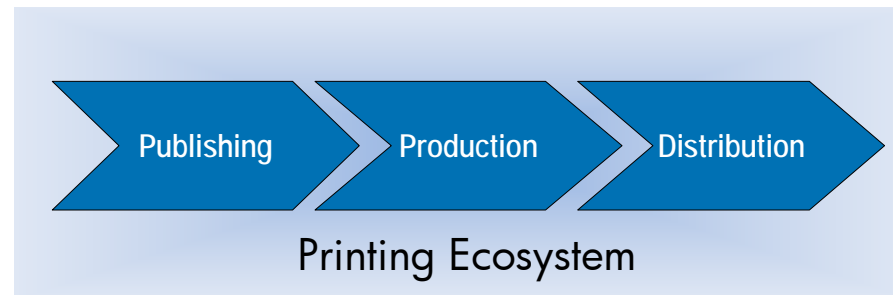
- Print is not going away – it is more relevant than ever before to consumers and enterprises
- Why disrupt the Printing Ecosystem?
  - to take advantage of opportunities and capabilities enabled by a pervasive and powerful digital infrastructure
  - to publish, produce and distribute printed material with the customization, efficiency, and immediacy provided by digital processes
    - Ex.: books, newspapers, mail, photos, packages, and signage
  - to open new printing markets with innovative products and services

Disrupting the Printing Ecosystem
what is HP doing?

Publishing → Production → Distribution

Printing Ecosystem
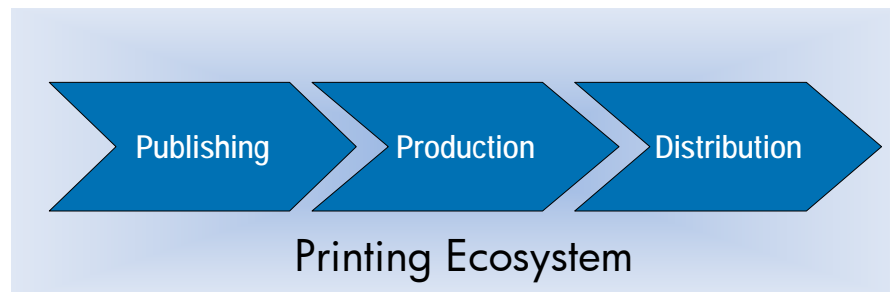
- Developing solutions based on HP's core competencies in both information technology and printing technology
- Leading and supporting development of the WW digital information infrastructure
- Delivering printing solutions that bring print fulfillment closer to the end-user
- Reducing the environmental impact of printing
- Innovating new solutions across all of HP's current printing markets
  - delivering advanced printing technologies, inks, and media
  - leveraging HP's R&D and manufacturing resources
  - entering new markets with proven technologies

Disrupting the Printing Ecosystem

Let's look at some key developments and opportunities

Home printing	SMB office	Enterprise	Retail application	Graphics	Industrial printing

✓   ✓

- Marketing Collateral and Mail
- Books and Manuals
- Newspapers
- Packaging
- Signage

✓

Home Printing

- Faster broadband delivers virtually unlimited digital content for entertainment, education, and personal/household management
  - shopping and services (financial, medical, recreational)
- Seamless integration of the Internet-enabled functionality
  - the Internet becomes embedded in everyday devices in the same way as computers
  - Q: do you know how many computers are in your home? your car? your pockets?
- Total mobility
- Fast and reliable printing and sharing of documents and photos

Small and Medium Business

SMB office

- Unprecedented access to information opens new markets and supports development of specialized services
  - market and customer demographics
  - customer targeting
  - technical resources
  - maps, graphics, and content
  - professional expertise
  - authoring tools to develop personalized content
- Easier than ever to set up "virtualized" businesses
- Transformation of marketing collateral and mail
  - from "carpet bombing" to "precision-guided"
  - cost savings from reduced waste and higher utilization

Marketing Collateral and Mail
"The Last Mile"

- People like getting REAL mail!
  - personalization is key for both personal and business mail
    - personalized by the sender (images and information about the sender)
      - Ex.: personalized postage from stamps.com
    - personalized to the recipient
      - more than just your name, something about you to grab your attention

- Local print production reduces transportation costs, energy use, and response time

- 21st century printing: *compose globally, print locally*
  - create content (everything from a post card to a magazine)
  - compose it anywhere in the world
  - print it at (or near) the destination
  - deliver it faster and cheaper than shipping from the point of origin
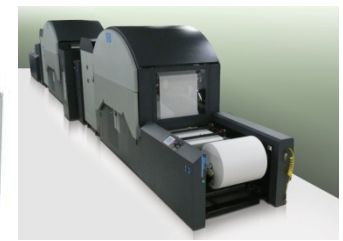
Books, Manuals, and other Published Material

- People still love to read books

- Books and manuals are user-friendly
  - easy navigation and annotation
  - ergonomic

- More titles were produced in the last decade than in all of recorded history

- Authoring tools allow individuals to create and publish books

- 30%+ of all printed books are scrapped without anyone reading them

- The average university student pays over $1000 per year for textbooks and course materials

- Electronic databases keep books "in print"
  - legacy titles are being optically scanned and cataloged

- By 2010, a major disruption will occur with more than 5% of all books printed digitally
(Source: Interquest)

Newspapers

- Newspapers rank 2nd to the USPS in "home delivery" volume

- News readership and advertising is moving to mobile and broadband

- Digital fulfillment of localized and personalized content opens new market opportunities
  - in both on-line and print media

- "Free" and targeted publications emerge from local and regional newspapers to better serve specific communities and markets

- A major disruption will come from high-speed inkjet web presses
  - 100% variable content page-to-page
  - high print quality on uncoated stock

Packaging

- "Packaging is the expression of the soul of every product" (Peter Brabeck, Nestlé CEO)

- Packages serve many purposes
  - provide product and brand security: contain, protect, and dispense
  - grab the customer's attention, stand-out on the shelf
  - track and trace inventory, provide electronic check-out

- Brands (even traditional ones) are changing their packaging at a very rapid rate
  - to add functionality and point-of-purchase appeal

- In 2008 twice as many new products introduced vs. 1998

- The average supermarket manages 40,000 SKU's

- A major disruption will come from producing short-run custom packages, labels, and inventory tags
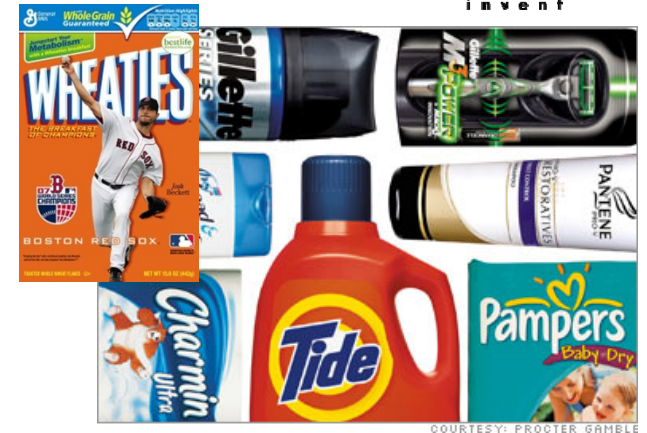
Signage

- Urban life surrounds people with colorful, informative banners and signage

- Digital content delivery and large-format inkjet printers produce display graphics with the immediacy and impact of today's news

- Outdoor durability requirements have driven solutions based on solvent inks and substrates (such as vinyl)

- A major disruption in the signage market will come from water-based inks with the performance of solvent inks and printed on recyclable substrates

Summary

- A pervasive transformation of the world's information infrastructure is underway driven by
  - broadband and mobile content delivery
  - unprecedented access to content
  - print and digital fulfillment moving closer to the user
  - environmental concerns

HP Blade Server

- With core competencies in both information technology and printing technology, HP is uniquely positioned to enable and advance this transformation

HP 4.25-inch Inkjet Printhead
(close-up view)

- Three key HP technologies that will disrupt the printing ecosystem will be presented today:
  - Scalable Printing Technology
  - Inkjet Web Press
  - Latex Printing Technologies
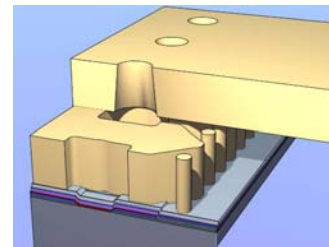
Disruptive Inkjet Technologies

Dr. Ross R. Allen
Senior Technical Specialist,
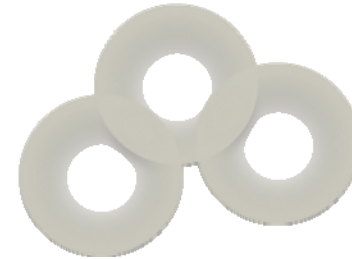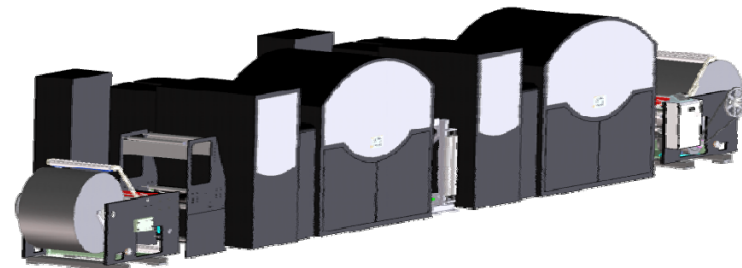Printing Technology Platforms

Scalable Printing Technology
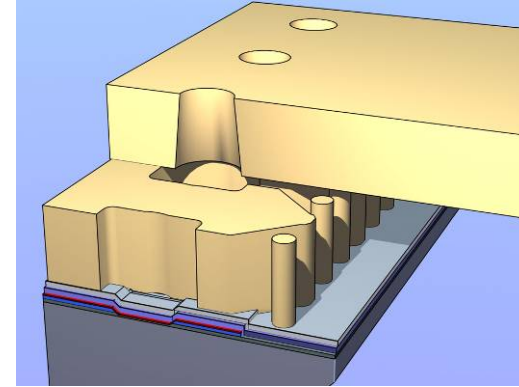
HP Latex Inks

HP Inkjet Web Press

HP Inkjet Technologies
matched to the application

- HP offers both piezo and thermal inkjet technologies for commercial and industrial printing solutions
  - choice of technology depends on many factors
- HP thermal inkjet printheads
  - high nozzle density (1,200 nozzles/inch)
  - high print quality at high print speeds
  - design optimized for water-based inks
  - easy replacement (snap in/snap-out)
- HP Scitex X2 piezo inkjet printheads
  - introduced in the HP Scitex FB7500 printer (UV-curable inks)
  - 100 nozzles per inch, stackable to higher resolutions
  - 128 nozzles/printhead
  - high drop volume (up to 50pl) [2]
  - design optimized for industrial inkjet inks
  - snap in/snap-out design
- OEM piezo printheads are used in HP Scitex industrial inkjet printers

HP TIJ 4.25-inch printhead
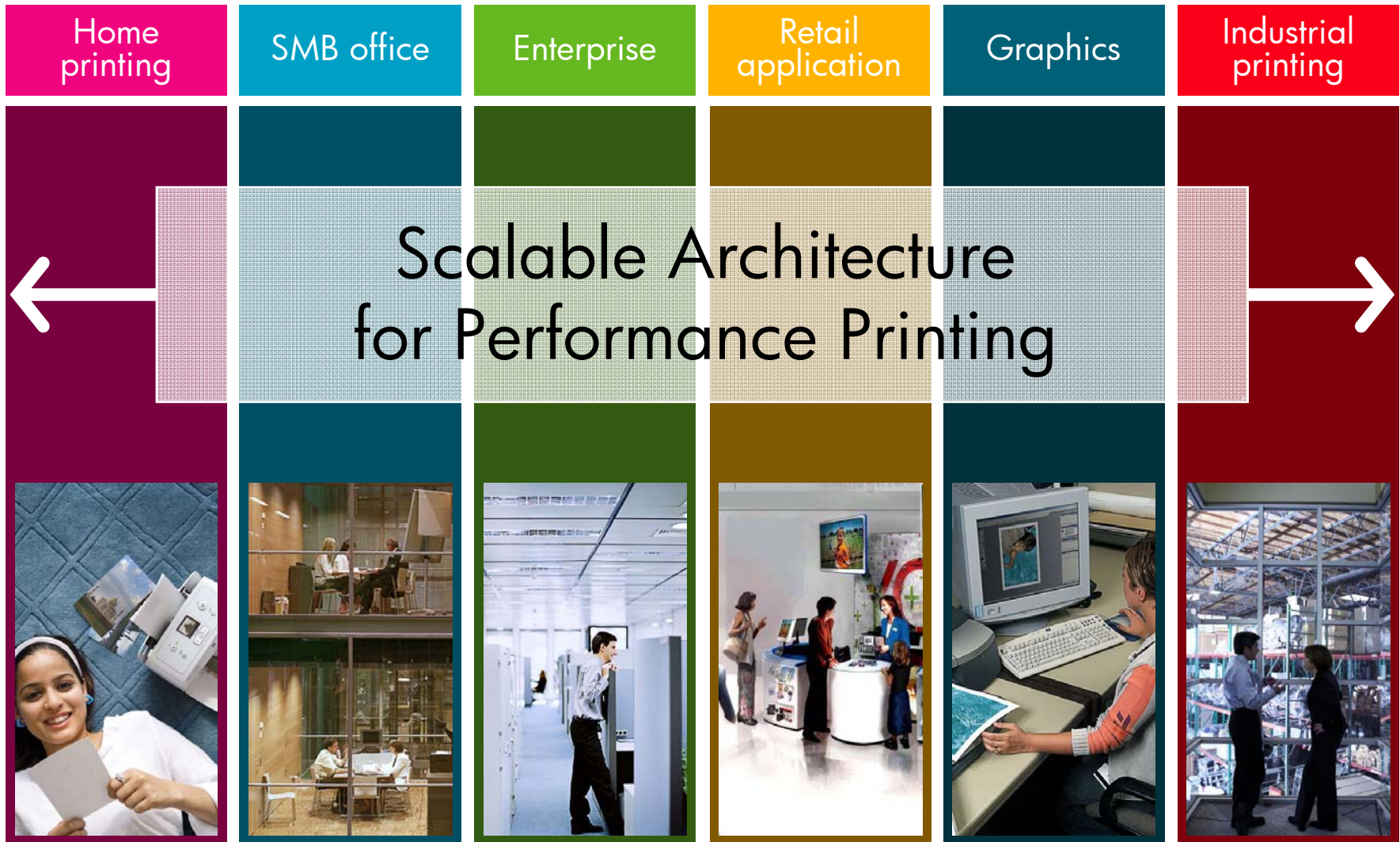
HP Scitex X2 piezo printhead

[1] for HP Scitex UV-curable inks

HP Scalable Printing Technology

HP Scalable Printing Technology (SPT)

HP R&D invested more than 4 years and 1.4B$ in SPT

Home printing	SMB office	Enterprise	Retail application	Graphics	Industrial printing

Scalable Architecture for Performance Printing

Scalable Printing Technology
new options, new opportunities

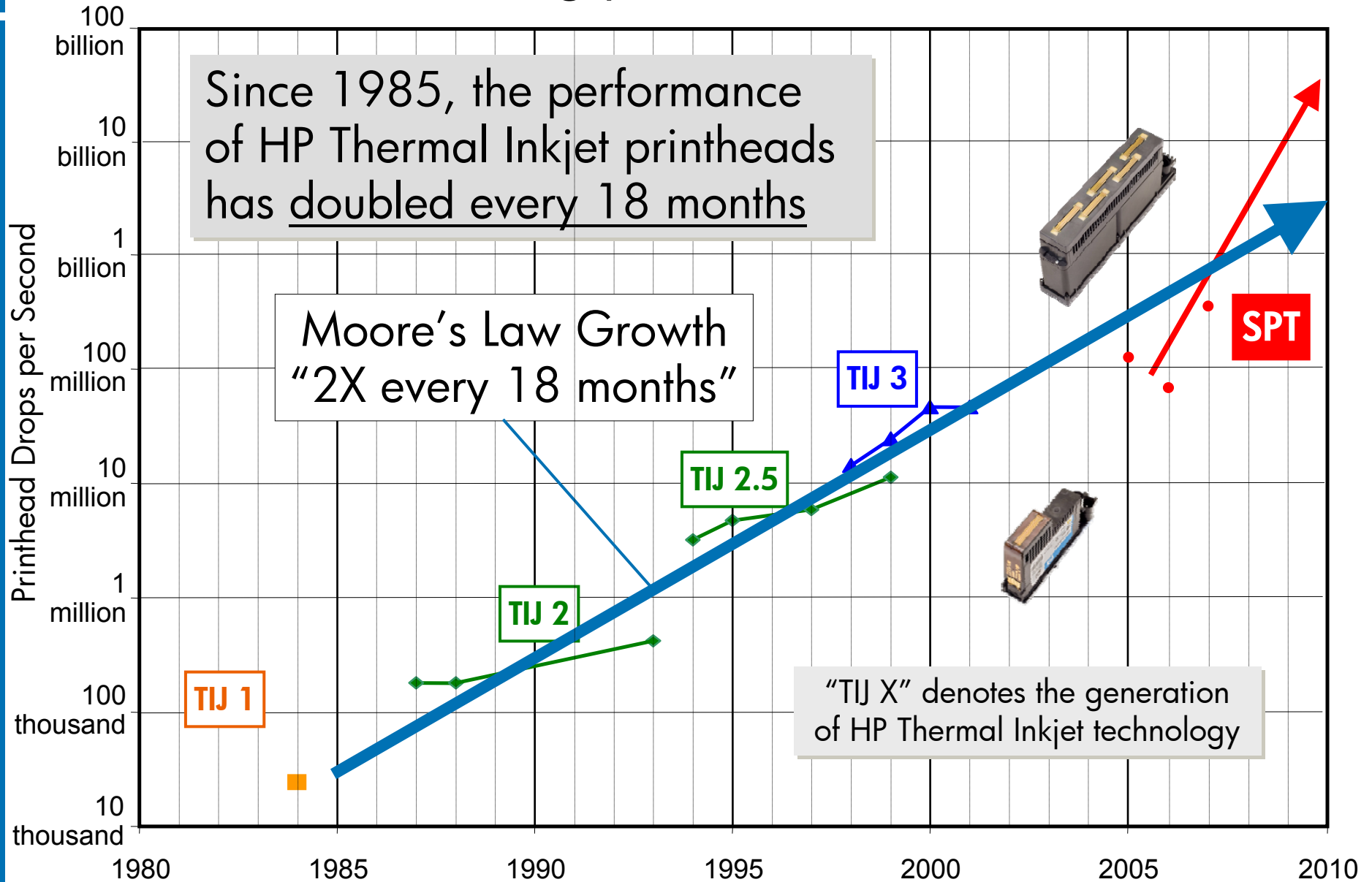| Home printing	SMB office	Enterprise	Retail application	Graphics	Industrial printing

- HP Commercial/Industrial Printing Solutions
  - large format inkjet
  - inkjet web press
- HP Latex Printing Technologies
- HP Wide Scan Printing Technology

✓extend HP Thermal Inkjet into new markets
✓leverage HP's R&D and manufacturing economies of scale across all markets
✓develop ink formulations with new features
✓improve durability and display permanence
✓provide innovative ink delivery systems
✓deliver faster print speeds

# HP Thermal Inkjet
SPT enables continuing performance advances

Printhead Drops per Second

Since 1985, the performance of HP Thermal Inkjet printheads has <u>doubled every 18 months</u>

Moore's Law Growth "2X every 18 months"

TIJ 3

TIJ 2.5

TIJ 2

TIJ 1

SPT

"TIJ X" denotes the generation of HP Thermal Inkjet technology

HP Thermal Inkjet Drop Generation
"nothing moves but the ink itself"
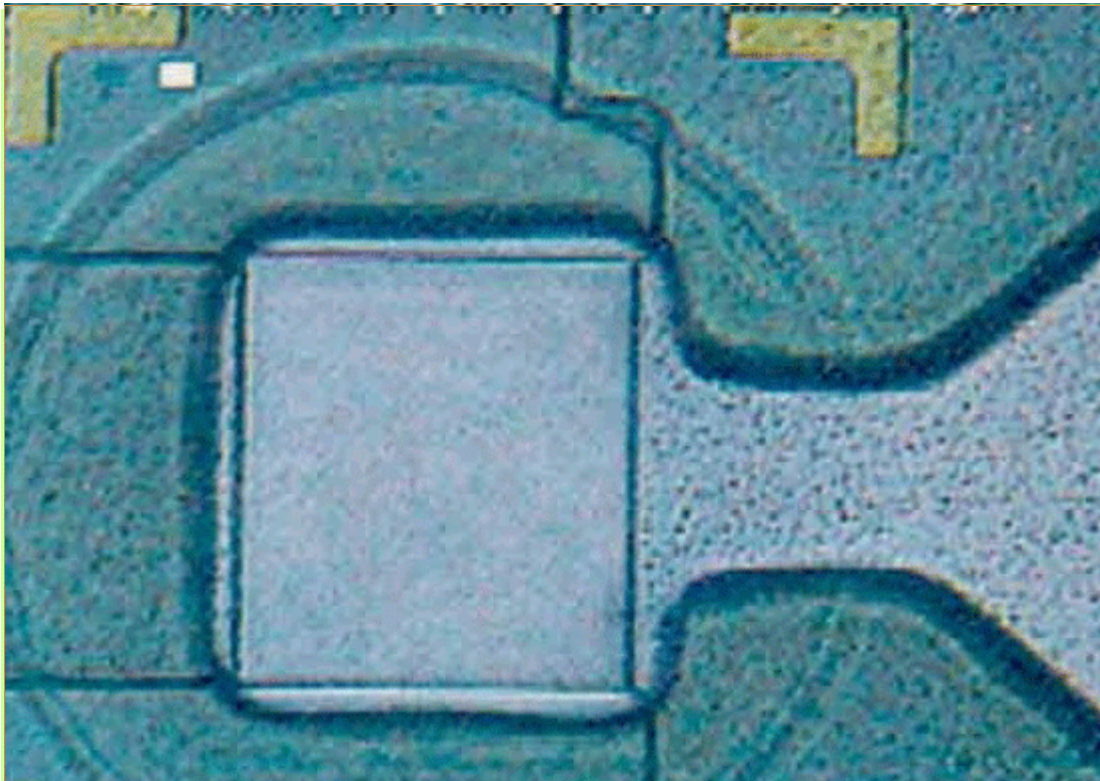
Microscopic view under stroboscopic illumination of a vapor bubble cycle
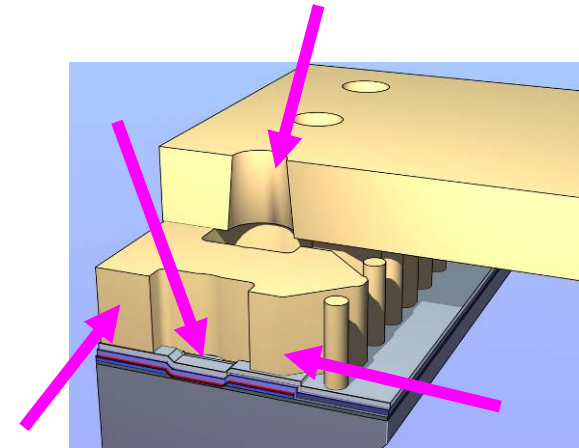
- **barrier** defines the walls of the chamber where the vapor bubble forms
- **refill channel** lets fresh ink flow into chamber
- **heater** generates the vapor bubble in the ink
- **orifice** is positioned over resistor to form a drop of ink
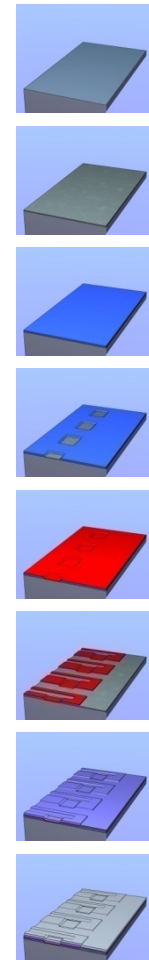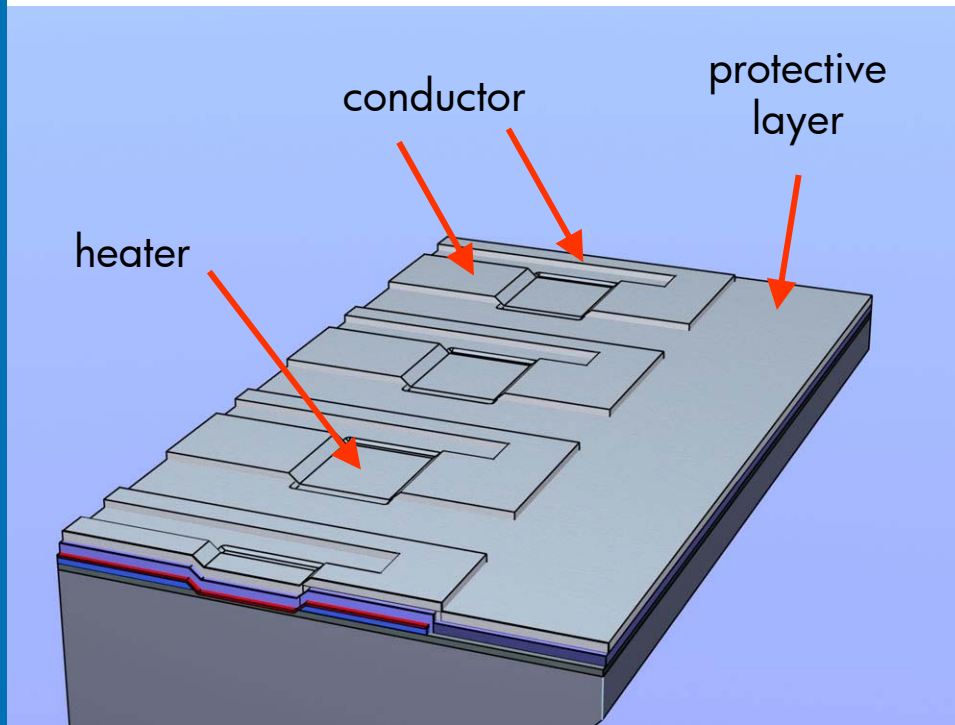
HP Scalable Printing Technology
a breakthrough in printhead architecture

- entire printhead created photolithographically
  - precision alignment of chamber and nozzles to heater improves drop placement accuracy
- 1200 nozzles/inch across the ink feedslot
 - high nozzle density for fast printing

ink flow

Orifice (nozzle)

Top Plate

Pillar

Chamber

thin films

Silicon Substrate

1200 npi
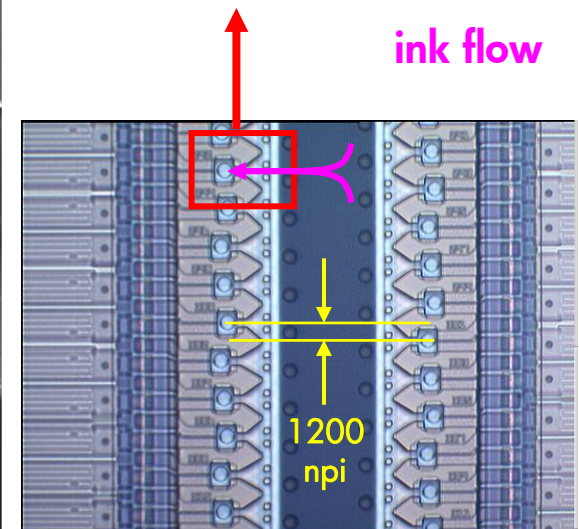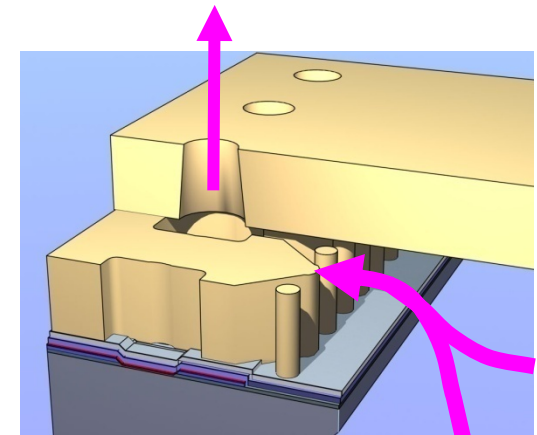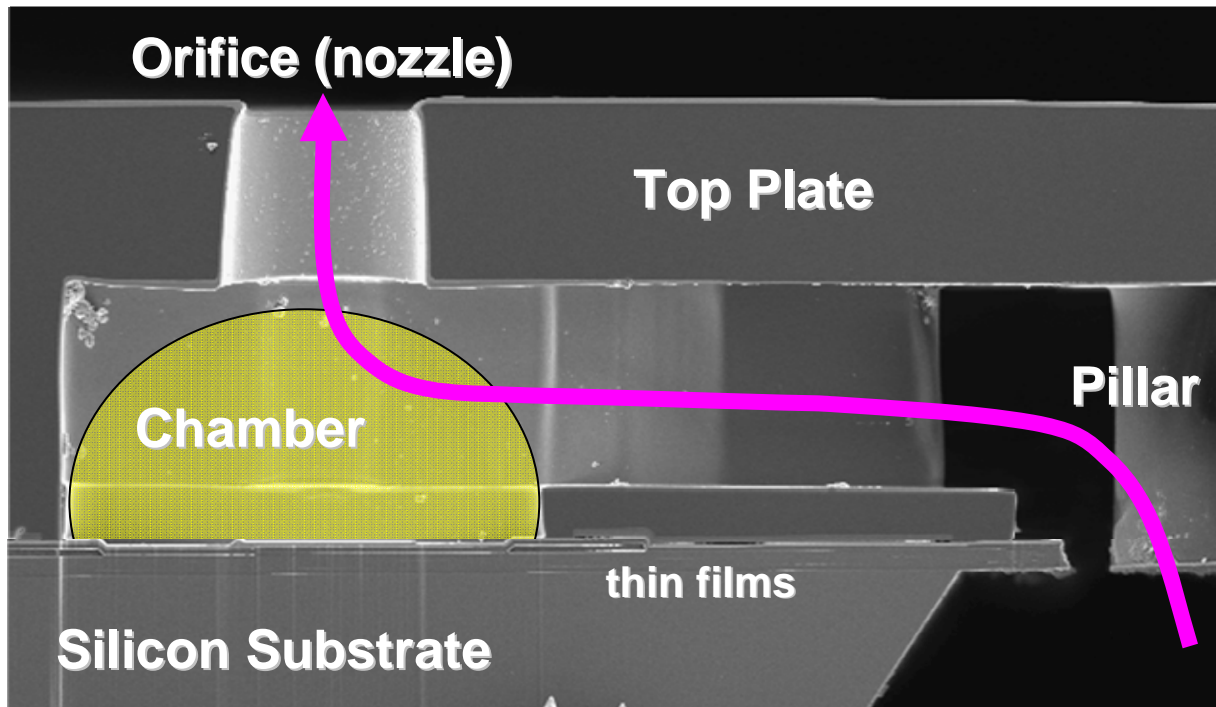
Making an SPT Inkjet Printhead (1)
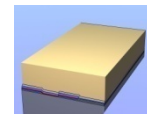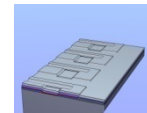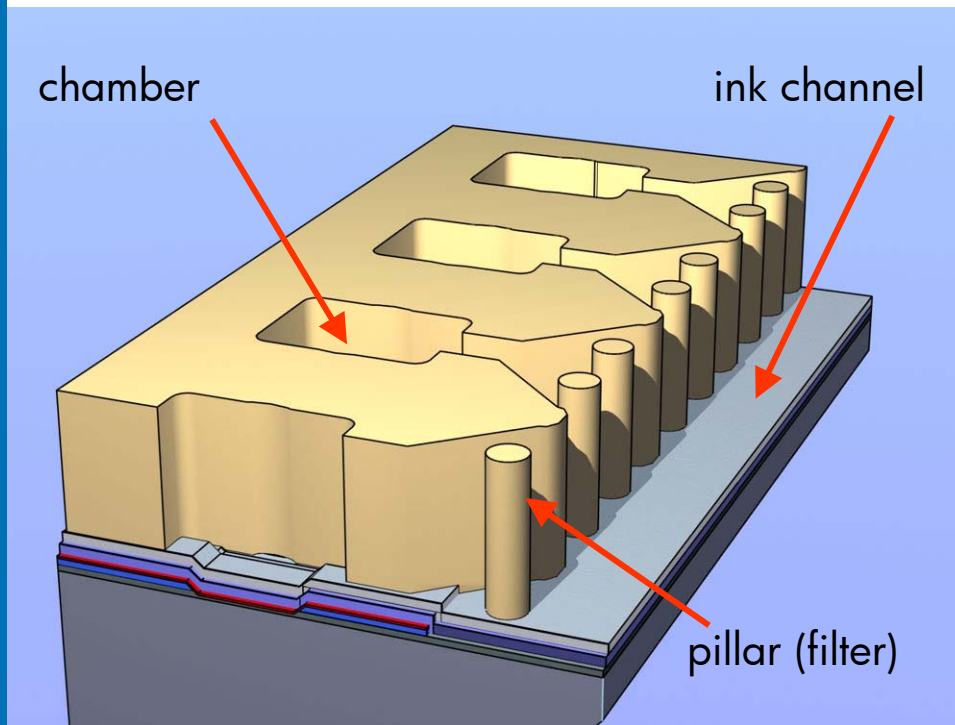## thin-films and heaters

conductor

protective layer

heater

- silicon wafer
- grow oxide layer
- deposit conductor film
- etch window for resistor
- deposit resistor film
- etch conductor and resistor
- deposit dielectric film
- deposit tantalum film
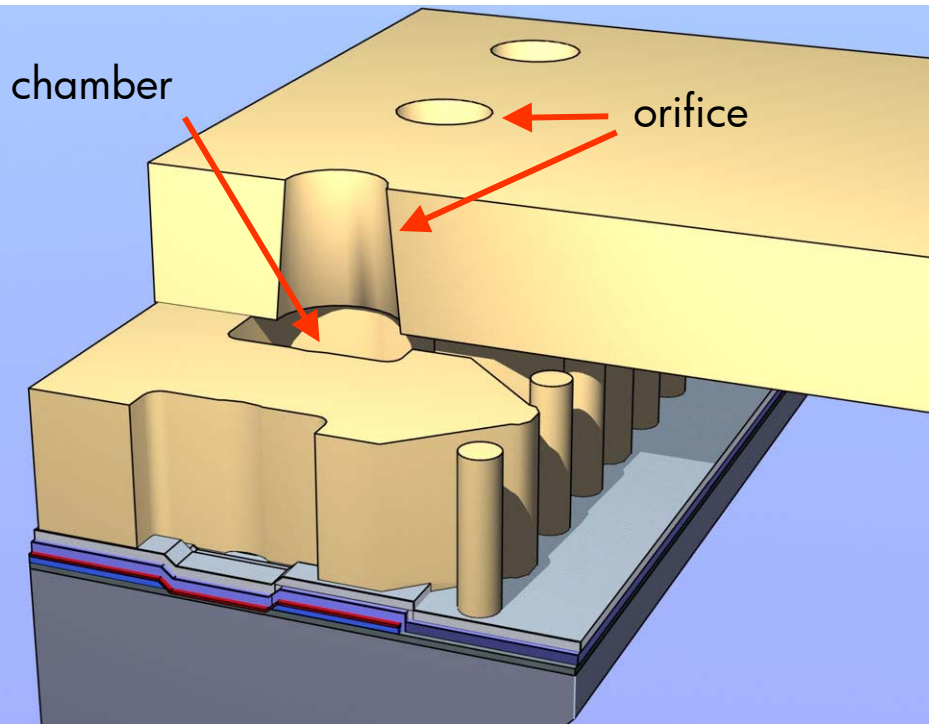
Making an SPT Inkjet Printhead (2)
drop generator chambers, channels, and pillars

chamber

ink channel

pillar (filter)
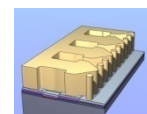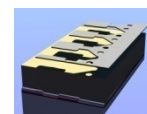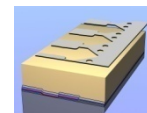
- apply photosensitive epoxy layer

- use a negative exposure mask

- expose

- chemically develop unexposed areas

Making an SPT Inkjet Printhead (3)
orifices

chamber

orifice

- fill chambers with "wax" to stabilize structures

- add photosensitive epoxy layer

- use a negative exposure mask

- expose

- chemically develop unexposed areas

- remove "wax"

SPT: a monolithic printhead assembled with submicron precision

HP Scalable Printing Technology
detail of drop generator and particle filters

- small feature size for high nozzle density and high printing speed
- filters help guarantee reliability over the life of the printer

Inlet: 9um

Orifice: 14.4um

Mesh filter (not shown) 1st filter

Example: a red blood cell ~ 8um

Example: toner, HP Color LaserJet

Off-shelf pillar: 2nd filter

On-shelf pillar: 3rd filter
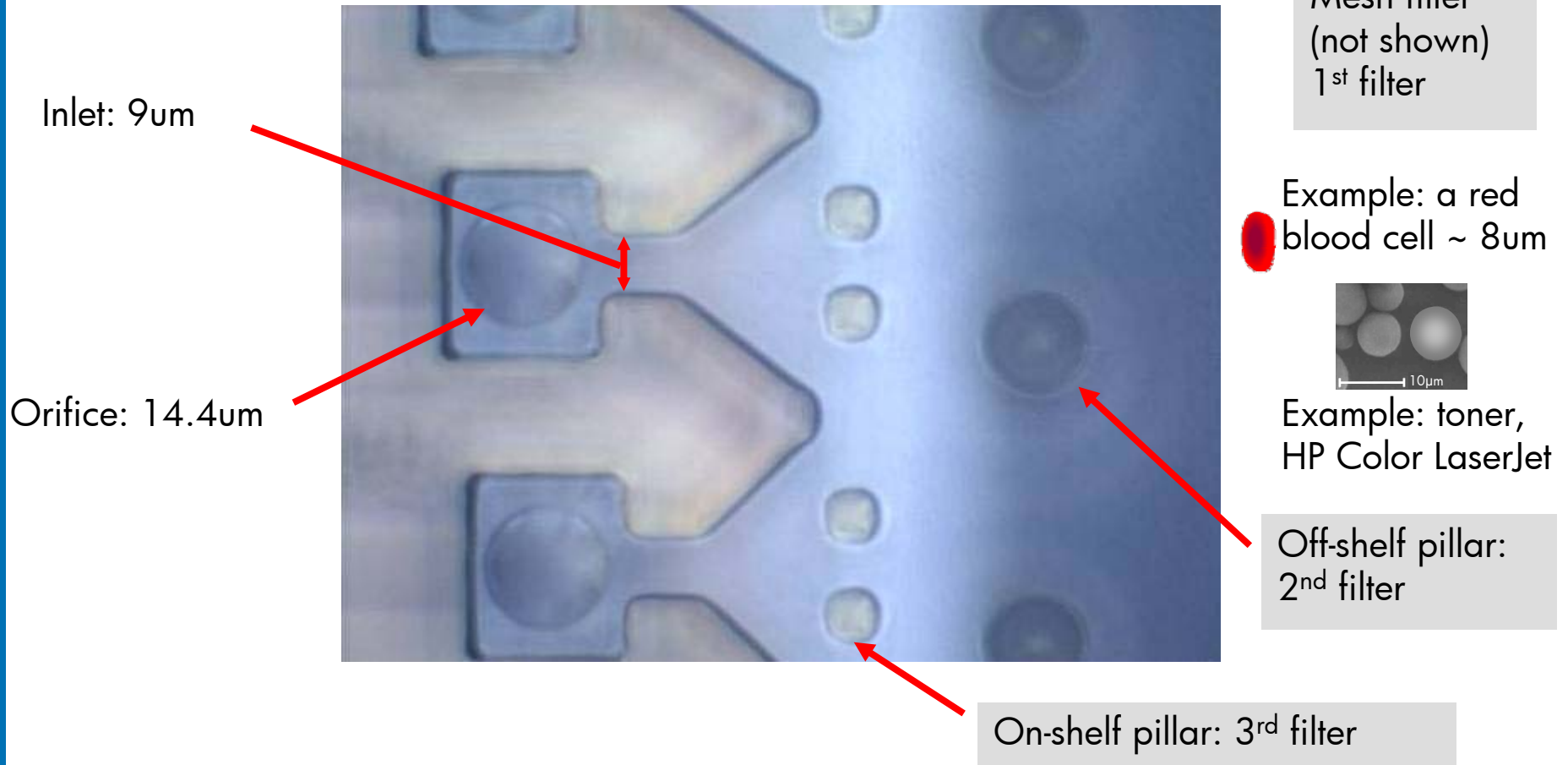
HP Scalable Printing Technology
4.25-inch Printhead: design details

- Printhead design is used in
  - HP Edgeline MFPs
  - HP Designjet L65500 with HP Latex Inks
  - HP Inkjet Web Press
- 5 HP Thermal Inkjet ("TIJ") Die
  - 1,200 nozzles per inch
  - 2 columns of 5,280 nozzles each
    - one ink: redundant nozzles
    - two inks: 2-color printhead
  - integral ink filters ("pillars")

TIJ Printhead

1200 npi

4.25 in.

(2) ink supply ports

(2) on-board ink supply pressure regulators

pillar

ink flow
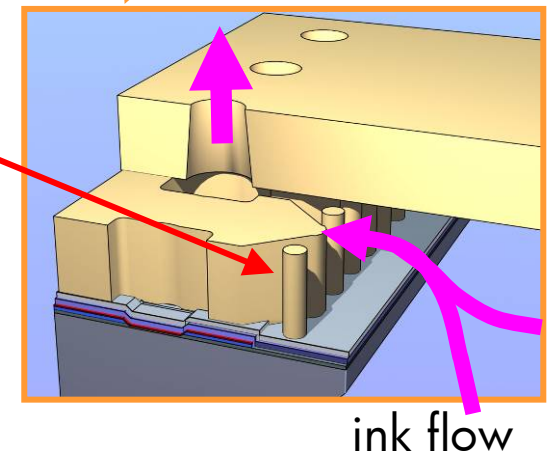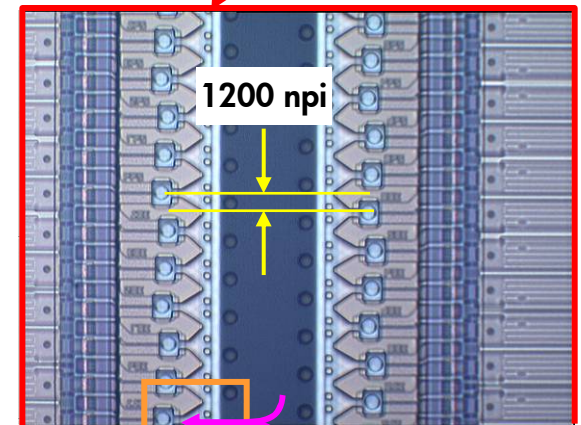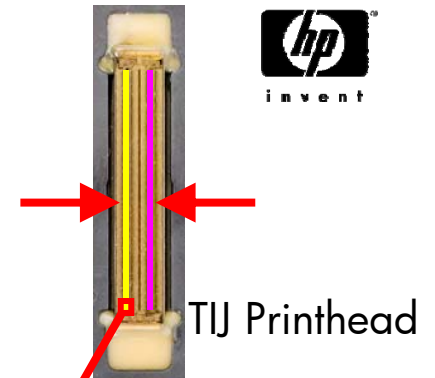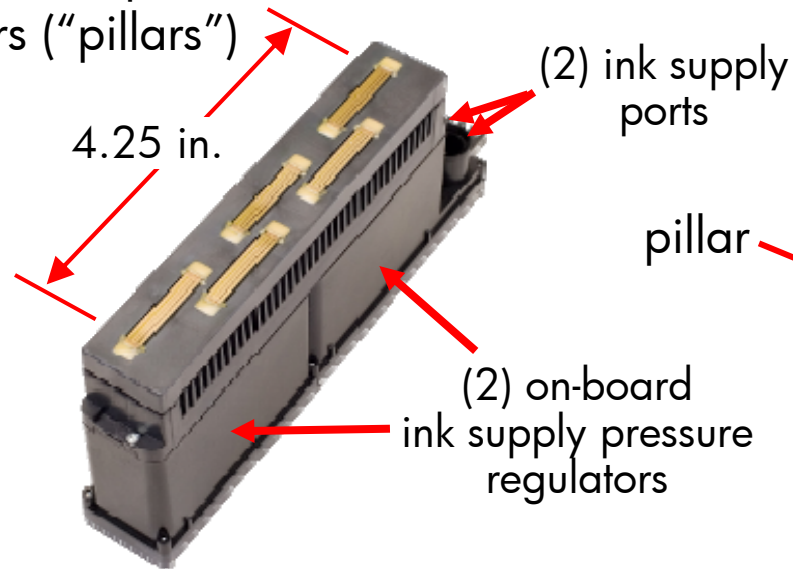
HP Latex Printing Technology

HP Latex Printing Technologies
overview

- "Latex" is a descriptive term for <u>aqueous-dispersed polymers</u>
  - polymer particles are dispersed (suspended) in the ink
  - the polymer in HP Latex Inks is synthetic and chemically different from natural rubber latex
  - HP Latex Inks are non-allergenic

- HP Latex Inks are <u>water-based</u>
  - designed to print on low-cost, uncoated, solvent-compatible media

  - Drying and Curing: HP Latex Inks vs. traditional water-based inks
  - HP Latex Inks require curing with heat inside the printer
    - ink vehicle is evaporated; latex particles coalesce into a durable film
    - prints made with HP Latex Inks are completely dry and ready-to-use out of the printer on all media
  - prints made with traditional water-based inks dry by evaporation or absorption of the ink vehicle
    - prints on swellable-coated or absorptive media (e.g., papers, etc.) must be dried outside the printer in air or by heat and forced air
    - porous-coated media absorb ink vehicle; prints are dry-to-touch out of the printer
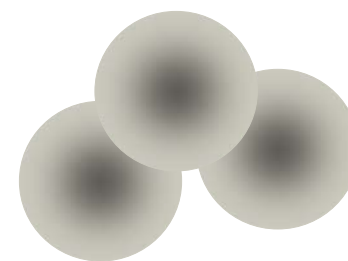
HP Latex Printing Technologies
overview

- Performance is comparable to solvent ink technologies*
  - indoor, in-window/outdoor display permanence
  - scratch-, smudge-, and water-resistance
  - color gamut
- High productivity and reliability
  - outdoor-quality prints at approx. 800 sq. feet/hour**
  - indoor-quality prints at approx. 400 sq. feet/hour**
  - HP Wide Scan Printing Technology
    - high image quality at high speed
  - HP Thermal Inkjet printheads
    - user-replaceable
    - snap-out / snap-in maintenance
  - no manual daily maintenance is required
    - printers using HP Latex Inks and HP Wide Scan Printing Technology employ fully-automatic printhead testing and maintenance systems.
  - prints are dry and ready-to-use right out of the printer
    - prints are odorless***

* HP image permanence and scratch, smudge, and water resistance estimates by HP Image Permanence Lab. Display permanence tested according to SAE J1960 using HP Latex and solvent inks on a range of media, including HP media; in a vertical display orientation in simulated nominal outdoor display conditions for select high and low climates, including exposure to direct sunlight and water; performance may vary as environmental conditions change. Scratch, smudge, and water resistance tested using HP Latex and solvent inks on a wide range of HP media. Laminated display permanence using Neschen Solvoprint Performance Clear 80 laminate. Results may vary based on specific media performance. For more information, see www.hp.com/go/supplies/printpermanence.
** Outdoor-quality speed based on printing in 2-pass unidirectional print mode; indoor-quality speed based on printing in 4-pass unidirectional print mode.
*** Printers using HP Latex Inks use internal heaters to dry and cure the latex polymer film. Some substrates may have inherent odor.

HP Latex Inks
a new category of commercial printing solutions

- HP Latex Inks provide the benefits of solvent-ink technology —like outdoor durability—without imposing the environmental, health, and safety considerations
  - no special handling required
    - contain no materials requiring hazard warning labels (world-wide)
    - non-flammable and non-combustible
  - extremely low VOC emissions
    - co-solvents and their concentrations in HP Latex Inks are similar to HP's aqueous Designjet inks used WW in office environments without special ventilation
  - prints are odorless* and dry, ready-to-use out of the printer
  - no special work space ventilation is required**
  - no ozone emissions***
  - no Hazardous Air Pollutants (HAPs)***
  - comply with Nordic Swan certification
  - ink cartridges designed to reduce use of materials and to maximize usable ink

  * Printers using HP Latex Inks use internal heaters to dry and cure the latex polymer film. Some substrates may have an inherent odor.
  ** Special ventilation is not required to meet US OSHA requirements on occupational exposure to VOCs from HP Latex Inks. Ventilation equipment installation is at the discretion of the customer—no specific HP recommendation is intended. Typically no air discharge permitting is required with inks that emit extremely low VOCs. Customers should consult state and local requirements and regulations.
  *** No ozone products expected based on ink composition and printing technology; HAPs per US Environmental Protection Agency Method 311.

HP Latex Inks
liquid and solid components

HP Latex Inks deliver performance similar to HP low-solvent* inks using a water-based ink vehicle, co-solvent concentration similar to HP's aqueous Designjet inks, and HP's innovative Latex (dispersed) polymer technology

Colorant — solids
- pigments

Latex (dispersed polymer)

Additives — liquids
- wetting agents
- humectants

Co-solvents for aqueous inks

Water

500ml
400
APPROXIMATE VOLUMES
300
200
100
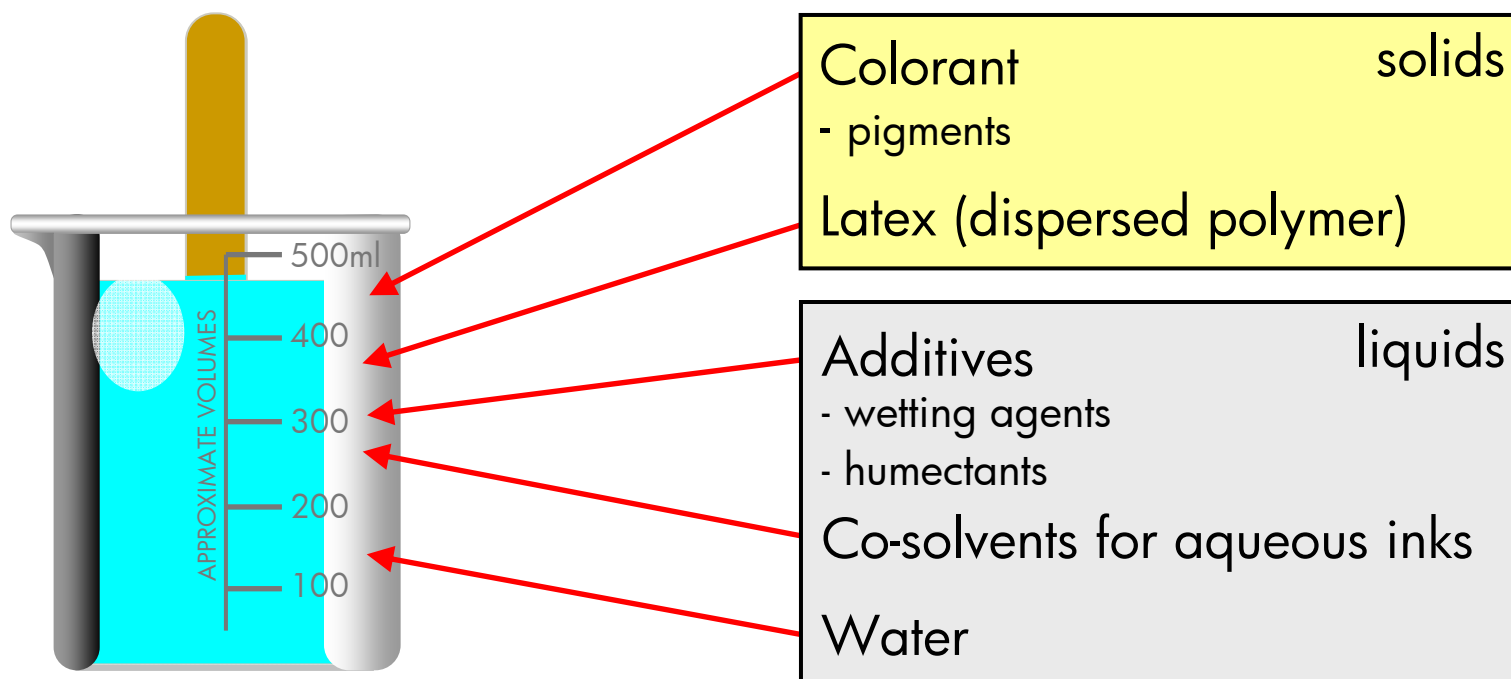
(figure does not represent exact proportions)

* HP low-solvent inks are used in the HP Designjet 8000s-, 9000s-, and 10000s-series printers

HP Latex Inks
liquid components

- The ink vehicle is a blend of water (~70%), co-solvents for aqueous inks (<30%), and additives

- Working together, liquid ink components deliver:
  - consistent drop ejection (weight, speed, trajectory)
    - wet inside the drop generators (minimizes de-primes)
    - provide fluid viscosity and surface tension for optimal TIJ* printhead performance
    - clean the surface of the TIJ heater resistor
    - minimize viscous plugs of ink in the nozzle
  - controlled ink-media interactions
    - wet the surface of the print medium for dot size and color bleed control
    - soften vinyl for high colorant film adhesion
   - evaporate quickly to form a durable film for dry and ready-to-use prints right out of the printer

* HP Thermal Inkjet

water   co-solvents   additives

wet   soften   dry
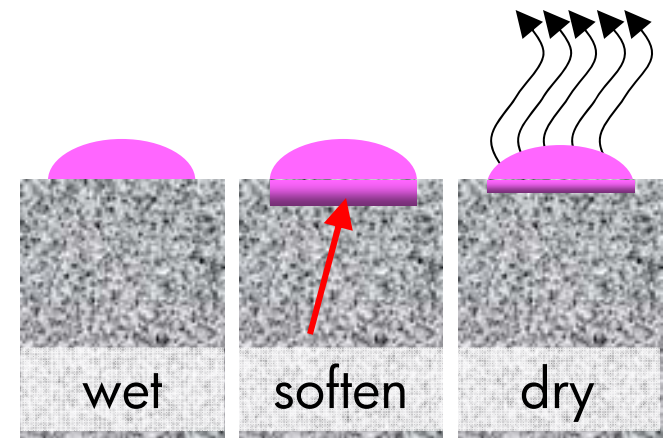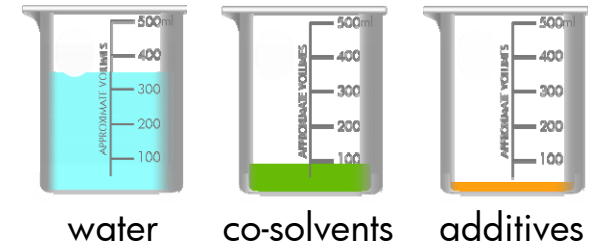
HP Latex Inks
solid components

latex

C M Y K

lc lm

- Latex particles
  - developed by HP for reliable drop ejection and high print durability
  - produce a high molecular weight polymer film*
    - latex bonds to surface of both non-absorbent media (vinyl) and absorbent/coated media
    - particles coalesce on the media with evaporation of the ink vehicle and heating to create a continuous film
    - film encapsulates pigment particles
      - very good scratch resistance
      - excellent water resistance
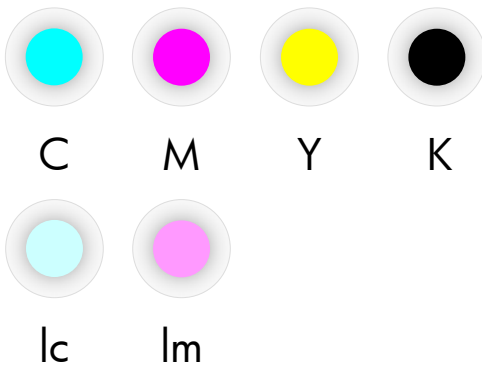
- Pigment particles
  - 4-color, 6-color (and more) writing systems
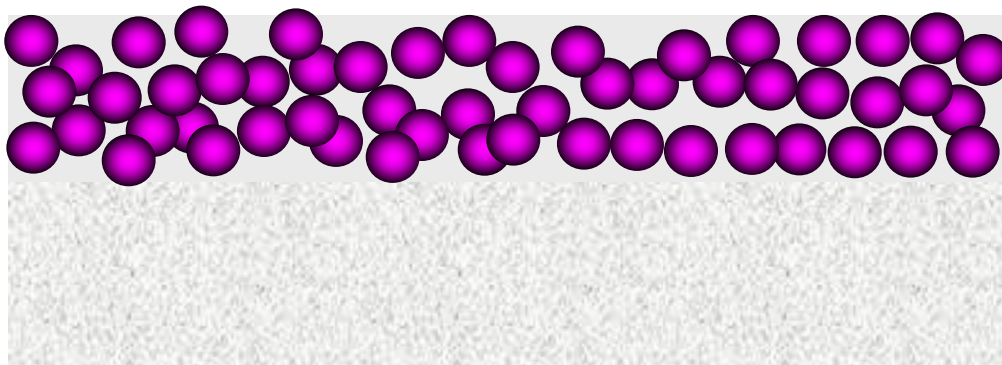 - higher pigment loading than most aqueous HP Designjet inks

* HP Latex film MW is typically higher than for solvent inks

HP Latex Inks
image formation process

(schematic drawing is not to scale)

- Ink drop makes a colored dot on the media surface

- Ink vehicle softens vinyl for good film adhesion

- Print Zone Heater evaporates water from the ink vehicle
  - ink forms a thin liquid film on the media surface
  - pigment particles are dispersed throughout the film
  - dot is "fixed" to prevent color bleed and dot coalescence

- Curing Zone Heater causes latex particles to form a continuous film on the media
  - co-solvents evaporate
  - latex particles coalesce
  - pigments are encapsulated
  - print is now dry and durable

HP Latex Inks
durability and display permanence[*]

- Prints produced with HP Latex Inks achieve durability and display permanence comparable to solvent ink technology

- Durability*
  - scratch, smudge, and water-resistant on a range of HP media

- Display permanence
  - outdoors: up to 3 years unlaminated and up to 5 years laminated on a range of media*
  - indoors: in-window up to 5 years unlaminated and up to 10 years laminated on a range of media**

* HP image permanence and scratch, smudge, and water resistance estimates by HP Image Permanence Lab. Display permanence tested according to SAE J1960 using HP Latex and solvent inks on a range of media, including HP media; in a vertical display orientation in simulated nominal outdoor display conditions for select high and low climates, including exposure to direct sunlight and water; performance may vary as environmental conditions change. Scratch, smudge, and water resistance tested using HP Latex and solvent inks on a wide range of HP media. Laminated display permanence using Neschen Solvoprint Performance Clear 80 laminate. Results may vary based on specific media performance. For more information, see www.hp.com/go/supplies/printpermanence .

** Interior in-window display ratings by HP Image Permanence Lab on a range of media including HP media. HP in-window predictions based on test data under Xenon-Arc illuminant. Calculation assumes 6,000 Lux/12 hr day. Laminated display permanence using Neschen Solvoprint Performance Clear 80 laminate. For details: www.hp.com/go/supplies/printpermanence.

HP Latex Inks
durability and display permanence[*] (Legal Edition)

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HP Wide Scan Printing Technology
scalable industrial writing systems

Color Print Order

Y M lm lc C K

scan

- **HP Wide Scan Printing Technology:**
  - Wide, scanning printhead arrays
    - 1,200 dpi (V)
    - high nozzle count (5,280/color)
    - high area coverage per swath
    - longer media moves (advances) between swaths
  - HP Optical Media Advance Sensor
   - provides the breakthrough in media positioning accuracy necessary for long advances

- **Wide Swath + Accurate Media Advance = High Quality at High Speed**
  - outdoor-quality: ~800 ft²/hr *
  - indoor-quality: ~400 ft²/hr *

- **High reliability for high printer up-time**
  - HP Latex Inks and HP Wide Scan printheads were developed together
  - HP Wide Scan Printheads are user-replaceable
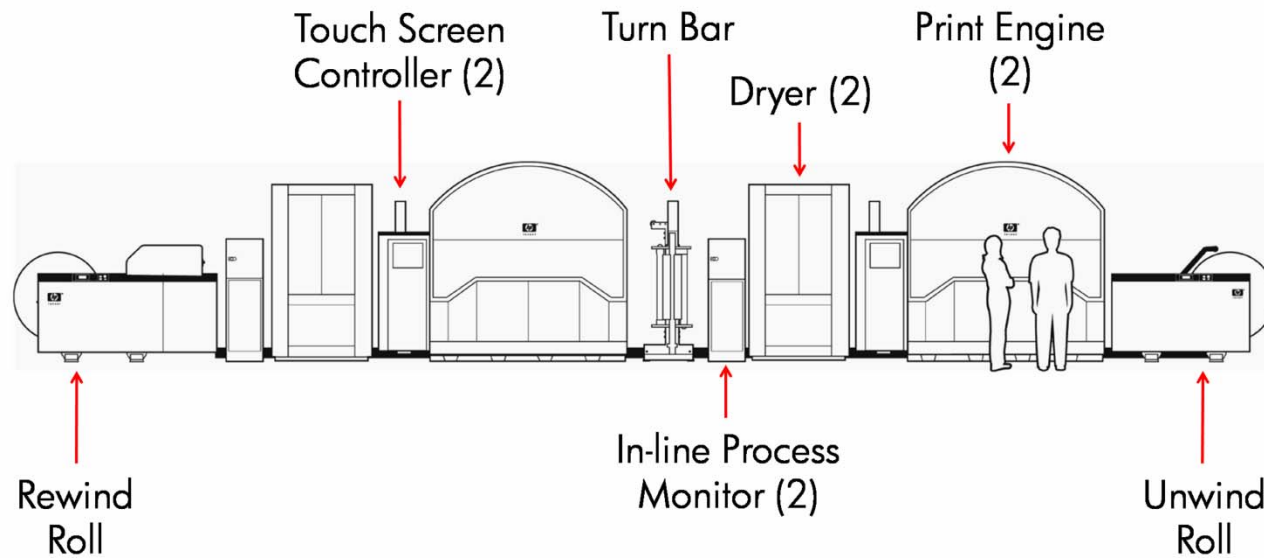 - Printheads are automatically tested and serviced
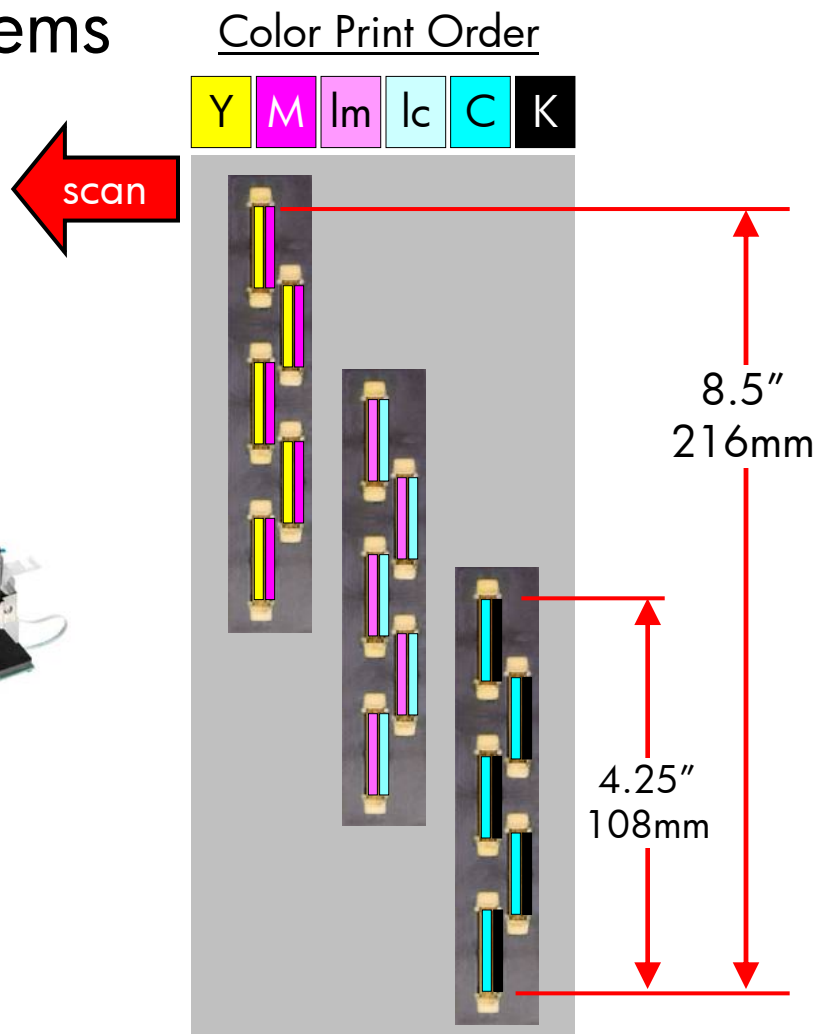
8.5"
216mm

4.25"
108mm

*outdoor-quality speed based on printing in 2-pass unidirectional print mode; indoor-quality speed based on printing in 4-pass unidirectional print mode.

HP Inkjet Web Press

HP Inkjet Web Press
overview

- Prints a 30-inch web at speeds up to 400 feet/minute
- 600 dpi, duplex 4-color printing
  - HP Bonding Agent for uncoated stock
- Uses HP's 4.25-inch SPT-based printheads
- Fault-tolerant design
- In-line process monitoring
- Raster image processing and process control at full press speed
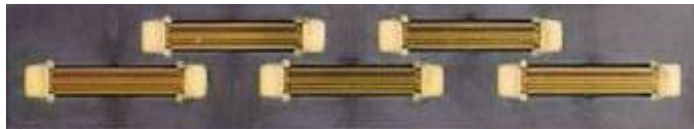 - HP Blade Server-based controllers

HP Inkjet Web Press
built on HP's Core Technologies: Print + IT

- Moore's Law for Printing

  – Scalable Print Technology
    - Fault tolerance
    - Load balancing

- Moore's Law for IT

  – Scalable blade servers
    - Fault tolerance
    - Load balancing

HP Printheads for Web Press
## design details

- Printhead Module
  - 5 HP Thermal Inkjet die
    - core technology and production leveraged from HP Retail Photo Kisoks, MFPs, and LFPs
  - precision die-to-die alignment
    - dies mounted on a flat, rigid ceramic substrate
  - 1,200 nozzles per inch
  - 2 columns of 5,280 nozzles each
    - 10,560 total nozzles per color
    - built-in fault tolerance
  - 4.25-inch (108 mm) print swath
  - up to 24K drops/sec/nozzle
- Snap-in/Snap-out design
  - printhead is user-replaceable
  - fully-modular printhead pocket
    - mechanical registration and lock-down
    - electrical connections
    - ink supply connections
  - no manual mechanical adjustments required
    - fully-automatic with in-line process monitoring system

ink supply port

4.25 inches

5280 nozzles

5280 nozzles

electrical interconnect

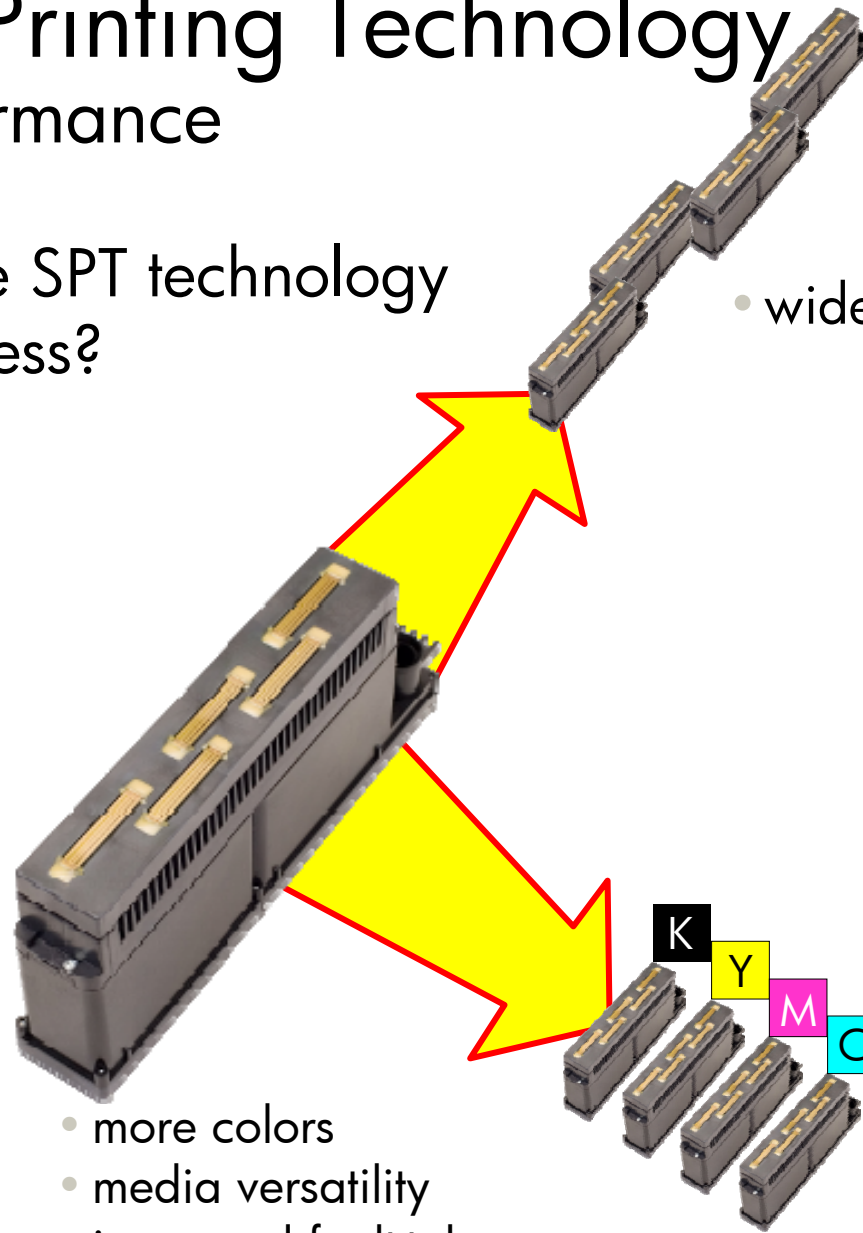on-board ink pressure regulator
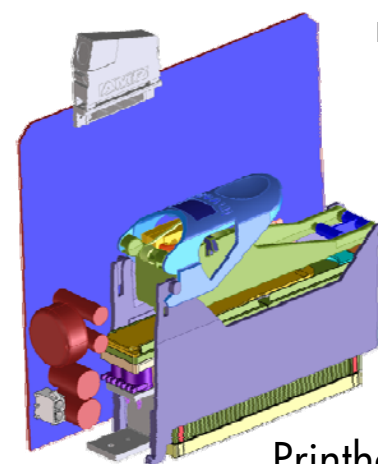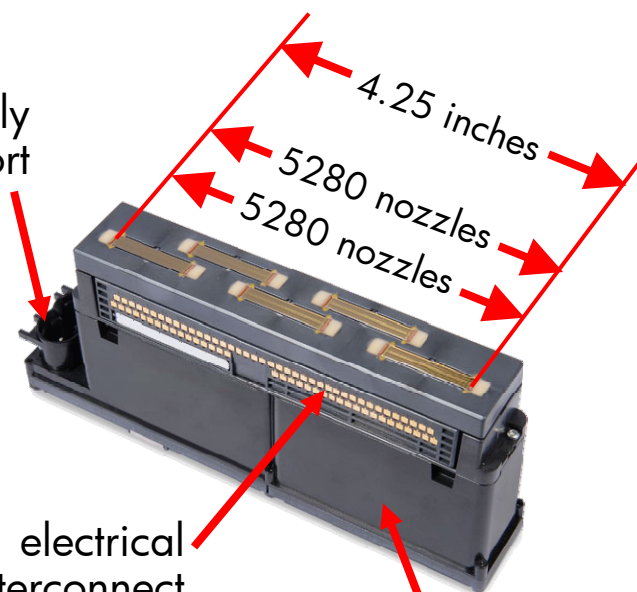
Printhead "Pocket"

HP Scalable Printing Technology
scalable in performance

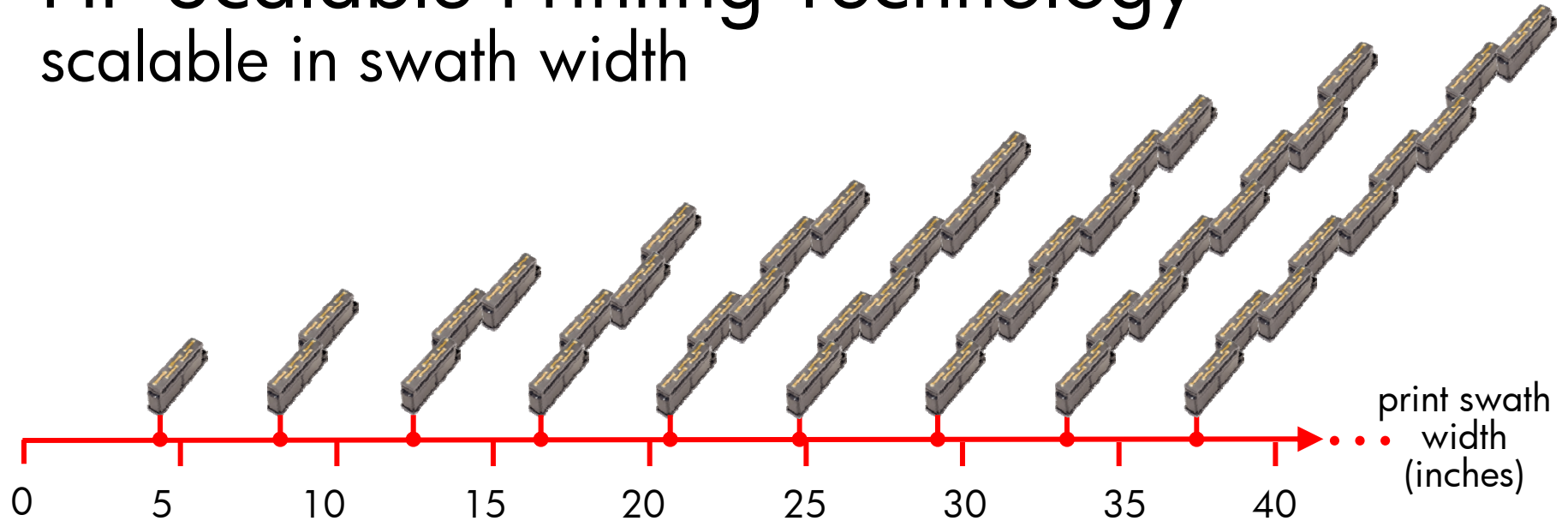Where can HP take SPT technology in an inkjet web press?

- wider print swath

- more colors
- media versatility
- increased fault-tolerance
- higher web speeds

HP Scalable Printing Technology
scalable in swath width

print swath width (inches)

0   5   10   15   20   25   30   35   40

- Assembling printheads <u>across the web</u>
  - prints across web width without a gap
  - fully-modular printhead "pocket"
  - snap-in, snap-out printhead replacement
  - replace only printheads that require maintenance, not the entire printbar
    - in-line process monitoring identifies printheads to be replaced
    - printheads are user-replaceable
- Automatic printhead alignment across the web
  - using in-line process monitoring system

Printhead "Pocket"

Print Bar
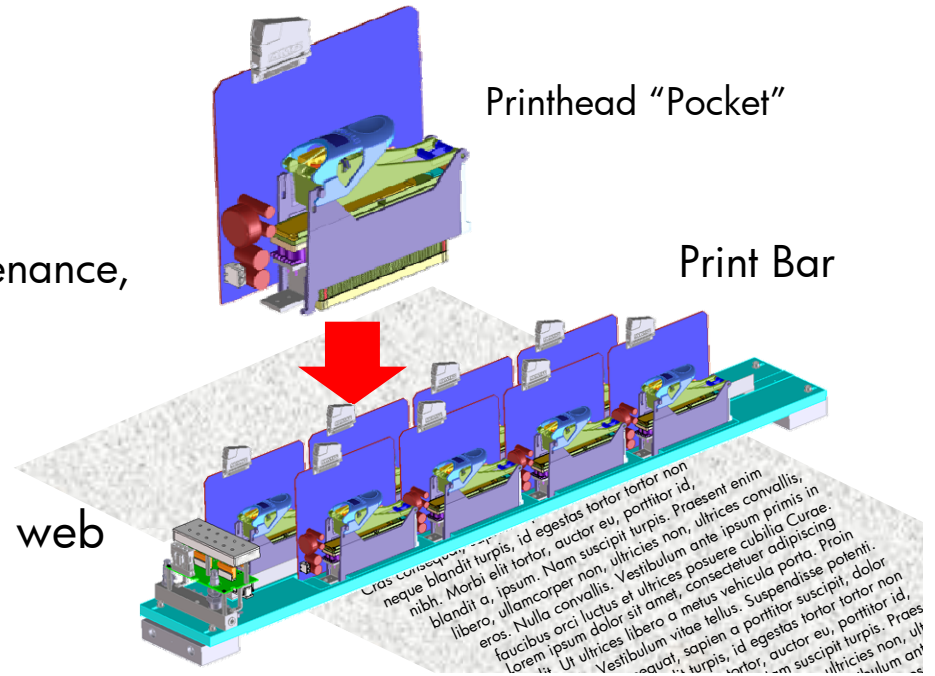
HP Scalable Printing Technology
## scalable in performance and features
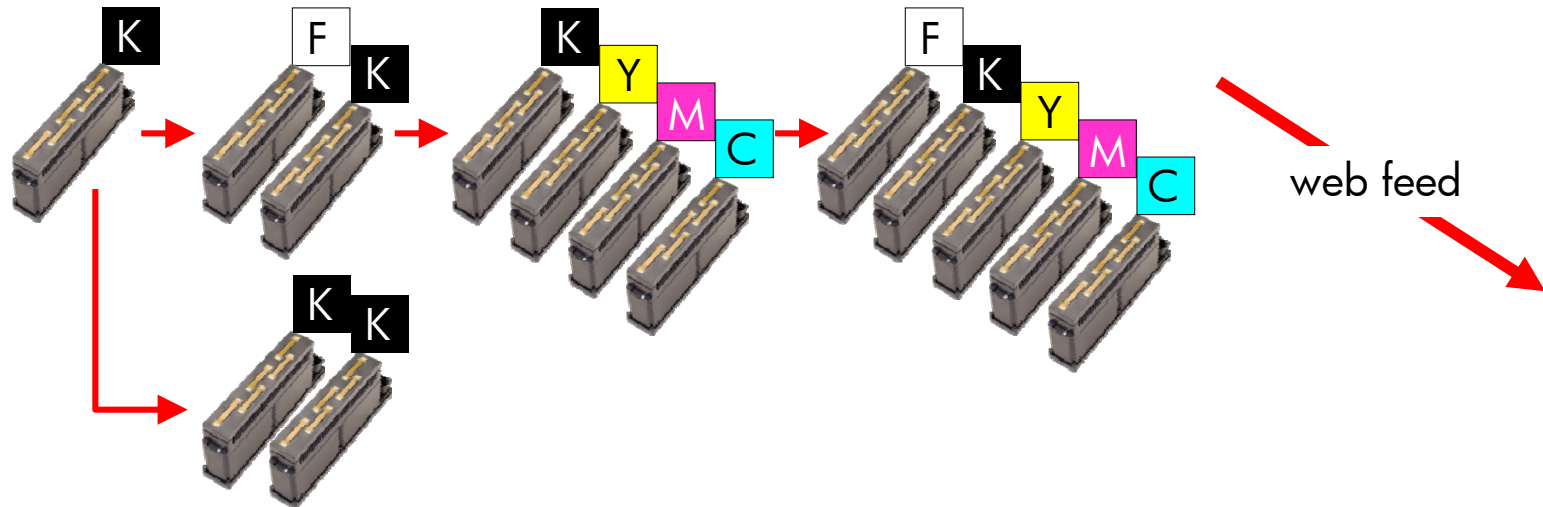
- Assembling printheads <u>along the web</u>
  - color options and media versatility
    - monochrome
    - monochrome + bonding agent (F) on uncoated media
    - color configurations: 4-color, 4-color + F
  - tandem printheads
    - higher web speeds
    - improved fault-tolerance
- Automatic printhead alignment along the web
  - using in-line process monitoring system

HP Scalable Printing Technology
## tandem architecture

web feed
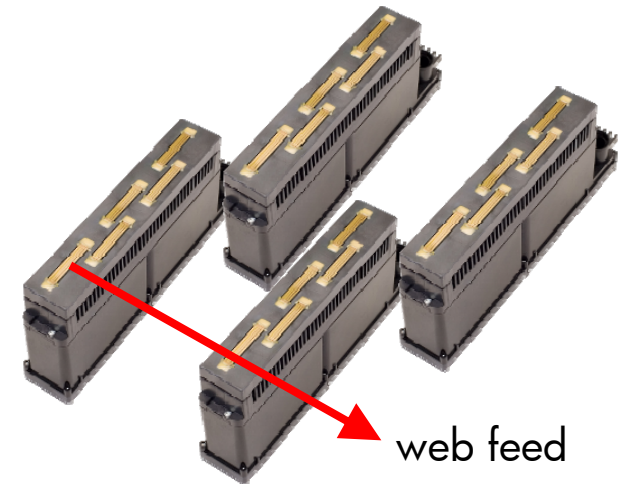
- Multiple nozzles per color address each 1/600" dot row
- Improved fault-tolerance
  - in-line process monitor automatically detects weak or missing nozzles
  - self-correcting: good nozzles automatically replace weak/missing ones
- 2-pass quality in single-pass printing
- Higher web speeds
- Lower printhead duty cycle for longer service life

HP Scalable Printing Technology
## writing system

- Web speed up to 400 feet/minute
- 600 dpi
- Example configuration:
  - C M Y K + Bonding Agent (F)
  - tandem printbars
  - ~70,000 active nozzles per color
  - 7 printheads on each printbar
  - 70 printheads
  - 2-pass print quality in a single pass
- Arched paper path
  - paper tensioning
  - paper positioning
  - printhead-paper spacing
- In-line dryer for each print array
- In-line process monitoring
  - fully-automatic print quality measurement and performance control

web feed

F

K

Y

M

C

web in

web out
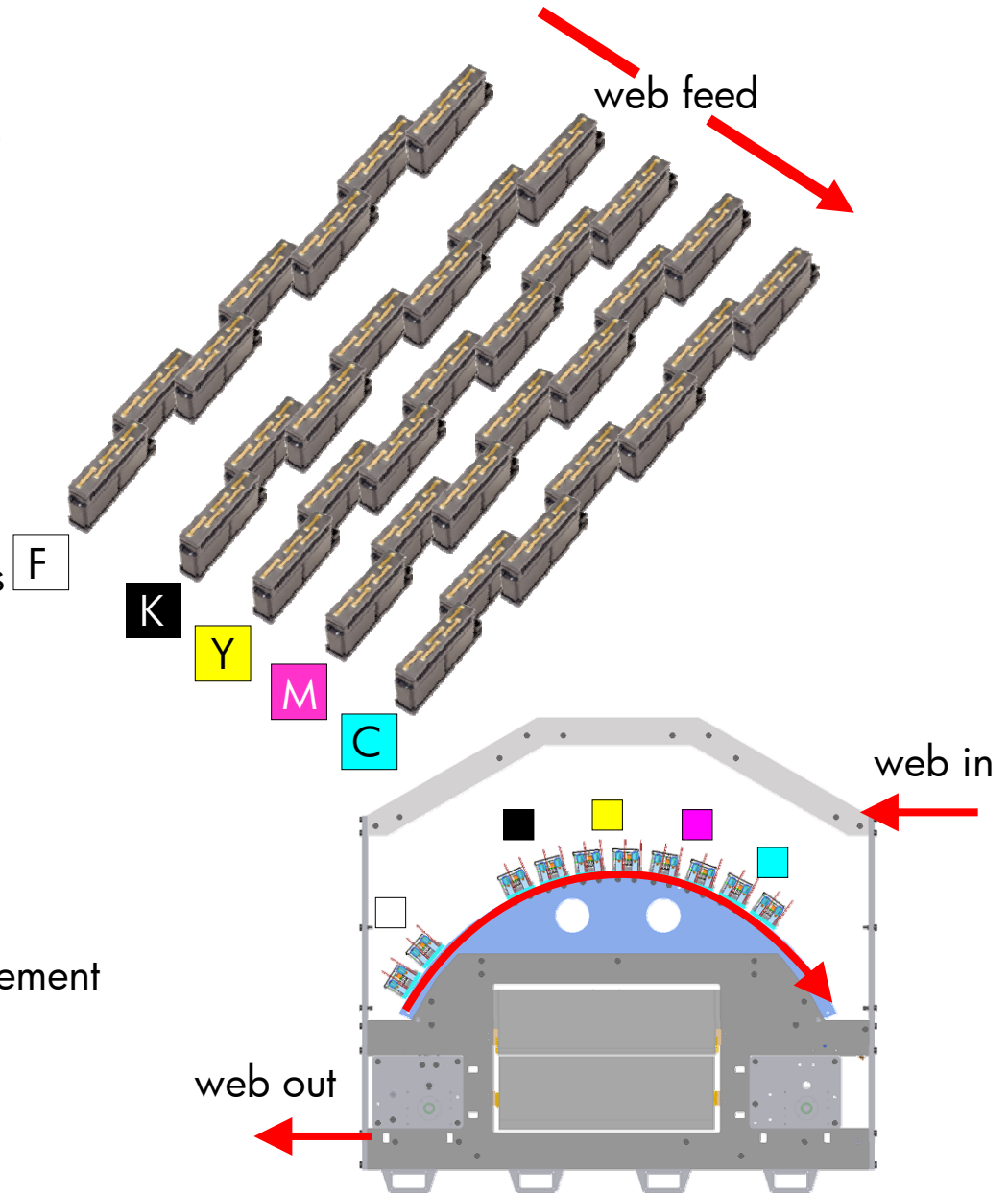
HP Pigment Inks
uncoated paper performance

- Water-based ink formulation
  - extremely low VOCs
  - no ozone, no hazardous air pollutants*
  - no ventilation required to manage occupational exposure to VOCs**
  - non-flammable and non-combustible

- Inks work with HP Bonding Agent on uncoated papers

- Compared to Euroscale Uncoated gamut:
  - better black optical density
  - larger color gamut

- Durability
  - smudge-resistant
  - water-resistant
  - highlighter-resistant
  - suitable for direct mail and book production
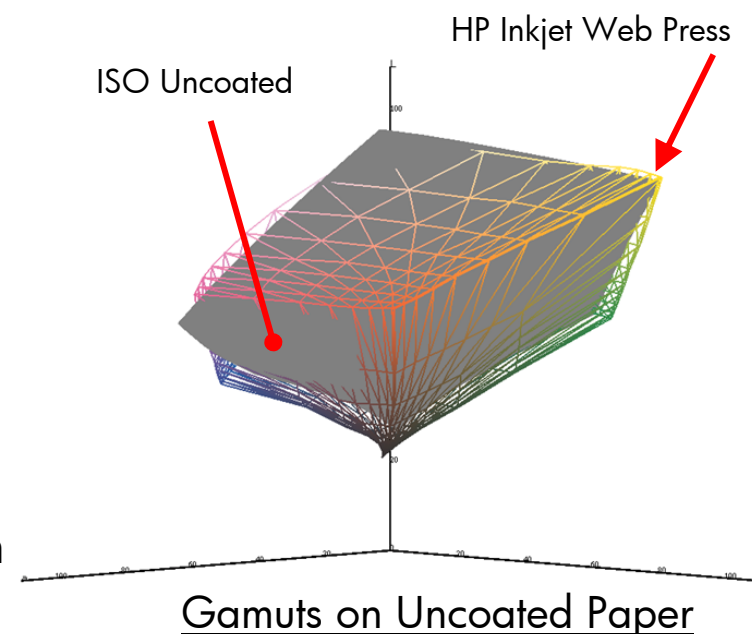
ISO Uncoated

HP Inkjet Web Press

Gamuts on Uncoated Paper

* No ozone products expected based on ink composition and printing technology; HAPs per US Environmental Protection Agency Method 311.
** Special ventilation is not required to meet US OSHA requirements on occupational exposure to VOCs from HP Latex Inks. Ventilation equipment installation is at the discretion of the customer—no specific HP recommendation is intended. Typically no air discharge permitting is required with inks that emit extremely low VOCs.

Bonding Agent
features and benefits

- Printed only where ink is applied

- Chemically reacts with HP pigment inks
  - effectively gives coated paper performance
  - improves image durability

- What it does:
  - controls ink penetration
  - controls dot spread
  - reduces strike-through
  - improves print optical density
  - reduces feathering

<u>Microscopic Cross-sectional Views of Uncoated Paper</u>

Colorant

(plastic encapsulant for cross-section preparation)
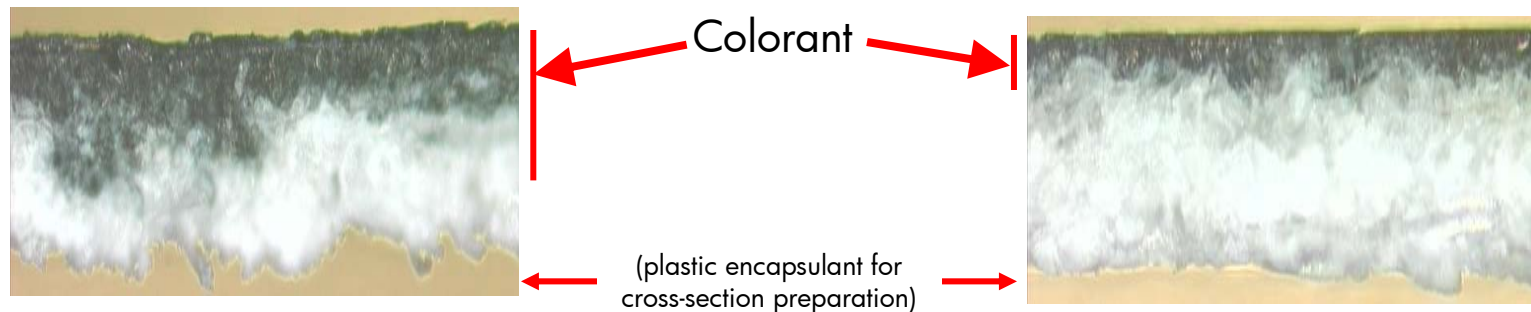
<u>Printing without HP Bonding Agent</u>

- Colorant penetrates into paper

<u>Printing with HP Bonding Agent</u>

- Colorant remains near the surface and binds to the paper

Image Source: HP R&D

HP Inkjet Web Press Technology
## writing system module

- Built-in ink filtration and degassing systems

- Arched paper path stabilizes paper moving through the print zone
    - reduces effects from wet cockle
    - controls printhead-paper spacing

- Automatically moves printbars into printing and servicing positions

- Built-in printhead service stations
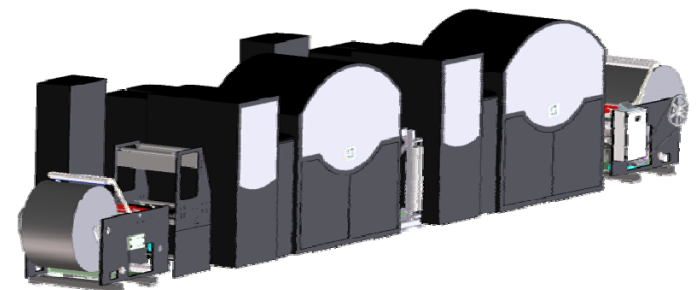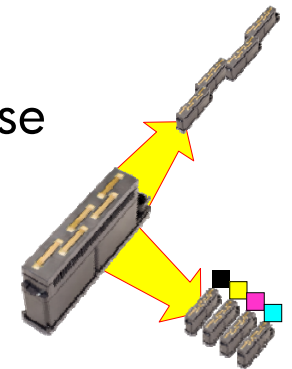
- Ink aerosol management
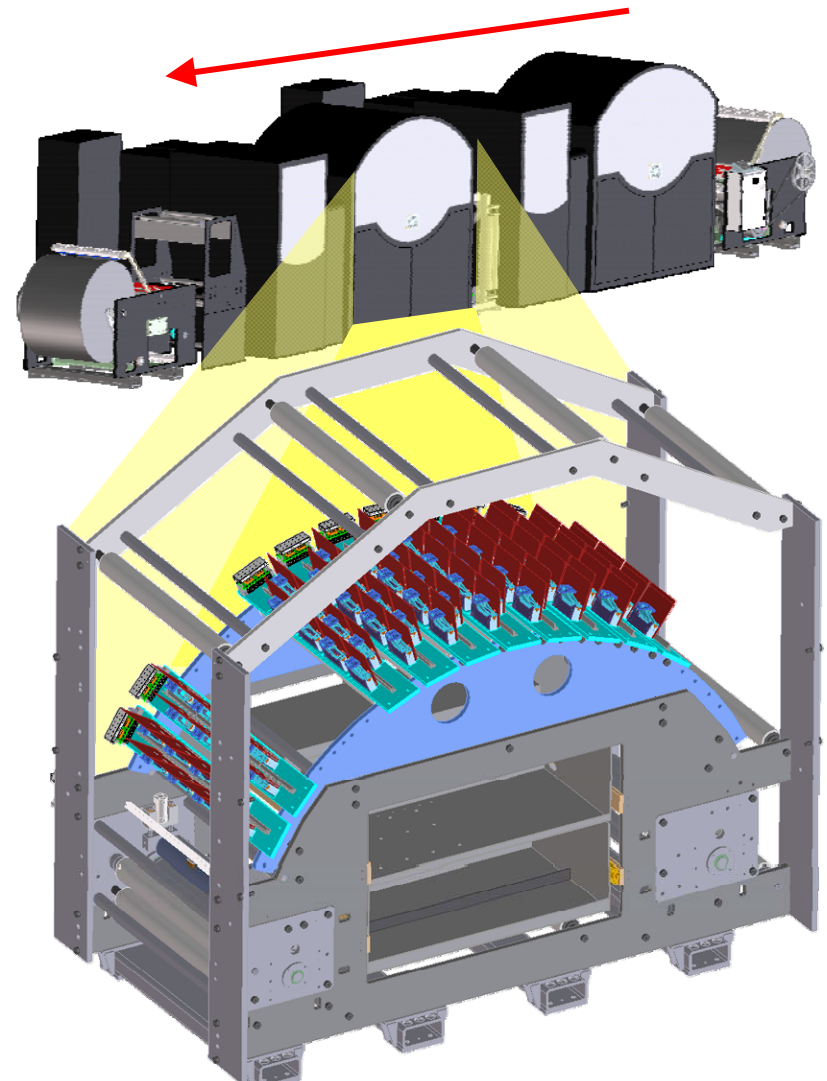
In-Line Process Monitoring Module
features

- Installed in-line after each print engine
- Synchronized with print engine controller
  - for test pattern type and location
  - RGB LED light bars
    - illumination is synchronized to color of test pattern for maximum image contrast
- Calibration and operational feedback
  - document content verification
  - closed-loop color calibration
    - matches desired output tone response
  - optical density uniformity across the web
  - nozzle-to-nozzle alignment when one or more printheads are replaced
    - within a primary and color-to-color
  - individual nozzle health
    - dot presence and placement
  - on-the-fly nozzle check
    - print quality acceptability
  - web width and position verification

camera, optics, control electronics

light bars

inspection roller

web
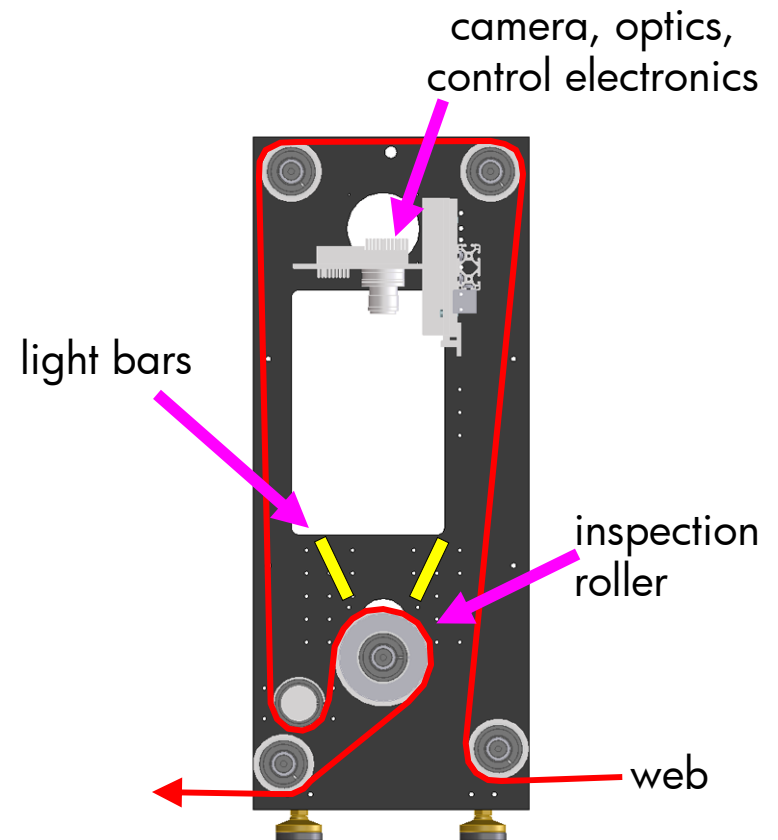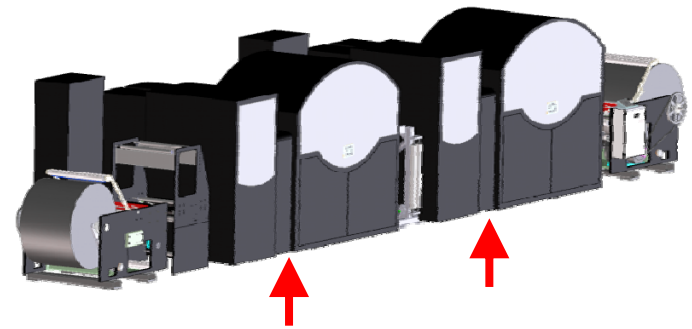
Take-away Messages

- HP's Scalable Printing Technology extends HP's core inkjet technologies into industrial printing solutions
  - industrial solutions benefit from HP's manufacturing expertise and economies of scale

- With SPT, HP's Inkjet Web Press offers performance scalable in features, speed, and web width

- HP pigment inks and bonding agent give coated paper print quality on uncoated stock

- In-line performance monitoring and control assure consistent performance and fault-tolerant web printing

Thank you