Introduction to Print Processes
Overview of the Printing Processes

Major Processes:
1. Relief (Letterpress and Flexography)
2. Planographic (Offset Lithography)
3. Intaglio (Gravure)
4. Stencil (Screen Printing)
5. Digital Printing
Digital Workflow Production

Relief (Letterpress and Flexography)

- Oldest Printing Process
- All image areas are raised in relief above non-image areas

Rubberized relief plate
Planographic (Offset Lithography)

• Most widely used process.
• Image and non-image are on the same plane.
• “Oil and water don’t mix”
• Chemical differences
• also waterless lithography.
**Intaglio (Gravure)**

- Etched image areas form reservoirs to receive ink.
- High run length
Stencil (Screen Printing)

- Ink passes through image areas.

- Virtually any surface, shape, size, or thickness can be printed.
Direct Digital Printing

- Short run, on-demand, variable information
- Imaging from fully composed digital files direct to the press.

- Examples
  - Xeikon DCP-32, 50
  - Indigo E-print 1000
  - Agfa Chromapress
  - Heidelberg GT0-DI
  - Docutech 6180 and DocuColor 2060
  - TR Systems MicroPress
Digital Workflow Production

Generic digital press

Indigo E-Print 1000
Digital Desktop Printers

- In some circumstances, may be the final output.

- Types:
  - Laser / Color Laser
  - Ink Jet
  - Dye Sublimation/Diffusion
  - Phase Change
  - Thermal Wax Transfer
Introduction to Workflow
Digital Workflow Production

Conventional
[ analog ]

- Project Planning
- Design
- Photographs
- Illustrations
- Typography
- Mechanical
- Sales
- Estimating
- Planning
- Scheduling
- Process Camera
- Trapping
- Stripping
- Film Flat
- Plate
- Press
- Finishing
- Shipping

Illustration adopted from PPP by P. Muir
Digital Workflow Production

Digital [ electronic ]

- Project Planning
  - Design
    - Text
    - Art
      - Scan
      - Raster
      - Vector
      - Page Layout
    - Customer Service
    - Preflighting
  - Estimating, Planning, Scheduling
    - Trapping
    - Imposition
    - Server
    - RIP
    - Film
    - Plate
    - Press
  - Finishing
  - Shipping

Illustration adopted from PPP by P. Muir
Prepress Systems

- **Operating System**
  examples ???

- **Hardware**
  examples ???

- **Software**
  Types ??? examples ???
File Formats

- BMP
- DCS (Desktop Color Separation)
- EPS (Encapsulated PostScript)
- GIF (Graphics Interchange Format)
- JPEG (Joint Photographic Experts Group)
- PDF (Portable Document Format)
- PICT
- Scitex CT (Continuous Tone)
- TIFF (Tagged Image File Format)
- TIFF/IT (Image Transfer)
- SVG (Scalable Vector Graphics)
- PNG (Portable Network Graphics)
Digital Workflow Production

Digital Type

- Bitmap
- TrueType
- PostScript Type 1
- PostScript Type 3
- Multiple Master
- Open Type
Today's Topics:

1. Standards in Printing
2. Planning
3. Color Models + Intro to Color Management
Standards in Printing
Why Standards?

• There are many variables in any printing process:
  - graphic repro, art/file origination, plates, substrate, ink, method/process, the human element . . .

• We need some basis for creation and production in order to achieve predictable and repeateable results.
Standards help identify common needs and addresses them with a set of guidelines that can be followed regardless of location in order to achieve repeatable and consistent quality. Effective communication is key.

Common Standards systems:

- **SNAP**
  Specifications (for) Non-Heat Advertising Printing

- **GRACoL**
  General Requirements for Applications in Commercial Lithography

- **SWOOP**
  Specifications for Web Offset Publications

- **FIRST**
  Flexographic Image Reproduction Standards and Tolerances
Some aspects of these standards:

- Film Required
- Screen Ruling/Frequency
- Screen Angles
- Film Identification
- Halftone Range
- Proofing Sequence
- Ink Density
- Printing Control Strips
- Dot Gain
- TAC
Digital Workflow Production

Job Planning
Planning a Project

- Even more crucial in a digital workflow

Variables:
1) Document creation and prepress
2) Digital Production variables
3) Non-digital production variables
Document creation and digital prepress variables

- Quality and control of image capture and input.
- Applications
- Image formats
- File Formats
- Fonts
- File transfer methods
- Platform and operating system support
- Digital Press specification
Digital Production variables
Some can be controlled by the content creator

- Dot Gain
- Trap and Overprint limits
- Solid Ink Densities
- Tone Reproduction Characteristics
- Colorant characteristics
Non-Digital Production variables

These fall under the control of the service provider.

- Schedule
- Quantities
- Finishing
- Price Breaks
- Special Requirements
- Training
Ways to control variables:

• Establish workflow and document standards
• Define Expectations
  - Price
  - Quality
  - Turnaround time
• Define Document Responsibility
• Establish guidelines for efficient files and preflighting.
Color Models
In a Digital Workflow, we deal with two main color spaces:

1) **Additive Color**

2) **Subtractive Color**
Digital Workflow Production

Additive Color:
The world of light.
Digital Workflow Production

Subtractive Color: The world of print
Many ways to describe these worlds of color:

• RGB
• CMYK
• L*a*b*
• HSB
• Others . . .
Comparison of Color Gamuts

- Think of a gamut as a chart of available colors.
- If you remember one thing, remember this chart.
Comparison of Gamuts of Conventional Process Printing (CMYK) vs. HIFI Color Printing
Color Management

An Introduction
**Color Management defined:**

The process of maximizing quality of color on each device in the reproduction chain.

- Color management is used to compromise what we can print and what we can see on screen without degrading the image.
Color Management Process:

1) Calibrate and Profile Monitors
2) Calibrate and Profile Scanners (input) and Printers (output)
3) Manage that color

What is the difference between calibrate and profile?

Calibrate: Standardize or linearize a device to ensure that it is working properly and to manufacturer’s specifications.

Profile: Measure the performance of a device to create a profile that describes the behavior of a device.

This allows for the most accurate color on a device.
Step One: a Calibrated Monitor

- This allows for consistency and repeatability.

- Once a monitor profile is generated, either by visual (human eye) means or by measurement device, it can then be accessed by ColorSync, an Apple system-wide color management application. Color Management is then used by all applications.
Step Two: Input Devices
Scanners and Digital Cameras

A target with known values is scanned or captured, and the differences between the original and as it was recorded are used to build the profile.
Step Three: Output Devices
Printers, Imagesetters, Presses

1) Calibrate the device, standardizing the process, linearizing both the imagesetter and platesetter.

2) Profile the device by printing a color target with known values and use profiling software to analyze the patches.

Each profile generated is only good for that specific set of variables.

Again, the original is compared with how the device reproduces it.
The profile becomes a “Process Engine” that converts color from one color space into the color space of the printing machine, usually CMYK.

Above: The Gretag MacBeth Spectroscan, a device used for reading the patches off a printed sample.
Color Managed Workflow

image capture
scanner

monitor
scanner profile
ICC
monitor profile
ICC

print
camera profile
ICC
monitor profile
ICC
print profile
ICC
Caveat:

Color management works best in a closed environment. Once that environment is opened, variables are introduced.

Color Mgmt. + Open environment = Color Manglement
Today's Topics:

1. Substrates (Paper)
2. Printing Inks
Digital Workflow Production

Substrates
**Substrate:**

Any material that is printed on, be it flat, two dimensional, or three dimensional.

**Two Main Categories:**

- **Porous:** ink is absorbed into the substrate  
  - ex: paper, both coated or uncoated
- **Non-Porous:** where ink sits on top of the substrate.  
  - ex: plastics
Focus on Paper:

- Main components:
  - Cellulose Fiber
    Think ground up trees.
  - Fillers/Additives
    These components add qualities to the paper.
    Ex: Surface smoothness, opacity, strength, stiffness, brightness, gloss, whiteness, folding endurance, etc.

- Felt side/Wire side
**Paper Specifications**

**Basis Weight:**
Standard set for referring to the different papers within a specific classification.

Ex: 20 lb. Bond = 500 sheets of 17” x 22” bond paper weighs 20 lbs.

When ordering paper:
- Quantity
- Size/weight
- Caliper
- Finish
- Color
- Grain Direction
- Special needs
Some Basic Sheet Sizes:

- **Bond/Writing/Ledger** 17” x 22”
  Lightweight paper in a variety of colors and surface textures. Prints better on the felt side and is not ideal for duplexing.

- **Book/Offset** 25” x 38”
  Wide range of sheets available in coated and uncoated. Has a higher opacity than bond.

- **Text** 25” x 38”
  Higher grade of paper in a wide range of weights, thickness, and textures.

- **Cover** 20” x 26”
  Heavier stock designed to match the colors and textures of other papers. Used for books and brochure covers, promo pieces, and business cards.
Relationship between Substrate and Ink:

- End Use Considerations
- Compatibility
- Equipment Influences
- Special Requirements for production process.

ex: Water is used in lithography
    Digital presses need smooth surfaces and have limited size capability.
Digital Workflow Production

Printing Inks
Requirements differ for each process

- Letterpress and Litho inks are "stiff-bodied"

- Gravure and Flexo inks are very fluid and dry primarily by evaporation of the solvent.

- Screen Printing inks are very heavy and thick.
Inks can be transparent or opaque, but all inks have three basic components:

1) Pigments
2) Vehicle
3) Drying compound

Other working properties include:

- Color
- Body
- Tack
- Length
- Drying
Points to Consider When Specifying Inks.

1. Printing Process
2. Type and speed of press
3. Paper type, grade, and finish
4. Ink finish desired (glossy, dull, transparent, opaque)
5. Ink colors and rotation of color printing
6. Drying method and equipment
7. End use of printed piece
   (food packaging, light exposure, etc.)
8. Processing of printed piece
   (Die-cutting, Varnishing, Coating, etc.)
Types of Printing Inks

• High Gloss inks
• Quick Setting inks
• metallic Inks
• Heat-set inks
• Ultraviolet (UV) and Electron Beam (EB) inks
Ink Problems

- Color
- Mottle
- Picking
- Set-off
- Piling
- Ghosting