# A Practical Guide to Implementing and Using the PDF/X-6 Standard:

Application Notes for Users and Implementers of PDF/X-6, PDF/X-6p, and PDF/X-6n

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Prepared by

Bruno Mortara - Brazil Jason Lisi - Canada



113 Seaboard Lane, Suite C-250 • Franklin, TN 37067 • TEL: 615-432-5421 • www.printtechnologies.org

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# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee.

The International Organization for Standardization (ISO) Technical Committee 130 (Graphic Technology) develops standards for the graphic arts industry. The ISO/TC130 is further divided into Working Groups and Task Forces.

The information in this document was developed by members of the ISO/TC130/WG2/TF2 (PDF/X), under the lead authorship of Jason Lisi, Professor in the School of Graphic Communications Management at Ryerson University in Toronto, Canada. Although its contents were approved by ballot of the voting members of ISO/TC130/WG2/TF2, this document has not been developed under the consensus process of the International Standards Organization, and is not an International Standards Organization consensus document. It does not have the status of a standard or technical report, and was developed to disseminate additional information regarding the ISO 15930 standard on PDF/X, and specifically part 9: Complete 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.

At the request of the ISO/TC130/WG2/TF2, the Association for Print Technologies (APTech) is making this document publicly available at no cost for informational and reference purposes only. APTech serves as the Secretariat of the U.S. Technical Advisory Group (US TAG) to ISO/TC130.

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# **1.0 About This Document**

This document is not a part of the ISO 15930 family, but is intended to supplement these standards by providing additional information and guidance specific to ISO 15930-9. None of the information contained herein should be construed as modifying the standard.

These Application Notes are subject to revision and enhancement. The most current version of this document can be found in the APTech standards workroom at <a href="https://printtechnologies.org/programs/standards-workroom/tools-best-practices/pdf-x/">https://printtechnologies.org/programs/standards-workroom/tools-best-practices/pdf-x/</a>. Some earlier revisions may be maintained at the same site.

Comments and suggestions should be sent to the Secretariat of the US TAG to ISO/TC 130 at dorf@ npes.org.

#### **1.1 Intended Audience**

This document is intended primarily for application developers (vendors) that wish to make their applications and processes PDF/X-6 compliant, however these application notes may also be of use to other interested parties. Examples of persons in the intended audience include, but are not limited to:

- Developers of software to read and write PDF/X-6 files, such as vendors of composition tools, preflight tools, imposition tools, RIPs, and digital front ends (DFEs).
- Print workflow integration tool vendors, including web-to-print solutions providers.
- Technically interested users.
- Consultants assisting in optimizing multi-channel communication campaigns.

#### 1.2. Goal of this document

The goal of this document is to provide information that is supplementary to ISO 15930-9, to further assist those mentioned in 2.1 with the successful implementation and use of tools and workflows that comply, and take full advantage of, the PDF/X-6 standard. This document focuses on the key differences between PDF/X-6 and its predecessor, PDF/X-4, and is not a substitute for the full standard.

#### **1.3 References and Relationships**

Unless otherwise noted, the information within this document applies to all three conformance levels of PDF/X-6 as described is ISO 15930-9, which are simply referred to as PDF/X-6.

In addition, this document makes reference to ISO 32000-2, which is referred to as PDF 2.0

#### 1.4. Conflict with Standards

If there is a conflict between this document and any part of ISO 15930-9 or ISO 32000-2, the standard(s) will always take precedence.

# **2.0 Introduction**

#### 2.1 What is the PDF/X Standard?

The PDF/X family of standards was, and is continuing to be, developed by ISO/TC130, Graphic technology. The goal is to provide an efficient vehicle for the exchange of combinations of vector and raster digital data, representing print ready material, within the graphic arts industry. It is a multi-part standard with several levels of compliance. The intent is that if a sender and a receiver of PDF/X files use applications that have compatible levels of compliance, digital data workflows can flow seamlessly between them and be processed without surprises to achieve the rendering intended by the client.

It is important to note that while these standards ensure the unambiguous exchange of the data, they make no statement about the quality of the data contained in the files, or if said data meets the unique requirements of specific market segments, publishers, and printers. Rather, this type of information can often be found in specifications published by reputable industry organizations that define market specific conditions for which PDF/X files can be created successfully. Preflight tools that can validate to both a PDF/X standard and to additional geographic or market requirements are often described as supporting "PDF/X Plus".

In many situations simply specifying and/or validating a file as having a specific level of PDF/X compliance will be the key element in assuring an efficient workflow between multiple participants in a printing and publishing endeavor.

#### 2.2 The History of PDF/X

One of the many interesting facts about PDF/X is that it actually became a standard long before PDF itself did! The first published PDF/X standard dates back to 1999, as an American National Standard (ANSI) and was based on PDF Version 1.2. In 2001, a revised form of the standard (based on PDF 1.3 was developed and published by the International Organization for Standardization (ISO). This standard, 15930-1, was the very first international standard based on the PDF file format.

The PDF/X standard has grown over time, and currently consists seven active parts. The seven active parts of ISO 15930 are:

- ISO 15930-1:2001, Graphic technology Prepress digital data exchange Use of PDF — Part 1: Complete exchange using CMYK data (PDF/X-1 and PDF/X-1a). Part 1 of the standard specifies the use of the Portable Document Format (PDF) v1.3 for the dissemination of complete digital data, in a single exchange, that contains all elements ready for final print reproduction. CMYK and spot color data are supported in any combination.
- ISO 15930-3:2002, Graphic technology Prepress digital data exchange Use of PDF — Part 3: Complete exchange suitable for color-managed workflows (PDF/X-3). Part 3 specifies the use of the Portable Document Format (PDF) v1.3 for the dissemination of complete digital data, in a single exchange, that contains all elements necessary for final print reproduction. Color-managed, CMYK, gray, RGB or spot color data are supported.
- ISO 15930-4:2003, Graphic technology Prepress digital data exchange Use of PDF — Part 4: Complete exchange of CMYK and spot color printing data using PDF 1.4 (PDF/X-1a). Part 4 specifies the use of the Portable Document Format (PDF) v1.4 for the dissemination of complete digital data, in a single exchange, that contains all elements ready for final print reproduction. CMYK, gray and spot color data are supported in any combination but no device independent color definitions.
- ISO 15930-6:2003, Graphic technology Prepress digital data exchange Use of PDF — Part 6: Complete exchange of printing data suitable for color-managed workflows

**using PDF 1.4 (PDF/X-3)**. Part 6 specifies the use of the Portable Document Format (PDF) v1.4 for the dissemination of complete digital data, in a single exchange, that contains all elements necessary for final print reproduction. In general all color-managed (device independent), CMYK, gray, RGB or spot color data is supported. In addition device colors may be used in the same color space as the Output Intent ICC profile plus gray (i.e. DeviceGray may be used with any Output Intent color space, whether CMYK, gray or RGB).

- ISO 15930-7:2010, Graphic technology Prepress digital data exchange using PDF Part 7: Complete exchange of printing data (PDF/X-4) and partial exchange of printing data with external profile reference (PDF/X-4p) using PDF 1.6. Part 7 specifies the use of the Portable Document Format (PDF) v1.6 for the dissemination of digital data, where all elements necessary for final print reproduction are either included (PDF/X-4) or provision is made for unique identification for an externally referenced ICC profile (PDF/X-4p). Colormanaged, CMYK, gray, RGB or spot color data are supported, as is transparency and the use of Optional Content Groups (OCGs).
- ISO 15930-8:2010, Graphic technology Prepress digital data exchange using PDF — Part 8 Partial exchange of printing data using PDF 1.6 (PDF/X-5). Part 8 specifies the use of the Portable Document Format (PDF) v1.6 for the dissemination of digital data, where all elements necessary for final print reproduction are either included or provision is made for unique identification. PDF/X-5g allows for externally referenced graphical content, PDF/ X-5n allows for embedded or externally referenced output intent ICC profiles for n-colorant print characterizations, and PDF/X-5pg allows for externally referenced graphical content as well as externally referenced characterized printing conditions using a gray, RGB, or CMYK process color model. Color-managed, CMYK, gray, RGB or spot color data are supported, as is transparency and the use of Optional Content Groups (OCGs). PDF/X-5 can be seen as an expansion and/or extension to PDF/X-4 and PDF/X-4p.
- ISO 15930-9:2020, Graphic technology Prepress digital data exchange using PDF Part 9: Complete 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. Part 9 specifies the use of the ISO 32000-2 Portable Document Format (PDF) v2.0 for the dissemination of digital data, where all elements necessary for final print reproduction are either included (PDF/X-6) or provision is made for unique identification of an externally referenced ICC profile (PDF/X-6p and PDF/X-6n). PDF/X-6n allows for the externally referenced ICC profiles for n-colorant print characterizations, whereas PDF/X-6p allows for externally referenced ICC profiles using a gray, RGB, or CMYK process color model. Color-managed, CMYK, gray, RGB or spot color data are supported, as is transparency and the use of Optional Content Groups (OCGs).

The different parts of ISO 15930 differ in their own unique way. Each unique "version" of PDF/X (e.g. PDF/X-1a versus PDF/X-3) is referred to as a conformance level . Table 1 below summarizes some of the key differences between the various conformance levels of PDF/X.

The information presented in Table 1 is useful to establish the chronology and compliance levels for PDF/X, however this document focuses exclusively on the latest conformance levels, as are described in ISO 15930-9 (PDF/X-6, PDF/X-6n and PDF/X-6p).

If the reader wishes to learn more about the other variations of PDF/X, they are encouraged to download and review previous PDF/X application notes available at no charge at <a href="https://printtechnologies.org/programs/standards-workroom/tools-best-practices/pdf-x/">https://printtechnologies.org/programs/standards-workroom/tools-best-practices/pdf-x/</a>.

TABLE 1: PDF/X CONFORMANCE LEVELS					
Conformance Level	Part of ISO 15930	Complete exchange	Color-managed data permitted	Print characterization spaces supported	PDF version
PDF/X-1:2001	1	Yes	No	Gray, CMYK	1.3
PDF/X-1a:2001	1	Yes	No	Gray, CMYK	1.3
PDF/X-1a:2003	4	Yes	No	Gray, CMYK	1.4
PDF/X-3:2002	3	Yes	Yes	Gray, RGB, CMYK	1.3
PDF/X-3:2003	6	Yes	Yes	Gray, RGB, CMYK	1.4
PDF/X-4:2010	7	Yes	Yes	Gray, RGB, CMYK	1.6
PDF/X-4p:2010	7	No	Yes	Gray, RGB, CMYK	1.6
PDF/X-5g:2010	8	No	Yes	Gray, RGB, CMYK	1.6
PDF/X-5n:2010	8	No	Yes	n-colorant	1.6
PDF/X-5pg:2010	8	No	Yes	Gray, RGB, CMYK	1.6
PDF/X-6:2020	9	Yes	Yes	Gray, RGB, CMYK	2.0
PDF/X-6p:2020	9	No	Yes	Gray, RGB, CMYK	2.0
PDF/X-6n:2020	9	No	Yes	n-colorant	2.0

These application notes currently only include information applicable to:

• ISO 15930-9:2020 – Defines the PDF/X-6/X-6p/X-6n conformance levels

See Version 4 of these Application Notes for information applicable to:

- ISO 15930-4:2003: Defines the PDF/X-1a:2003 conformance level
- ISO 15930-5:2003: Defines the PDF/X-2:2003 conformance level
- ISO 15930-6:2003: Defines the PDF/X-3:2003 conformance level

See Version 3 of these Application Notes for information applicable to:

- ISO 15930-1:2001: Defines the PDF/X-1:2001 and PDF/X-1a:2001 conformance levels
- ISO 15930-3:2002: Defines the PDF/X-3:2002 conformance level

It is anticipated that a variety of products will be developed around the PDF/X-6 standard such as readers (including viewers), writers, and processors of PDF/X files, and products that offer combinations of these features. Different products will incorporate various capabilities to prepare, interpret and process conforming files based on the application needs as perceived by the suppliers of the products. However, it is important to note that a conforming reader must be able to read and appropriately process all files conforming to a specified conformance level.

#### 2.3 Why PDF/X-6?

The PDF/X-6 standard was developed to take full advantage of the latest enhancements to PDF, and to address emerging challenges and trends within the print industry. PDF/X-6 is the first PDF/X standard written to conform to PDF 2.0 (ISO 32000-2). As such, PDF/X-6 takes advantage of enhancements and additions to PDF that other PDF/X standards cannot. It is expected that using PDF/X-6 files with compliant workflow tools can result in both time-savings and cost-savings through increased efficiency, enhanced features, cross-media capabilities, and flexibility, all within a defined standard that ensures a level of stability when dealing with blind exchange of complete or partial documents. PDF 2.0 is

already adopted by several segments on the market but is usage in printing envinronment is expected to follow our previous experience. As per PDF/X-4, when the standard was released much before an important market adoption, PDF/X-6 is now available, as well as the engines to render a conformance file. Now it is expected to follow creation apps and other tools, usual in the printing workflow.

# 3. Major Differences between PDF/X-4 and PDF/X-6

TABLE 2: COMPARISON OF KEY DIFFERENCES BETWEEN PDF/X-4 AND PDF/X-6				
Attribute	PDF/X-4	PDF/X-6		
Referenced PDF Standard	1.6 as described in PDF Reference fifth edition (Adobe Systems)	2.0 as described by ISO 32000-2		
Output Intents	Document-level only	Document-level and page-level		
Annotations	Not permitted in visible page area	Permitted in visible page area with restrictions		
Interactive Forms	Not permitted in visible page area	Permitted in visible page area with restrictions		
Digital Signatures	Not permitted	Permitted		
Actions	Not permitted	Permitted with restrictions		
Enabling/Disabling Black Point Compensation for PDF objects	Not Supported	Supported		

#### 3.1. PDF Version

PDF/X-6 conforms to PDF 2.0 as described by ISO 32000-2. PDF/X-4 conforms to PDF 1.6 as described in PDF Reference fifth edition (Adobe Systems).

#### 3.2. Output Intents and Inheritance Rules

PDF/X-6 can have both document-level and page-level output intents defined. If a document does not have a document-level output intent defined, there must be page-level output intent defined. When both page-level and document-level output intents are defined, the page-level output Intents take precedence over the document-level output intent for the specific page the output intent is defined for.

In contrast, PDF/X-4 does not allow for page-level output Intents, and only uses a document level output intent.

Understanding the relationship and inheritance rules for output intents is important to ensure that the resulting output of a PDF/X-6 file has the intended appearance. Note that the inheritance rules also apply to transparency blending. Transparency groups and their transparency blending color spaces are also a part of this inheritance model.

A reason why a document might have both document level and page level output intents defined would be when a single document that has pages that will be output on different substrates or by different methods. For example, there may be a book that will be printed in a digital printing system, with a uncoated stock, and the document level output intent is defined accordingly. However, in that same document, there are the cover with four pages that will be printed in color on a glossy coated stock. These color pages can be given their own page-level output intent suitable for them and the document can be printed with this one file and outputed collated ready for binding process.

#### 3.3. Annotations

Before PDF 2.0 annotations were prohibited. The reason is that they would eventually change the appearance of the page. This was fixed in PDF 2.0 where every annotation comes with a fully developed PDF description for its appearance and then, there was not a real reason anymore to disallow annotations because annotation is can be understood.

PDF/X-6 allows for a restricted set of annotations (as specified in ISO 32000-2) to be included inside the visible area of the page. The reason that the annotations set allowed in PDF/X-6 is restricted is to ensure that the annotations that are present cannot change the visual state of the PDF/X-6 file. Annotations that are hidden, or that are visible but not printable are not allowed.

PDF/X-4 does not allow for annotations inside the visible area of a PDF file (defined by the BleedBox).

An annotation in PDF can either use a default appearance (that is not defined in the PDF file but taken from the PDF viewer) or an appearance that is built into the PDF file. PDF/X-6 limits annotations to those that carry their appearance with them in the PDF file and where that appearance complies to all requirements for any page content in a PDF/X-6 file. By doing this, PDF/X-6 ensures that the annotations that are present have a defined appearance and will look the same with every PDF/X-6 compliant viewer or processor.

#### 3.4. Interactive Forms and Digital Signatures

As a new feature, PDF/X-6 permits the inclusion of Interactive Forms and digital signatures inside the viewable area. XML-based XFA forms are not permitted. PDF/X-4 does not allow for interactive forms, XFA forms, or digital signatures.

When an interactive form is present within a PDF/X-6 file, a conforming processor will not use the value of the form field to render. Instead, the conforming processor will render the appearance dictionary for the form fields.

PDF/X-6 allows for document, certifying, or user rights signatures via the use of signature fields. When a conforming processor generates the appearance of signatures and/or other objects as part of the signing process, it must do so in such a way that it remains compliant to the PDF/X-6 standard.

#### 3.5. Actions

PDF/X-6 allows for a restricted set of actions to be included in the file. The general premise is that an action can be included as long as the execution of that action does not alter the appearance of the file. PDF/X-4 does not allow for actions to be included in the PDF file.

#### 3.6. Black Point Compensation

PDF/X-6 introduces native support for black point compensation as part of its enhanced colour management support features. Black Point Compensation (BPC) is a feature of color conversion engines.

"Black point compensation (BPC) is a technique used to adjusts the colour transformation that will be applied, especially towards the shadow end of the tone scale, by aligning the darkest colour that could be described by the colour space of the data to be displayed with the darkest colour that the output profile for the display device (screen or print) can produce. Black point compensation as used in PDF is formally defined in ISO 18619:2015.Black point compensation is already widely used in production printing, especially in situations where the combination of the substrate, colourants (e.g. inks) and printing process cannot achieve a very high density for blacks"<sup>1</sup>. In PDF/X-4 it was not

<sup>1</sup> PDF 2.0 Application Note 001: Black Point Compensation, page 3, available in www.pdfa.org

possible to specify whether or not Black Point Compensation should be used, however, this is now possible in PDF/X-6.



Figure: example of Black Point Compensation usage<sup>2</sup>

#### 3.7. DPart Metadata

As a new standard feature of PDF Dpart function is defined is ISO 32000 as "The DPart key in a page object allows a PDF processor to directly retrieve the section of the document part hierarchy that applies to this page object. For example, for certain implementation approaches to cut and stack imposition, this allows for efficient retrieval of DP-based on-page indices"<sup>3</sup>.

DPart metadata makes it possible to specify page based metadata in a tree structure parallel to the page tree structure. In combination with ISO 21812-1 Print product metadata, this allows for automated workflows in which pages from the same PDF are produced in a different way. In combination with page based Output Intents, this can be a powerful feature for further prepress automation. DPart Metadata is supported in PDF/X-6 but is not supported in PDF/X-4.

# 4. PDF/X-6 overview

#### 4.1. Why use PDF/X-6?

There are several advantages to using PDF/X-6 over previous PDF/X versions, or simply creating a PDF 2.0 file when it comes to printing and cross media applications.

#### 4.1.1 Compatibility with PDF 2.0

Choosing to support and use PDF/X-6 in a workflow is beneficial because PDF/X-6 is built upon the foundation of PDF 2.0 (ISO 32000-2). There are significant enhancements to PDF 2.0 over its predecessor, and as such, it can accomplish things that previously were not possible. Since PDF/X-6 is built upon the PDF 2.0 framework, the advanced functionality of PDF 2.0 is inherently built in.

3 ISO 32000-2, page 89, available at www.iso.org

<sup>2</sup> Idem.

#### 4.1.2 Quality assurance

PDF/X-6 is an asset to graphic communication production because it optimizes the features of PDF 2.0 as they relate to both print and cross channel applications. As with previous PDF/X conformance levels, the optimized subset results in files that are less likely to have issues at the production stage, increasing runability and repeatability, while at the same time reducing the probability of files that cannot be processed correctly. In previous versions of PDF the definition of color colored objects and groups of colored objects, especially with transparency should be rendered, was ambiguous or no unambiguously. When rendering a transparency stack of images or elements of a page, better conformance is obtained in caparison to previous version of PDF, because blend mode color space definitions we defined very carefully and PDF 2.0 in order to create a better understanding of which color space is being referenced where the blending occurs. For example, PDF/X-6 makes clear which color definitions might occur with each other, and if several such definitions are available for an object or a group of objects, which one takes precedence.

PDF 2.0 has enhanced features and functionality that are not always adequate to be used in a graphic communication production environment. PDF/X-6 takes advantage of many of the advanced features of PDF 2.0, while at the same time ensuring that the features that are inadequate to a graphic communications workflow are restricted, taking the guess work and unpredictability out of the production workflow. Also, with the added functionality found within PDF/X-6, it is now easier than ever to create a single PDF file that can be used for distribution across multiple channels (e.g. print and online viewing).

The self-documented characteristics of PDF/X family allows exchange with less need for communication between sender and receiver, also known as "blind exchange". PDF/X-6 is reliable in blind-exchange scenarios, and reduces the chance of improperly produced PDF files being generated and sent to the end producer/consumer.

Taking a look at inheritance of transparency color spaces we see benefith from PDF 2.0 where, "under certain circumstances, a RIP will now automatically apply a color- managed (CIEBased) color space when a device color space (such as DeviceCMYK) is used in a transparent object. It will do that by inheriting it from a containing Form XObject or the current page.

That sounds very technical, but the bottom line is that it will now be much easier to get the correct color when imposing multiple PDF files from different sources together. That's especially the case when you're imposing PDF/X files that use different profiles in their output intents, even though they may all be intended for the same target printing condition. The obvious examples of this kind of use case is placing display advertising for publications, or gang-printing"<sup>4</sup>.

Another advantage of PDF/X-6 in relation to PDF/X-4 is that there is enough enough commonality between the PDF/A-4 standard file and PDF/X-6 standard file so that many files, if not most, can conceivably be tagged as both PDF/X-6 and PDF/A-4 compliant, having the best appearance (PDF/X-6) and the best archiving structured file (PDF/A-4).

#### 4.1.3 Predictability and repeatability

PDF/X standards were created, in part, for the purpose of accurately and consistently preserving the visual appearance of the content within the PDF/X document. This is a key advantage of the PDF/X family of standards as it increases predictability and repeatability, both qualities which are essential to successful production.

With regards to predictability, PDF/X-6 files by their nature provide a significant degree of predictability

4 Bayley, M. Getting to know PDF 2.0: rendering PDF transparency, available at https://www.globalgraphics.com

for the people that have to use those files in a production environment. This is due to the restrictions and rules that are inherent in the file format itself. PDF/X-6 files are designed for graphic communications output, and prevent the addition (or omission) of features detrimental to successful output. Further, products that consume PDF files that conform to PDF/X-6 are able to take advantage of all the features and benefits of the file format, which in turn helps ensure predictable outcomes.

Repeatability plays a significant role in production where the same file is used on multiple occasions, such as in the case of print where reruns of the same job are common. Using PDF/X-6 affords the same repeatability advantages of previous PDF/X versions for print, but also adds a new dynamic: repeatability across multiple mediums. This is significant in todays production environments where the same product is produced in multiple ways (e.g. print as well as online distribution). So PDF/X-6 not only promotes predictability and repeatability for traditional print, but also for other graphic communication mediums as well.

#### 4.1.4 Cross channel flexibility

As indicated above, many different products now have the requirement of being produced for multichannel distribution; this type of workflow is sometimes defined as CODM (Create Once Distribute Many). In past versions of PDF/X, the restrictions inherent in the file format were not adequate to cross channel publishing, especially where user interactivity was desirable. With the ability to assign multiple output intents, include actions, and allow annotations, the same PDF/X-6 file can be used for both print and non-print applications with little to no modification. The CODM workflow reduces time and labour for production facilities, and offers expediency and flexibility that can reduce time to market (TTM) for many cross channel jobs. PDF/X-6 is the most dynamic and flexible PDF/X conformance level for cross channel diversification.

#### 4.1.5 Colour management flexibility

The advantage of multiple output intents within a single PDF file should not be underestimated. This addition to the PDF/X-6 conformance level can enable a designer to create a single PDF file for multiple products. For example, a magazine could possible have different colour management requirements for the cover as opposed to the inside pages. Even the inside pages might have unique colour management requirements (e.g. colour pages versus black and white). The ability to assign the appropriate output intent to the relevant pages at the PDF creation stage helps reduce the chance of colour rendering mistakes downstream. This is extremely valuable for products that have multiple sections (such as a magazine), or for situations where it is advantageous to create a single PDF that has different, multiple products within it (e.g. a PDF file that has a wedding invitation as page one and the envelope for the invitation as page two).

PDF/X-6 (through PDF 2.0) officially adds support, potentially at the object level (using the extended graphics state) for Black Point Compensation. Prior to PDF 2.0 and PDF/X-6, Black Point Compensation was really only available as a vendor-specific feature at the job level and was not a feature that was recognized in the PDF file format itself. This enhances the output quality of the proceed files.

PDF/X-6 also includes support for embedding of CxF/X-4 (as part of the Output Intent structure) as defined in ISO 17972-4. This is done via the SpectralData Key in an output intent dictionary defined in an output intent subtype, in this case, the GTS\_PDFX subtype.

#### 4.1.6 Compatibility and conformance with PDF/A and PDF/UA

PDF/A is an ISO standard that is used for archival and retrieval of PDF documents, and PDF/UA is an ISO standard that defines how to create PDF files in such a way as to make them accessible. PDF/X-6 is fully compliant and compatible with both PDF/A and PDF/UA, which means that a PDF/X-6 file can be produced in a way that makes it compliant with all three of the standards at the same time. The three siblings share major text portions so that it is easy for implementers to identify corresponding

provisions and additional provisions. This is a major advantage for any organization that uses PDF/A and PDF/UA as it reduces the number of PDF files required to satisfy both output and cataloging of PDF files.

#### 4.1.7 Workflow automation

There are several features in PDF/X-6 that make it well suited to enhanced workflow automation. For example, the introduction of features such as page-level output intents, DPart metadata for pages and black point compensation make it possible to create streamlined automation processes within capable workflow solutions that were not possible with previous PDF/X versions. Dpart information may be found in ISO 21812-1:2019 Graphic technology — Print product metadata for PDF files — Part 1: Architecture and core requirements for metadata.

#### 4.2. Who should adopt PDF/X-6?

As mentioned, PDF/X-6 is significantly different than previous PDF/X conformance levels. It is the first PDF/X standard to adhere to ISO 32000-2 (PDF 2.0), and offers features previously unavailable. Any one wishing to stay current with PDF conformance, while at the same time benefit from the added benefits of predictability and repeatability of PDF/X should adopt PDF/X-6. This includes, but is not limited to:

- **Creatives**. Individuals that are creating content for print and/or cross channel publication will benefit from using PDF/X-6 as the production file format for production.
- Software vendors. Companies that develop software that either produces or processes PDF files should include PDF/X-6 conformance in their product offerings. Examples would be illustration and page layout programs, PDF readers/viewers, production workflow solutions (i.e. RIPs), and preflighting software.
- **Brand owners**. PDF/X-6 offers several advantages for brand owners, particularly with the enhancements to colour management and output intents, that improves accuracy and efficency of brand colour reproduction.
- **Print producers**. Adopting PDF/X-6 allows print producers to benefit from the predictability and repeatability that PDF/X is known for, while at the same time maintaining currency to the most recent PDF standard and all the benefits inherent within.
- **Cross channel marketers**. PDF/X-6 simplifies the process and workflow for distributing content across multiple platforms by offering one file that works for many different distribution channels with little to no reworking.
- **Publishers.** Publishers who need to archive their publications. PDF/X-6 files comply with ISO 19005, PDF/A, for use with long-time archiving.

#### 4.3. Understanding and using the three PDF/X-6 conformance levels

Within the PDF/X-6 standard are three separate conformance levels. The main PDF/X-6 conformance level is intended to serve for the vast majority of all print and prepress workflows. The other two conformance levels serve specialized niche workflows. It is good to know what the intention of each conformance level is so that an informed decision can be made with regards when to use each one.

The following is a brief explanation of each of the PDF/X-6 conformance levels.

#### 4.3.1 PDF/X-6

PDF/X-6 is the least specific of the three conformance levels, and thus, has the potential to be the most versatile. It is also the conformance level that can be best be described as a "complete exchange", in that all the information needed to properly process the PDF file is contained within the

PDF file itself. PDF/X-6 can be used in most printing and cross media applications that use typical colour spaces such as RGB, CMYK and spot colour printing.

#### 4.3.2 PDF/X-6p

A PDF/X-6p is different from the PDF/X-6 conformance level mentioned above in that it can have one or more external ICC profiles referenced from PDF/X output intents. This means that the PDF file by itself is not enough for a PDF/X-6p file to conform. In this case, PDF/X-6 must considered as a set of files, that together, constitute a whole and complete PDF/X-6p. Only when both the PDF/X-6p file and its externally referenced profiles are accessible can the file set be considered valid.





There are some use cases where using a PDF/X-6p file would be advantageous. First, the ability to externally reference an external ICC profile can result in smaller files sizes for PDF documents. Removing these profiles from the PDF file reduces its physical file size, making it more efficient to send electronically or view online.

One example where this is useful is for classified ads for newspapers. Every ad will share the same Output Intent. Saving the PDF with the ICC Profile externally linked instead of embedded will result in a smaller file size. Since there are so many classified ads in a single newspaper, having these smaller file sizes can have a big impact.

Typically, creating a PDF/X-6p file with an externally referenced profile would only be done for standard Output Intent ICC profiles.

#### 4.3.3 PDF/X-6n

PDF does in principle allow for multi color via spot colors. Today spot colors are increasingly used in a process color like way, i.e. designers want to use more than one spot color or a mix of spot and process colors (CMYK) for a single object. In addition designs are using partly overlapping spot color objects (or objects using a mix of spot and process colors). One area where such designs are very common is packaging or label printing.

PDF/X was designed to allow for complete exchange of print production data. As the creator of a PDF file typically does not know what printing machinery or even printing process will be used, PDF/X files require an Output Intent that colorimetrically defines the intended printing process.

For a PDF using the features described above this means that not only the process colors (CMYK) and their interaction need to be defined in the Output Intent, but also the spot colors and related interactions. But n-colorant ICC profiles (multicolor profiles) are not allowed to be embedded in



Figure 2: Example Multichannel Output Workflow incorporating PDF/X-6

OutputIntents in PDF 2.0. This is where PDF/X-6n comes into play.

The main purpose of a PDF/X-6n file is to provide the ability to use n-colorant page elements on the page, with color values defined by n-colorant ICC profiles within a PDF file. The profile remains as an external reference on a PDF/X-6n file. By doing so, PDF/X-6n files make it possible to use n-colorant ICC profiles while still conforming to ISO 32000-2 (PDF 2.0).

This allows for repurposing: When printing on a device that cannot print the spot colors, e.g. a digital printing machine, color conversion can be done using the well defined and established mechanisms of ICC based color conversions. Another use cases is proofing of the above file which basically has the same requirements (but will in addition have to take the characteristics of the printing device into account).

The ability to use n-colorant profiles is of particular importance to brand owners and producers of printed packaging. Another use case is the preparation of PDF files for 7c digital printing presses that are more and more used in reality, and there are other use cases where PDF/X-6n can be of particular use.

# 5.0 typical PDF/X-6 workflows

There are several different workflows that can be used to accomplish the successful delivery of a

Figure 3: Example of a Full Printed Product Represented by a Single Source Document And Resultant PDF/X-6 File



PDF/X-6 file, and it is out of the scope of this document to attempt to define them all. The following sections are meant to illustrate just one example of how PDF/X-6 might be used in both a traditional print and a multichannel output scenario.

#### 5.1 Traditional print output workflow

For the purpose of this example, a traditional print workflow refers to a scenario where the purpose of the PDF/X-6 file is to generate a physical printed product only. As you can see in the Figure 1 below, this does not preclude the possibility that the PDF file might be printed on multiple different devices.

The steps in this example workflow would be as follows:

- 1. Separate image files, vector art files, and text are combined in a standard page layout software application and saved in that application's native file format. For this example, the page layout software has PDF/X-6 export functionality built-in.
- 2. The native file is exported as a PDF/X-6 file using the software's built in PDF/X-6 export functionality.
- 3. The exported PDF/X-6 file is sent to the print provider for output, and at the same time is uploaded to central repository for archival purposes.
- 4. The print provider uploads the PDF/X-6 file to a production workflow that includes a PDF/X-6 compliant raster Image Processor (RIP) that renders the PDF/X-6 file.
- 5. The rendered PDF/X-6 file is used to generate raster data that is used to drive the imaging system of a colour managed proofing device. The proofing device outputs colour accurate proofs for each printing process based upon the PDF/X-6 file's embedded output intent(s). The proof is shown to the client, and the client signs off on the proof.
- 6. The rendered PDF/X-6 file is used to generate raster data that is used to image the printing plates for both the offset press and the flexo press. The plates are used to print the job on each of the two presses.
- 7. The rendered PDF/X-6 file is also rasterized for the colour managed digital press, and the raster data is used to drive the imaging system of the digital output device. The digital press colour manages the print based upon the PDF/X-6 file's embedded output intent(s).

#### 5.2 Multichannel output workflow

For the purpose of this example, a multichannel output workflow refers to a scenario where the same PDF/X-6 file is used to produce multiple types of output. For example, one PDF/X-6 file is generated for use in a print workflow, as well as for distribution across the web and for an email campaign.

The steps in this example workflow would be as follows:

- 1. Separate image files, vector art files, and text are combined in a standard page layout software application and saved in that application's native file format. For this example, the page layout software has PDF/X-6 export functionality built-in.
- 2. The native file is tagged with appropriate metadata (XML) to describe objects and content.
- 3. The native file is exported as a PDF/X-6 file using the software's built in PDF/X-6 export functionality.
- 4. The exported PDF/X-6 file is uploaded to a cross channel distribution server, where the file is ingested, analyzed and transformed into its various non-print formats.
- 5. At the same time, the PDF/X-6 file is uploaded to a central repository for archival purposes.

- 6. The cross channel distribution server distributes the transformed files, and these files are published on their respective electronic platforms. Colour for these various transformations are controlled via the files embedded output intent(s).
- 7. The rendered PDF/X-6 file is also rasterized for the colour managed digital press, and the raster data is used to drive the imaging system of the digital output device. The digital press colour manages the print based upon the PDF/X-6 file's embedded output intent(s).

### 6.0 PDF/X-6 conformance level case studies

This section of the document provides example use cases for each of the three conformance levels of PDF/X-6, to help provide context and understanding of how each of these conformance levels might be used.

#### 6.1 Case study for the PDF/X-6 conformance level: Romantic Koosbania

Romantic Koosbania is a fictional travel book written by Gustav Hunckledinkle, a professor of Geography at the University of Northern South Dakota At Hoople. The book has been written, and the publisher has hired a designer to design the first edition. The book has different components to it, including a cover, black and white text pages, full colour illustration pages, and full colour map pages. In addition to the book, the publisher has decided to create a full colour poster that will be given away for free with the first edition book as part of the marketing strategy for the book's launch.

After consulting with the printer for the book, the designer has decided to create on single document that contains all parts of the book as well as the poster. The file will be exported as a PDF/X-6 file to take advantage of the ability to include appropriate page level output intents for each of the different components. Figure 3 Illustrates an overview of the five different components found within the single PDF/X-6 file.

TABLE 3: DETAILS FOR SPECIFIC COMPONENTS OF KOOSBANIA PDF/X-6 FILE			
COMPONENT	ATTRIBUTES	PRINTING PROCESS	
Book Cover	Colours: CMYK (Process) Size: 12.5 inches × 7.25 inches Bleed: 0.125 inches, all 4 sides Page Level Output Intent: CF_RPC7a	Offset Lithography	
Text Pages	Colours: Process Black (K) Only Size: 5 inches × 7 inches Bleed: None Page Level Output Intent: Dot Gain 15% (Grayscale)	High-speed Production Inkjet (webfed)	
Illustration Pages	Colours: CMYK (Process) Size: 5 inches × 7 inches Bleed: None Page Level Output Intent: GRACoL2013 CRPC6	Offset Lithography	
Map Pages	Colours: CMYK (Process) Size: 9 inches × 7 inches Bleed: None Page Level Output Intent: GRACoL2013 CRPC6	Offset Lithography	

The specific details of each component of the book project are explained in Table 3 below.

TABLE 3: DETAILS FOR SPECIFIC COMPONENTS OF KOOSBANIA PDF/X-6 FILE				
COMPONENT	ATTRIBUTES	PRINTING PROCESS		
Poster	Colours: CMYK (Process) Size: 13.5" × 18" Bleed: 0.125 inches, all 4 sides Page Level Output Intent: FOGRA 51	High-speed Production Inkjet (sheetfed)		

Once the PDF/X-6 file is exported, it will be electronically delivered to the printer. Upon receipt of the file, the printer checks the file to ensure that it is a valid PDF/X-6 file, and that the file is technically accurate. This validation will be done using using the DPart metadata. By checking to ensure the file is a valid PDF/X-6 file, the printer can proceed with confidence with regards to the predictability of the file's intended output.

Once the file passes validation, it will be processed via the workflow RIP. Using rules-based automation, the different components of the file will be identified via the embedded page-level output intents, and automatically distributed and rendered using the correct workflow parameters for the particular device and output intent assigned. Due to the high level and accuracy of the automation used, the printer is able to complete this part of production with minimal touch points, reducing the time needed to complete this production, which in turns increases productivity and profitability.

The imposed, production ready files will be checked for correct imposition via the workflow's built-in preview tool. Once imposition is verified, the production ready files will be sent to a colour managed proofer, proofs will be output and sent to the customer, and the customer will sign off on the proofs (if correct). Once the proofs have been approved, the different components will be printed, folded, assembled and finished. Finished products will be delivered to the customer.

#### 6.2 Case study for the PDF/X-6p conformance level: Daily Newspaper

One example where this is useful is for classified ads for newspapers. Every ad will share the same Output Intent. Saving the PDF with the ICC Profile externally linked instead of embedded withh result in a smaller file size. Since there are so many calssified ads in a single newspaper, haveing these smaller file sizes can have a big impact.

Typically, creating a PDF/X-6p file with an externally referenced profile would only be done for standard Output Intent ICC profiles.

#### 6.3 Case study for the PDF/X-6n conformance level: Extended gamut Package printing

Extended gamut printing refers to a process where an extended ink set (typically cyan, magenta, yellow black, orange, green and violet) is used to print. The benefit of extended gamut printing is that it can reproduce a much larger color gamut than just 4-color printing, and can be used to accurately reproduce a large number of spot colors without the need to change inks between jobs.

In this example, there is a poato chip company that prints all of their plastic chip bags using extended gamut inks on fleographic printing presses. There are different colored bags for each chip flavor, and the colors of the bags also change by country. Due to the large volume of printing and the companies international reach, these potato chip bags are printed in more than one loaction around the world. It is critical that the colors of the bags match closely with one another, despite which location they are printed at, since these colors are very much part of the company's corporate identity.

In order to maintain accurate color control, each digital file sent to press is a PDF/X-6n file that has an associated 7-color ICC profile embedded in its Output Intent. This 7-color ICC profile is then used to guide the proofing and printing of the chip bags, providing clear and measureable targets for the

printers to achieve.

Ed Note: If we are all happy with where this example is going, I can elaborate and add some visuals

# 7. Conclusion

This document has highlighted the main differences and advantages of PDF/X-6 over PDF/X-4, and has discussed the benefits of adopting PDF/X-6 within production workflows. While PDF/X-6 is advantageous in all print environments, it might be of particular interest to users that produce content for multi-channel distribution. To illustrate ways in how PDF/X-6 might be used, example workflows and case studies were presented.

It is recommended that content creators consult with their print production/multi-channel distributors about their best practices in using PDF/X-6 within their workflows. Software and hardware vendors looking to conform to PDF/X-6 within their products are advised to use both ISO 32000-2 and ISO 15930-9 as road maps and guidelines to achieve conformance.

# 8. Bibliography

PDF 2.0 Application Note 001: Black Point Compensation, available in www.pdfa.org

**ISO 32000-2:2020** - Document management — Portable document format — Part 2: PDF 2.0 available at www.iso.org

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