



The Future of Print Workflow – PDF 2.0 and PDF/X-6

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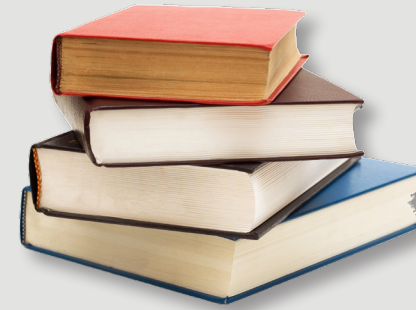
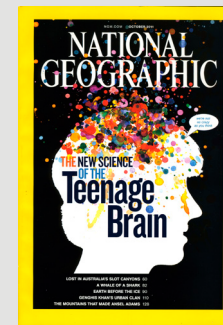
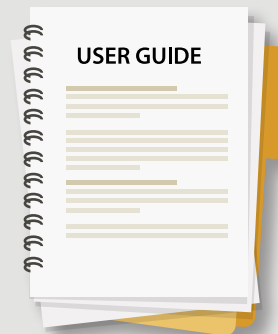
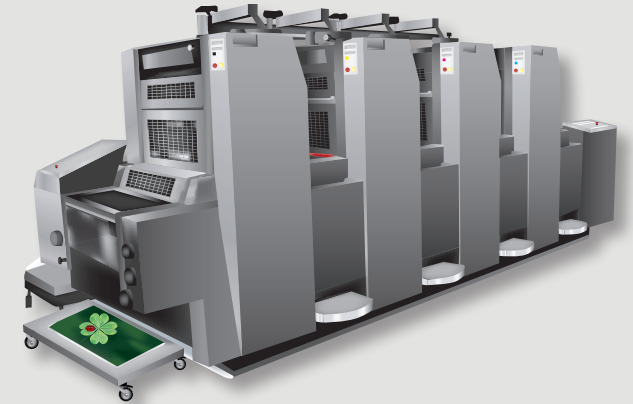


Ghent
Workgroup

BACKGROUND: Print is *NOT* Dead, But is Changing Dramatically!

The “Old Print”

- Books, Magazines, Newspapers, Manuals, Marketing Collateral, Reports, Calendars, etc.
- Overwhelmingly paper substrates
- Overwhelmingly plate-based offset/gravure/flexo printing;
- Print long runs centrally, warehouse, and distribute
- Digital printing relegated to short runs, proofs, and enterprise printing; primarily monochrome!



BACKGROUND: Print is *NOT* Dead, But is Changing Dramatically!

The “Old Print”

- Design content for particular, very specific *print* conditions (CMYK + spot colors only)
- Content only from graphic arts-centric applications
- Digital imagery converted to DeviceCMYK early in workflow
- Long lead times and correspondingly high expenses in “adjusting” colors and/or content to “get it right”
- Device-dependent PostScript and early PDF workflows
- Boring and increasingly limited profitability!



BACKGROUND: Print is *NOT* Dead, But is Changing Dramatically!

The “New Print”

- Books, Magazines, Newspapers, Manuals, Marketing Collateral, Reports, etc. are increasingly read on-screen or downloaded as PDF files from the Internet
- Print increasingly consists of packaging, signage, and textiles as well as specialized and personalized items of all types
- Print on *anything* or *everything*, including paper!
- Increasingly digital and/or wide format printing facilitating every “copy” to have personalized content
- Increasingly “print on demand” or short runs
 - In multiple locations
 - With multiple press types and print conditions



BACKGROUND: Print is *NOT* Dead, But is Changing Dramatically!

The “New Print”

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DRAMATICALLY INCREASED
USE OF COLOR

- And not just process CMYK and boring, old spot colors:
Increased gamut high fidelity colors, “brand colors,” metallics, fluorescents, pastels, textured varnishes, etc.
- Design content for *both* web and print
(increasingly web-first, color-managed RGB)
- High level of graphic complexity (including transparency, both explicit and implied)
- PDF workflows based on more recent PDF versions

BACKGROUND: What is PDF/X?

PDF/X is a series of ISO standards defining a subset of the full PDF specification for use in printing

- The graphic arts industry needed a means of providing reliable eXchange of graphical content for printing
- Limits which PDF features may be used
- Requires use of specific PDF features and specifies how they must be used
- Fonts must be embedded (including the “base 14” fonts – no fonts “by reference”)
- Specifies the method of PDF/X version identification
- Addresses concerns (some very well-founded) about use of unconstrained PDF for printing (Javascript, Movies, Sounds, etc.)



BACKGROUND: PDF/X Evolves

The challenge has been to evolve the PDF/X standards to meet changing imaging models, technology, and industry needs

1999

- Opaque (no transparency) imaging model; transparency effects simulated by overprinting and other hacks
- Color management in infancy
- Most commercial printing via offset press using film to plate or emerging CTP technologies
- Most PDF created via distillation of PostScript; Most PDF printing via conversion to PostScript

The Present

- Use of transparency effects ubiquitous
- Ability to repurpose content in general and in PDF is a requirement
- Digital printing processes challenge offset printing
- Color management a requirement due to color-managed digital imagery and digital presses
- Direct PDF creation and printing
- All reasonably recent vintage RIPs/DFEs directly support ICC color management and transparency in PDF

BACKGROUND: PDF/X Evolves

	PostScript 2 & 3	PDF/X-1a : 2001	PDF/X-3 : 2002	PDF/X-4 & 4p	PDF/X-5g, 5pg, & 5n
Based on PDF version	N/A	1.3 Acrobat 4	1.3 Acrobat 4	1.6 Acrobat 7	1.6 Acrobat 7
Color Support	Device & Color-Managed CMYK, Gray, & RGB; Spot	Device CMYK & Gray; Spot	Device CMYK & Gray; Spot; Color-Managed CMYK, Gray, & RGB	Device CMYK & Gray; Spot; Color-Managed CMYK, Gray, & RGB	Device CMYK & Gray; Spot; Color-Managed CMYK, Gray, & RGB
Color Management	PostScript CIE-based Color Management	ICC Color Management (Output Profile/Condition)	ICC Color Management	ICC Color Management (External output profile for PDF/X-4p)	ICC Color Management (External output profile for PDF/X-5pg; n-colorant external profile for PDF/X-5n)
Live Transparency	NO Application "flattened"	NO Application "flattened"	NO Application "flattened"	YES	YES
Layer Support	NO	NO	NO	YES	YES
Page Independence & Random Access	NO	YES	YES	YES	YES
Blind Exchange	NO	YES	YES	YES (PDF/X-4 only)	NO
Print Job Control	Normally Internal via /setpagedevice	External (Possibly via JDF)	External (Possibly via JDF)	External (Possibly via JDF)	External (Possibly via JDF)
Annotations / Forms	NO	NO	NO	NO	NO
Multiple Page Types / Production Metadata	NO	NO	NO	NO	NO
Normal Overall Characterization	Highly Device-Dependent	Device-Dependent	Device-Dependent (due to flattened transparency)	Device-Independent	Device-Independent



What is PDF 2.0?

- ISO Standard 32000-2 PDF 2.0
 - Standard development the responsibility of ISO TC171 SC2 / WG8
 - Published by ISO in July 2017 after nine years in development
 - 984 pages in length!
- First new version of the PDF specification since ISO 32000-1 PDF 1.7 was published in 2008
- First “non-Adobe” version of PDF specification
- ISO 32000-1 PDF 1.7 was the result of a “fast track” publication of Adobe PDF 1.7, donated to ISO TC171 in 2008
- A dated revision (mostly editorial corrections, some limited technical changes) going for DIS (Draft International Standard) vote; expected publication date early 2020



What is New and/or Different in PDF 2.0?

- *ISO-fication* of the specification document
32000-1 was not much more than a slight rewording and reformatting of the Adobe PDF 1.7 specification document
- Corrections and clarifications to the 32000-1 text
- Formal adoption of new and/or augmented features, new to ISO PDF
 - Adobe PDF 1.7 extensions
 - PDF/VT and similar existing extensions (i.e. DPart)
 - Other features for a wide range of PDF use cases and content
- Corrections, clarifications, and augmentation of existing features
- Deprecation of obsolete features (such as XFA forms)

PDF 2.0 FEATURES FOR PRINT: Black Point Compensation

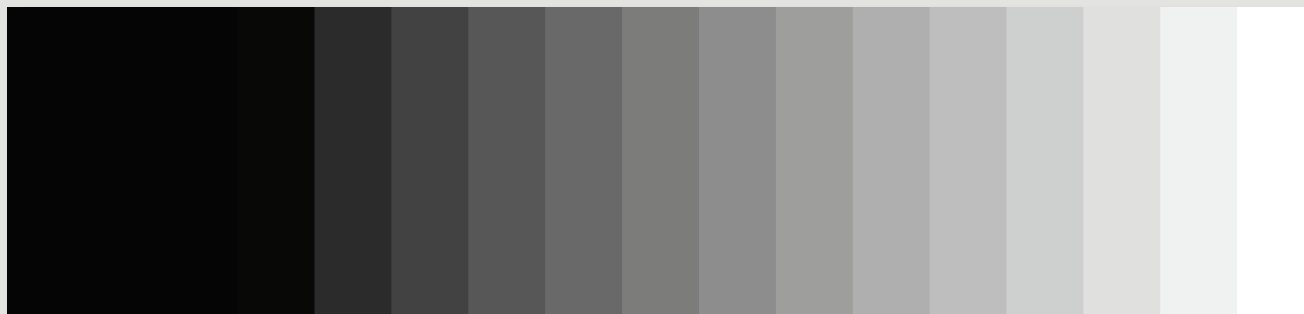
- Originally an Adobe extension to ICC color management, not an official part of PDF, typically globally enabled in an application or in a renderer
- Now an ISO standard:
ISO 18619 – Image technology colour management
– Black point compensation
- Methodology for creating adjustments between the maximum black levels of color-managed digital content and the black capabilities of rendering device

PDF 2.0 FEATURES FOR PRINT: Black Point Compensation – CONTINUED

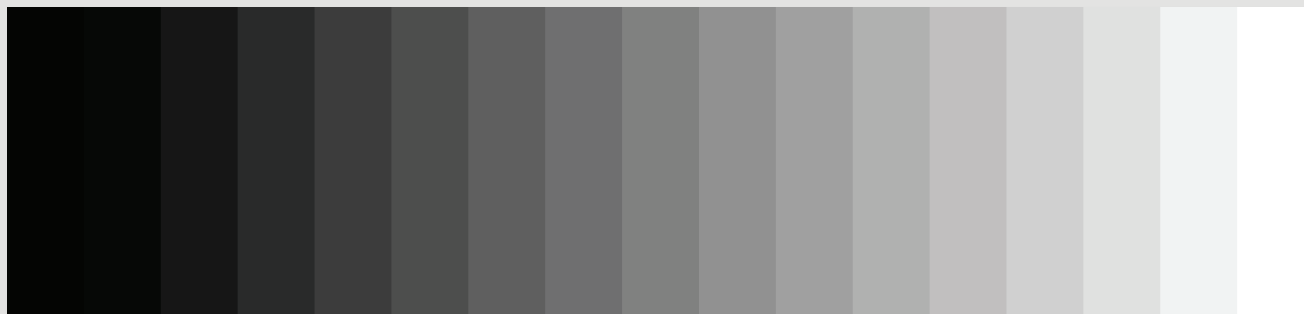
- Example

Conversion of R=G=B swatches, *Adobe RGB* to
US Web Coated (SWOP) v2 CMYK (relative colormetric rendering intent)

- Black Point Compensation *disabled*



- Black Point Compensation *enabled*



PDF 2.0 FEATURES FOR PRINT: Black Point Compensation – CONTINUED

- Real world example



BPC enabled

BPC disabled

(from https://www.colourphil.co.uk/rendering_intents.shtml)

PDF 2.0 FEATURES FOR PRINT: Black Point Compensation – CONTINUED

- PDF 2.0 effectively allows BPC to be explicitly specified
 - The new *UseBlackPtComp* key in a graphics state parameter dictionary allows BPC to be turned on or off for different graphics objects in a PDF.
 - The key can take three states: *ON*, *OFF* and *Default*
 - The default value is *Default*, which means that whether BPC should be turned on or off is up to the PDF processor.
- Available for all PDF 2.0, *not* PDF/X-dependent!
Will be inherited by PDF/X-6

PDF 2.0 FEATURES FOR PRINT: Transparency

- Introduced into the PDF imaging model in Adobe PDF 1.4
- Unchanged in Adobe PDF 1.7 and subsequently in the ISO 32000-1 PDF 1.7
- PDF 2.0 specification:
Section 11, Transparency, has been significantly rewritten
 - No “new” features
 - Includes implications of Black Point Compensation (BPC)
 - Corrections to the specification to match actual implementations
Example: *ColorDodge* and *ColorBurn* blending mode specs
 - Clarification to eliminate ambiguity of specification
Example: Color space inheritance model
- Applicable to for all PDF 2.0, not PDF/X-dependent! Will be inherited by PDF/X-6
- **Changes should have minimal impact on existing content!**

PDF 2.0 FEATURES FOR PRINT: Transparency – CONTINUED

- Workflow & Application Considerations

- Avoid promiscuous use of Transparency Groups to avoid unintended results and overhead
- Avoid unnecessary specification of Transparency Color Blending Space at page or Transparency Group level to avoid unintended results and overhead

Example: PDF files from Office documents with RGB-based page level Transparency Color Blending Space

- Keep in mind “hierarchy” of application of Transparency Color Blending Spaces and transparency blending itself for the document, page, and (possibly nested) transparency groups (including interaction of Output Intents for PDF/X files)

PDF 2.0 FEATURES FOR PRINT: Page Level Output Intents

- Output Intents at the document level
 - Introduced into the Adobe PDF specification to meet the needs to specify the intended rendering color space of a PDF/X document; also adopted by PDF/A and PDF/E
 - Defines the default Transparency Blending Color Space
 - Have no meaning for PDF files other than those subset standards that define their usage
- PDF 2.0 Specification:
 - Provides the option to specify page level Output Intents; Only applicable for PDF subset specifications that explicitly define their usage
 - If a document level Output Intent (OI) is provided, any page level OI overrides the document level OI Intent for the particular page and serves as the page's Transparency Blending Color Space
 - If no document level Output Intent (OI) is provided, each page must have a page level OI defined, serving as the page's Transparency Blending Color Space

PDF 2.0 FEATURES FOR PRINT: Page Level Output Intents – CONTINUED

- In conjunction with DPart metadata, enables use of a single PDF file with multiple page types with different printing conditions (substrates, colorants, etc.) for printing on one or more (typically digital) presses
- Will require PDF/X-6 which explicitly defines their use
- Workflow & Application Considerations
 - At minimum, both document and page level Output Intents must be “passed through” in PDF workflow systems and applications
 - Document and page level Output Intents in placed PDF/X must be reconciled with the container document for generated PDF 2.0 files
 - PDF/X renderers must be significantly re-engineered to support the possibility of different output color spaces for each page
 - Layout software supporting multiple pages or artboards must be significantly re-engineered to support the possibility of different default output color spaces and output preview for each page

PDF 2.0 FEATURES FOR PRINT: Output Intents Dictionary Enhancements

- Output Intent Dictionary enhanced to better support display and proofing of PDF with DeviceN and spot colors
- Begins to address the needs for printing of packaging and other complex color content
- PDF 2.0 Specification:
 - Optional Mixing Hints dictionary within an Output Intent dictionary provides data that can be used in the process of rendering or color converting the colorants specified in the Solidities dictionary referenced from the Mixing Hints dictionary
 - Optional Spectral Data dictionary where each key represents a colorant defined as in separation color spaces and where the value of each key is a stream whose contents represent CxF/X-4 spot color characterization data per ISO 17972-4:2015
 - Will require PDF/X-6 by virtue of their being a component of Output Intents

PDF 2.0 FEATURES FOR PRINT: Document Parts

- Introduced as a “sanctioned extension” of PDF by ISO TC171 SC2 / WG8 for use in PDF/VT-1 and PDF/VT-2 for the purposes of:
 - Identifying different page types or “parts” of a VDP print job and associating same with external job tickets
 - Providing metadata associated with “field contents” for selective page group / record selection and/or printing
- Now officially part of PDF 2.0
- Provides the PDF file infrastructure for support of documents with multiple parts and page types
- In conjunction with page level Output Intents, enables use of a single PDF file with multiple page types with different printing conditions (substrates, colorants, etc.) for printing on one or more (typically digital) presses

PDF 2.0 FEATURES FOR PRINT: Document Parts – CONTINUED

- Will require PDF/X-6 only if used in conjunction with Page Level Output Intents
- Formalization of metadata and processes associated with DPart data in process by ISO TC130 WG2 / TF5 developing the ISO 21812 standard with precedents based on CIP4 JDF and PDF/VT
- We will review an example of use of *Page Level Output Intents* in conjunction with *Document Parts*

PDF 2.0 FEATURES FOR PRINT: Halftone Origin

- The PDF 2.0 Halftone Origin (HTO) feature replaces a feature from before PDF 1.3, HTP, to allow the location of the origin or phase of a halftone to be specified
- Feature is expected to be most useful for manually-imposed applications such as step-and-repeat
- Available for all PDF 2.0, *not* PDF/X-dependent!
Will be inherited by PDF/X-6

What is PDF/X-6?

- *ISO Standard 15930-9 – Graphic Technology – Prepress digital data exchange of printing data (PDF/X-6) and partial exchange of printing data with external profile reference (PDF/X-6p and PDF/X-6n) using PDF 2.0*
 - Standard development the responsibility of ISO TC130 WG2 / TF2
 - To enter DIS (Draft International Stage) soon; Publication? Likely 2020
 - First new part of the PDF/X specification since the 2010 updates to ISO 15930-7 (PDF/X-4) and 15930-8 (PDF/X-5)
- Three conformance levels:
 - PDF/X-6 – Complete (“blind”) Exchange
 - PDF/X-6p – External Output Intents
 - PDF/X-6n – External Output Intents; n-colorants
- Will serve as the basis for PDF/VT-3, an updated version of PDF/VT-1 (currently based upon PDF/X-4)

What is New and/or Different in PDF/X-6?

- Based upon ISO PDF 2.0 instead of Adobe PDF 1.6
- Inherits new PDF 2.0 features unless explicitly prohibited
- Improved support for modern digital print workflows by virtue of support of PDF 2.0 features, especially:
 - Page level Output Intents
 - DPart metadata
 - Mixing Hints and Spectral Data dictionaries
- Specification more in alignment with PDF/A, allowing PDF files to be compliant with *both* PDF/X and PDF/A
- Allows annotations including digital signatures, forms fields (with some limitations), and videos in the printable areas of pages

The New PDF/X Lineup

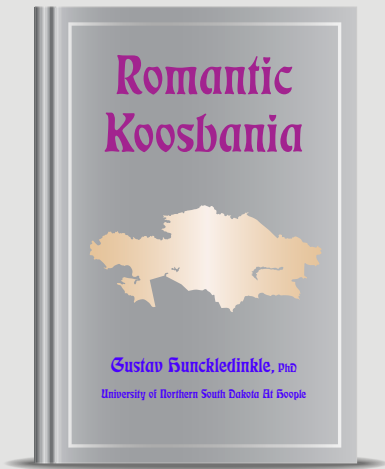
	PDF/X-1a : 2001	PDF/X-3 : 2002	PDF/X-4 & 4p	PDF/X-5g, 5pg, & 5n	Under Development: PDF/X-6, 6p, & 6n
Based on PDF version	1.3 Acrobat 4	1.3 Acrobat 4	1.6 Acrobat 7	1.6 Acrobat 7	2.0 ISO 32000-2
Color Support	Device CMYK & Gray; Spot	Device CMYK & Gray; Spot; Color-Managed CMYK, Gray, & RGB	Device CMYK & Gray; Spot; Color-Managed CMYK, Gray, & RGB	Device CMYK & Gray; Spot; Color-Managed CMYK, Gray, & RGB	Device CMYK & Gray; Spot; Color-Managed CMYK, Gray, & RGB
Color Management	ICC Color Management (Output Profile/Condition)	ICC Color Management	ICC Color Management (External output profile for PDF/X-4p)	ICC Color Management (External output profile for PDF/X-5pg; n-colorant external profile for PDF/X-5n)	ICC Color Management (External output profile for PDF/X-6p; n-colorant external profile for PDF/X-6n) & BPC
Live Transparency	NO Application "flattened"	NO Application "flattened"	YES	YES	YES
Layer Support	NO	NO	YES	YES	YES
Page Independence & Random Access	YES	YES	YES	YES	YES
Blind Exchange	YES	YES	YES (PDF/X-4 only)	NO	YES (PDF/X-6 only)
Print Job Control	External (Possibly via JDF)	External (Possibly via JDF)	External (Possibly via JDF)	External (Possibly via JDF)	External (Possibly via DPart & JDF)
Annotations / Forms	NO	NO	NO	NO	YES (with some limits)
Multiple Page Types / Production Metadata	NO	NO	NO	NO	YES (Optional via DPart and Page Level Output Intents)
Normal Overall Characterization	Device-Dependent	Device-Dependent (due to flattened transparency)	Device-Independent	Device-Independent	Device-Independent



Example of a Multiple Part Printed Product / Document

Imagine a printed product consisting of a bound book and a poster

The Book



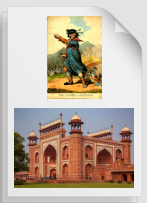
Book Cover

A single page representing the imposition of the back, spine, and front of the book's cover to be printed on book cover cloth material



Text Pages

Multiple pages representing text pages of this book, printed on white, coated text paper, monochrome only.



Full Colour Illustration Pages

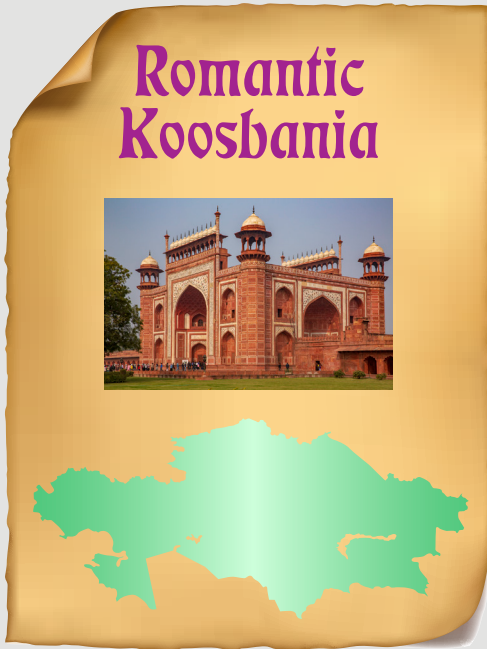
Multiple pages within the book containing high quality imagery printed on coated, heavy, glossy paper using process CMYK.



Full Colour Map Pages

Multiple pages within the book containing maps on fold-in pages simplex printed on coated, heavy, glossy paper using process CMYK.





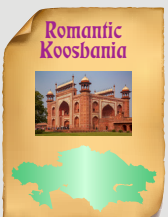
The Poster



A single page representing the content to be printed as a poster on coated, very heavy, glossy paper using process CMYK.

Example of a Multiple Part Printed Product / Document – CONTINUED

The product as represented with PDF/X-6 and a “compatible” source document

Component Pages (Source Document & PDF file)		Page Level Output Intent	Page Geometry + DPart Production Metadata
	Book Cover A single page representing the imposition of the back, spine, and front of the book's cover to be printed on book cover cloth material	Full process CMYK colour <i>CF_RPC7a</i>	Page size 12.5" × 7.25" with no bleed <pre> << /CIP4_Root << /CIP4_DescriptiveName (book cover) /CIP4_Intent 837 0 R /Type /CIP4_Root >> >> << /CIP4_LayoutIntent 1283 0 R /CIP4_MediaIntent 1284 0 R /CIP4_ProductType /WrapAroundCover: /Type /CIP4_Intent >> << /CIP4_Sides /OneSided /CIP4_SpreadType /Spread /Type /CIP4_LayoutIntent >> << /CIP4_MediaQuality (RuggedCloth) /CIP4_MediaTypeDetails /Cloth /Type /CIP4_MediaIntent >> </pre>
	Text Pages Multiple pages representing text pages of this book, printed on white, coated text paper, monochrome only.	Process black printing using: <i>Dot Gain 15%</i> (Grayscale)	Page size 5" × 7" with no bleed <pre> << /CIP4_Root << /CIP4_DescriptiveName (book body) /CIP4_Intent 838 0 R /Type /CIP4_Root >> >> << /CIP4_LayoutIntent 1285 0 R /CIP4_MediaIntent 1286 0 R /CIP4_ProductType /Body /Type /CIP4_Intent >> << /CIP4_Sides /TwoSidedHeadToHead /Type /CIP4_LayoutIntent >> << /CIP4_Coating /Matte /CIP4_ISOPaperSubstrate /PS2 /CIP4_MediaQuality (Text100) /CIP4_Weight 100 /Type /CIP4_MediaIntent >> </pre>
	Full Colour Illustration Pages Multiple pages within the book containing high quality imagery printed on coated, heavy, glossy paper using process CMYK.	Full process CMYK colour <i>GRACoL2013 CRPC6</i>	Page size 5" × 7" with no bleed <pre> << /CIP4_Root << /CIP4_DescriptiveName (color text) /CIP4_Intent 839 0 R /Type /CIP4_Root >> >> << /CIP4_LayoutIntent 1287 0 R /CIP4_MediaIntent 1288 0 R /CIP4_ProductType /Body /Type /CIP4_Intent >> << /CIP4_Sides /TwoSidedHeadToHead /Type /CIP4_LayoutIntent >> << /CIP4_Coating /Gloss /CIP4_ISOPaperSubstrate /PS1 /CIP4_MediaQuality (Text120) /CIP4_Weight 120 /Type /CIP4_MediaIntent >> </pre>
	Full Colour Map Pages Multiple pages within the book containing maps on fold-in pages simplex printed on coated, heavy, glossy paper using process CMYK.	Full process CMYK colour <i>GRACoL2013 CRPC6</i>	Page size 9" × 7" with no bleed <pre> << /CIP4_Root << /CIP4_DescriptiveName (fold varnished foldout map) /CIP4_Intent 840 0 R /Type /CIP4_Root >> >> << /CIP4_ColorIntent 1292 0 R /CIP4_FoldingIntent 1291 0 R /CIP4_LayoutIntent 1289 0 R /CIP4_MediaIntent 1290 0 R /CIP4_ProductType /Map /Type /CIP4_Intent >> << /CIP4_Coatings [/Varnish] /Type /CIP4_ColorIntent >> << /CIP4_FoldCatalog /F6-7 /Type /CIP4_FoldingIntent >> << /CIP4_Sides /OneSided /CIP4_SpreadType /Spread /Type /CIP4_LayoutIntent >> << /CIP4_Coating /Gloss /CIP4_ISOPaperSubstrate /PS1 /CIP4_MediaQuality (Special150) /CIP4_Weight 150 /Type /CIP4_MediaIntent >> </pre>
	Poster A single page representing the content to be printed as a poster on coated, very heavy, glossy paper using process CMYK.	Full process CMYK colour <i>FOGRA 51</i>	Page size 13.5" × 18" <i>plus 0.25" bleed on all sides</i> <pre> << /CIP4_Root << /CIP4_DescriptiveName (additional poster) /CIP4_Intent 282 0 R /Type /CIP4_Root >> >> << /CIP4_ColorIntent 846 0 R /CIP4_LayoutIntent 844 0 R /CIP4_MediaIntent 845 0 R /CIP4_ProductType /Poster /Type /CIP4_Intent >> << /CIP4_Coatings [/Varnish] /Type /CIP4_ColorIntent >> << /CIP4_Sides /OneSided /Type /CIP4_LayoutIntent >> << /CIP4_Coating /Gloss /CIP4_ISOPaperSubstrate /PS1 /CIP4_MediaQuality (Special140) /CIP4_Weight 150 /Type /CIP4_MediaIntent >> </pre>

Preparing for the Future PDF/X-6 Workflows

Finally embrace and adopt 21st Century, Best Practice, End-to-End, PDF Publishing Workflows based on PDF/X-4

- Maintain digital assets (raster imagery as well as vector artwork destined for both print and web) in their original color spaces with any live transparency until content rendering (proofer, RIP/DFE)
- Don't misuse *spot color* swatches
- Specifying PDF/X-4, but requiring DeviceCMYK and pre-flattened transparency is effectively a PDF/X-1a workflow, perfect for the late 1990s
- "If it ain't broke, don't fix it" is generally the mantra of Luddites who can't recognize the symptoms of processes that are very broken!
- Learn, Un-Learn, Relearn!



Q&A



Dov Isaacs
<isaacs@adobe.com>



Adobe



Ghent
Workgroup