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Technical Guidelines for Digitizing Cultural Heritage Materials

Creation of Raster Image Files

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Technical Guidelines for Digitizing Cultural Heritage Materials: Creation of Raster Image Master Files *http://www.digitizationguidelines.gov/guidelines/FADGI_Still_Image-Tech_Guidelines_2010-08-24.pdf*	Don Williams and Michael Stelmach
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Technical Guidelines for Digitizing Archival Records for Electronic Access: Creation of Production Master Files – Raster Images *http://www.archives.gov/preservation/technical/guidelines.pdf*	Steven Puglia, Jeffrey Reed, and Erin Rhodes U.S. National Archives and Records Administration
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approaching the limit of the file format to define white. These specific values are defined in each section of the guidelines.

Illuminance Non-Uniformity

Both lighting and lens performance contribute to this measurement. Ideally, there should be a perfectly even recording of a neutral reference from center to edge and between points within the image. ISO 17957:2015 defines the shading measurements. Specific values are defined in each section of the guidelines.

Color Accuracy

There is no perfect imaging system or perfect method of color evaluation. Color accuracy is measured in DICE by computing the color difference (ΔE2000) between the imaging results of the standard target patches and their pre-measured color values. By imaging the DICE target and evaluating through the DICE software, variances from known values can be determined, which is a good indicator of how accurate the system is recording color. Dice measures the average deviation of all color patches measured (the mean). Refer to ISO 13658:2000 for additional documentation on color accuracy measurement.

Color Channel Mis-Registration

All lenses focus red, green, and blue light slightly imperfectly. This parameter measures the spread of red, green, and blue light in terms of pixels of mis-registration. This parameter is used in the evaluation of lens performance.

MTF/SFR (Modulation Transfer Function / Spatial Frequency Response)

Modulation Transfer Function is a measurement of the contrast difference between the original image and the digital image. MTF is defined as the modulation ratio of the output image and the ideal image. Spatial Frequency Response measures the imaging systems ability to maintain contrast between increasingly smaller image details. Using these two functions, an accurate determination of resolution can be made as it relates to sampling frequency. ISO 12233:2000, ISO 16067-1:2003, and ISO 16067-2:2004 define MTF/SFR measurement.

Reproduction Scale Accuracy (Future Implementation)

This parameter measures the relationship between the size of the original object to the size of that object in the digital image. This parameter is measured in relation to the pixels per inch (ppi) or pixels per mm (ppmm) of the original digital capture. For example, capturing an image of a ruler at 400 ppi will digitally render at the correct size when displayed or printed at 400 ppi. It is critically important in cultural heritage imaging to maintain the relationship to the original size of the object.

The original size of microfilmed documents can only be determined if the filming “reduction ratio” is known. The scale is referred to as 8x or 10x (or other) reduction, indicating that the magnification of the image on the microfilm is 1/8th or 1/10th the size of the original document. This may or may not be known when digitizing microfilm. Unless noted in metadata, the scale of the original will be lost when microfilm is digitized. Microfilm is digitized at the same ppi resolution, regardless of the original “reduction ratio.”

Photographic film cannot be related to a reproduction scale, unless there is a physical measurement in the image to scale to. Photographic film is digitized to appropriate resolutions relative to the size of the film.

Sharpening

Almost all digital imaging systems apply sharpening, often at a point where the user has no control over the process. Sharpening artificially enhances details to create the illusion of greater definition. DICE

- Sharpen images to match the appearance of the originals, and compensate for variations in originals and the digitization process (grayscale and color images).

The following sections address various types of image adjustments that we feel are often needed and are appropriate. The amount of adjustment needed to bring images to a common rendition will vary depending on the original, on the scanner/digital camera used, and on the image processing applied during digitization (the specific scanner or camera settings).

Color Management

Digitization is the conversion of analog color and brightness values to discrete numeric values. A number, or set of numbers, designates the color and brightness of each pixel in a raster image. The rendering of these numerical values, however, is dependent on the device used for capture, display, or printing. Color management provides a context for objective interpretation of these numeric values, and helps to compensate for differences between devices in their ability to render or display these values, within the many limitations inherent in the reproduction of color and tone.

Color management does not guarantee the accuracy of tone and color reproduction. Color management cannot compensate for poor imaging and/or improper device calibration.

Every effort should be made to calibrate imaging devices and to adjust scanner/digital camera controls to produce the most accurate images possible in regard to tone and color. Calibration will not only improve accuracy of capture, but will also ensure the consistency required for color management systems to function by bringing a device to a stable, optimal state. Methods for calibrating hardware vary from device to device, and are beyond the scope of this guidance.

International Color Consortium (ICC) Color Management System

ICC-based color management is the most widely implemented approach. It consists of four components that are integrated into software (both the operating system and applications).

- PCS (Profile Connection Space)
  - Typically, end users have little direct interaction with the PCS. It is one of two device-independent measuring systems for describing color based on human vision, and is usually determined automatically by the source profile. The PCS will not be discussed further.
- Profile
  - A profile defines how the numeric values that describe the pixels in images are to be interpreted, by describing the behavior of a device or the shape and size of a color space.
- Rendering Intent
  - Rendering intents determine how out-of-gamut colors will be treated in color space transformations.
- CMM (Color Management Module)
  - The CMM performs the calculations that transform color descriptions between color spaces.

Profiles

Profiles are sets of numbers, either a matrix or look up table (LUT), that describe a color space (the continuous spectrum of colors within the gamut, or outer limits, of the colors available to a device) by relating color descriptions specific to that color space to a PCS.

Although files can be saved with any ICC-compliant profile that describes an input device, output device or color space (or with no profile at all), it is best practice to adjust the color and tone of an image to achieve an accurate rendition of the original in a common, well-described, standard color space. This minimizes future effort needed to transform collections of images, as well as streamlines the workflow for repurposing images by promoting consistency. Although there may be working spaces that match more efficiently with the gamut of a particular original, maintaining a single universal working space that covers most input and output devices has additional benefits. Should the profile tag be lost from an image or set of images, the proper profile can be correctly assumed within the digitizing organization, and outside the digitizing organization it can be reasonably found through trial and error testing of the small set of standard workspaces.

Some have argued that saving unedited image files in the input device space (profile of the capture device) provides the least compromised data, and allows a wide range of processing options in the future; but these files may not be immediately usable and may require individual or small batch transformations. The data available from the scanner has often undergone some amount of adjusting beyond the operator's control, and may not be the best representation of the original. We recommend the creation of master image files using a standard color space that will be accurate in terms of color and tone reproduction when compared to the original.

The RGB color space for master files should be gray-balanced, perceptually uniform, and sufficiently large to encompass most input and output devices. Color spaces that describe neutral gray with equal amounts of red, green, and blue are considered to be gray-balanced. A gamma of 2.2 is considered perceptually uniform because it approximates the human visual response to stimuli.

The Adobe RGB 1998, ProPhoto and ECIRGBv2 color space profiles adequately meet these criteria and are recommended for storing RGB image files. These color spaces have reasonably large color gamuts, sufficient for most purposes when saving as 48-bit RGB files. Using these large gamut color spaces with low-bit (8 bit per channel) files can cause quantization errors, therefore wide gamut color spaces may be more appropriate when saving high-bit or 48-bit RGB files. Gray Gamma 2.2 (16 bit) is recommended for grayscale images.

An ideal workflow would be to scan originals with a calibrated and characterized device, assign the profile of that device to the image file, and convert the file to the chosen workspace. Not all hardware and software combinations produce the same color and tonal conversion, and even this workflow will not always produce the best results possible for a particular device or original. Different scanning, image processing, and printing applications have their own interpretation of the ICC color management system, and have varying controls that produce different levels of quality. It may be necessary to deviate from the normal, simple color managed workflow to achieve the best results. There are many options possible to achieve the desired results, many of which are not discussed here because they depend on the hardware and software available.

Rendering Intents

When converting images from one color space to another, one of four rendering intents must be designated to indicate how the mismatch of size and shape of source and destination color spaces is to be resolved during color transformations: perceptual, saturation, relative colorimetric, or absolute colorimetric. Of the four, perceptual and relative colorimetric intents are most appropriate for creation of master files and their derivatives. In general, we have found that perceptual intent works best for photographic images, while relative colorimetric works best for images of text documents and graphics. It may be necessary to try both rendering intents to determine which will work best for a specific image or group of images.

When perceptual intent is selected during a color transformation, the visual relationships between colors are maintained in a manner that looks natural, but the appearance of specific colors is not necessarily maintained. As an example, when printing, the software will adjust all colors described by the source color space to fit within a smaller destination space (printing spaces are smaller than most source or working spaces). For images with significant colors that are out of the gamut of the destination space (usually highly saturated colors), perceptual rendering intent often works best.

Relative colorimetric intent attempts to maintain the appearance of all colors that fall within the destination space, and to adjust out-of-gamut colors to close, in-gamut replacements. In contrast to absolute colorimetric, relative colorimetric intent includes a comparison of the white points of the source and destination spaces and shifts all colors accordingly to match the brightness ranges while maintaining the color appearance of all in-gamut colors. This can minimize the loss of detail that may occur with absolute colorimetric in saturated colors if two different colors are mapped to the same location in the destination space. For images that do not contain significant out of gamut colors (such as near-neutral images of historic paper documents), relative colorimetric intent usually works best.

Color Management Module

The CMM uses the source and destination profiles and the rendering intent to transform individual color descriptions between color spaces. There are several CMMs from which to select, and each can interact differently with profiles generated from different manufacturers' software packages. Because profiles cannot provide an individual translation between every possible color, the CMM interpolates values using algorithms determined by the CMM manufacturer and each will give varying results.

Profiles can contain a preference for the CMM to be used by default. Some operating systems allow users to designate a CMM to be used for all color transformations that will override the profile tag. Both methods can be superseded by choosing a CMM in the image processing application at the time of conversion. We recommend that a CMM that produces acceptable results for project-specific imaging requirements be chosen, and switched only when unexpected transformations occur.

Image Processing

After capture and transformation into one of the recommended color spaces (referred to as a "working space" at this point in the digitization process), most images require at least some image processing to produce the best digital rendition of the original. The most significant adjustments are color correction, tonal adjustment, and sharpening. These processes involve data loss and should be undertaken carefully since they are irreversible once the file is saved. Images should initially be captured as accurately as possible. Image processing should be reserved for optimizing an image, rather than for overcoming poor imaging.

Color Correction and Tonal Adjustments

Many tools exist within numerous applications for correcting image color and adjusting the tonal scale. The actual techniques of using them are described in many excellent texts entirely devoted to the subject. There are, however, some general principles that should be followed.

Properly calibrated systems for reflective capture should require little post-scan correction. This guidance would always apply to color and b&w film negatives for appropriate rendering.

- As much as possible, depending on hardware and software available, images should be captured and color corrected in high bit depth.
- Images should be adjusted to render correct highlights and shadows usually neutral (but not always) of appropriate brightness, and without clipping detail. Also, other neutral colors in the image should not have a color cast (see aimpoint discussion above).
- Avoid tools with less control that act globally, such as brightness and contrast, and that are more likely to compromise data, such as clipping tones.
- Use tools with more control and numeric feedback, such as levels and curves.
- Despite the desire and all technological efforts to base adjustments on objective measurements, some amount of subjective evaluation may be necessary, and will depend upon operator skill and experience.
- Do not rely on "auto correct" features. Most automatic color correction tools are designed to work with color photographic images and the programmers assumed a standard tone and color distribution that is not likely to match your images. This is particularly true for scans of text documents, maps, plans, etc.
- Color correction and tonal adjustments can only be accurately performed on a graphic workstation with a calibrated monitor capable of displaying the appropriate color space, and under controlled environmental conditions.

bits per channel), may be beneficial when re-purposing images and when working with images that need major or excessive adjustments to the tone distribution and/or color balance.

Color Mode

Grayscale image files consist of a single channel, commonly either 8 bits (256 levels) or 16 bits (65,536 levels) per pixel with the tonal values ranging from black to white. Color images consist of three or more grayscale channels that represent color and brightness information. Common color modes include RGB (red, green, blue), CMYK (cyan, magenta, yellow, black), and L*a*b* (lightness, red-green, blue-yellow). The channels in color files may be either 8- bits (256 levels) or 16-bits (65,536 levels). Display and output devices mathematically combine the numeric values from the multiple channels to form full color pixels, ranging from black to white and to full colors.

RGB represents an additive color process: red, green, and blue light are combined to form white light. This is the approach commonly used by computer monitors and televisions, film recorders that image onto photographic film, and digital printers/enlargers that print to photographic paper. RGB files have three color channels: 3 channels x 8- bits = 24-bit color file or 3 channels x 16-bits = 48-bit color. All scanners and digital cameras create RGB files by sampling for each pixel the amount of light passing through red, green, and blue filters that is being reflected or transmitted by the item or scene being digitized. Black is represented by combined RGB levels of 0-0-0, and white is represented by combined RGB levels of 255-255-255. This is based on 8-bit imaging and 256 levels from 0 to 255; this convention is used for 16-bit imaging as well, despite the greater number of shades. All neutral colors have equal levels in all three color channels. A pure red color is represented by levels of 255-0-0, pure green by 0-255-0, and pure blue by 0-0-255.

CMYK files are an electronic representation of a subtractive process: cyan (C), magenta (M), and yellow (Y) are combined to form black. CMYK mode files are used for prepress work and include a fourth channel representing black ink (K). The subtractive color approach is used in printing presses (four color printing), color inkjet, and laser printers (four color inks, many photo inkjet printers now have more colors), and almost all traditional color photographic processes (red, green, and blue sensitive layers that form cyan, magenta, and yellow dyes).

L*a*b* color mode is a device independent color space that is matched to human perception: three channels representing lightness (L, equivalent to a grayscale version of the image), red and green information (A), and blue and yellow information (B). One benefit of L*a*b* mode is that it is matched to human perception, and also L*a*b* mode does not require color profiles (see section on color management). Disadvantages of L*a*b* include the potential loss of information in the conversion from the RGB mode files from scanners and digital cameras, the need to have high-bit data, and the fact that few applications and file formats support it.

Avoid saving files in CMYK mode. CMYK files have a significantly reduced color gamut (see section on color management) and are not suitable for master image files for digital imaging projects involving holdings/collections in cultural institutions. The conversion from RGB to CMYK involves the replacement of a portion of the neutral color with black (K). This conversion is not reversible back to RGB without the loss of color accuracy.

While theoretically L*a*b* may have benefits, at this time we feel that RGB files produced to the color and tone reproduction described in these *Guidelines* and saved with an appropriate ICC profile, are the most practical option for master files and are relatively device independent. We acknowledge that the workflow described in these *Guidelines* to produce RGB master files may incur some level of loss of data; however, we believe the benefits of using RGB files brought to a common rendering outweigh the minor loss.

Documents (Unbound): Manuscripts and Other Rare and Special Materials

Performance Level:

	1 Star	2 Star	3 Star	4 Star
Master File Format		TIFF, JPEG 2000, PDF/A	TIFF, JPEG 2000, PDF/A	TIFF, JPEG 2000, PDF/A
Access File Formats		All	All	All
Resolution		300 ppi	300 ppi	400 ppi
Bit Depth		8	8 or 16	16
Color Space		Adobe 1998, ProPhoto, ECIRGBv2	Adobe 1998, ProPhoto, ECIRGBv2	Adobe 1998, ProPhoto, ECIRGBv2
Color		Color	Color	Color
Measurement Parameters				
Tone Response (OECF) (Luminance)		± 9 count levels ≤ 8	± 6 count levels ≤ 5	± 3 count levels ≤ 2
White Balance Error (Luminance)		± 6 count levels ≤ 6	± 4 count levels ≤ 4	± 3 count levels ≤ 2
Illuminance Non-Uniformity		<5%	<3%	<1%
Color Accuracy (Mean ΔE 2000)		<8	<5	<3
Color Channel Misregistration		<.80 pixel	<.50 pixel	<.33 pixel
MTF10 (10% SFR)		sampling efficiency > 70% and SFR response at half sampling frequency < 0.4	sampling efficiency > 80% and SFR response at half sampling frequency < 0.3	sampling efficiency > 90% and SFR response at half sampling frequency < 0.2
MTF50 (50% SFR)		50% of half sampling frequency: [30%,85%]	50% of half sampling frequency: [35%,75%]	50% of half sampling frequency: [40%,65%]
Reproduction Scale Accuracy		<+/- 3% of AIM	<+/- 2% of AIM	<+/- 1% of AIM
Sharpening (Maximum MTF)		<1.2	<1.1	<=1.0
Noise ΔL* St. Dev (Luminance)		<5 count levels < 3	<4 count levels < 2	<3 count levels < 1

Count values are expressed as 8 bit equivalents

Documents (Unbound): Manuscripts and Other Rare and Special Materials

Rare and special materials represent manuscripts, illustrations of special artistic or graphic interest; also documents with poor legibility or diffuse characters, e.g., carbon copies, Thermofax, etc.

Recommended Technologies

- Planetary scanners – manually operated
- Digital cameras

Not Recommended Technologies

- Lighting systems that raise the surface temperature of the original more than 4 degrees F (2 degrees C) in the total imaging process.
- Sheet fed scanning systems that contact the recto (face) or verso (back) of the original in any way.

Notes

- To be FADGI compliant, all imaging performed on special collections materials must be done by personnel with advanced training and experienced in the handling and care of special collections materials. FADGI compliance requires proper staff qualifications in addition to achieving the performance levels defined in this document. It is out of the scope of this document to define proper staff qualifications for cultural heritage imaging.
- Special collections materials will often contain colors that are outside of the gamut of current color reproduction systems and will require special imaging techniques to approximate the original in digital form. Alternative imaging techniques, including but not limited to texture lighting, multiple light source exposure, and multispectral/hyperspectral imaging may be used to best reproduce the original. These techniques should be accomplished as single exposures, not blends of multiple exposures. An “image cube” of multiple single exposures may be considered an archival master file, but a single base image must meet the specifications in the chart above for FADGI compliance in all respects. Note that color accuracy is measured against the color test target, not the artifact.

  This topic will be addressed in more detail in future revisions of these guidelines.
- If a backing sheet is used, it must extend beyond the edge of the page to the end of the image on all sides of the page.
- Single exposure total area capture scanning systems are considered the most appropriate technologies when imaging special collections materials. However, FADGI permits the use of other technologies that may be appropriate as long as none of the stated restrictions are compromised by the use of that technology.
- When imaging materials that are sensitive to rapid moisture absorption, matching temperature and humidity between storage and imaging conditions is critical.
- Special collections materials should not be placed in contact with glass or other materials in an effort to hold originals flat while imaging, without the approval of a paper or book conservator. This technique can lead to physical damage to the original. Spatulas or other implements to assist in holding pages flat for imaging may be used, but must not obscure informational content. If used, these should not be edited out of master files.
- Holding down an original with the use of a vacuum board should also be approved by a paper or book conservator. Air forced through the original over the vacuum ports can permanently degrade some originals.
- No image retouching is permitted to master files.
- Image processing techniques are approved for the creation of access files in FADGI.

- For master files, documents should be imaged to include the entire area and a small amount beyond to define the area. Access files may be cropped.
- At 4*, no software de-skew is permitted. Images must be shot to a +/- 1 degree tolerance.
- Image capture resolutions above 400 ppi may be appropriate for some materials, but imaging at higher resolutions is not required to achieve 4* compliance.
- Single exposure total area capture scanning systems are considered the most appropriate technologies when imaging special collections materials, including documents. However, FADGI permits the use of other technologies that may be appropriate as long as none of the stated restrictions are compromised by the use of that technology.

Aimpoint Variability

Reference color calibration targets are surrogates for the colors in the actual collections. While current color management systems do well in connecting target colors to actual object colors, inaccuracies are inevitable due to metamerism[6] and other factors. Careful calibration of a digitization system using a DICE reference target (for reflection copy), or an appropriate color target for transmission originals, provides a best compromise calibration for most digitization.

[6] https://en.wikipedia.org/wiki/Metamerism_(color)

Prints and Photographs

Performance Level:

	1 Star	2 Star	3 Star	4 Star
Master File Format	TIFF	TIFF	TIFF	TIFF
Access File Formats	All	All	All	All
Resolution	100 ppi	200 ppi	400 ppi	600 ppi[1]
Bit Depth	8	8	8 or 16	16
Color Space	Grey Gamma 2.2 SRGB Adobe 1998 ProPhoto ECIRGBv2	Grey Gamma 2.2 SRGB Adobe 1998 ProPhoto ECIRGBv2	Adobe 1998 ProPhoto, ECIRGBv2	Adobe 1998 ProPhoto, ECIRGBv2
Color	Grayscale or Color	Grayscale or Color	Color	Color
Measurement Parameters				
Tone Response (OECF) (Luminance)	± 9 count levels ≤ 8	± 7 count levels ≤ 6	± 5 count levels ≤ 4	± 3 count levels ≤ 2
White Balance Error (Luminance)	± 8 counts ≤ 8	± 6 counts ≤ 6	± 4 count levels ≤ 4	± 3 count levels ≤ 2
Illuminance Non-Uniformity	<8%	<5%	<3%	<1%
Color Accuracy (Mean ΔE 2000)	<10	<6	<4	<2
Color Channel Misregistration	<1.2 pixel	<.80 pixel	<.50 pixel	<.33 pixel
MTF10 (10% SFR)	sampling efficiency > 60% and SFR response at half sampling frequency < 0.4	sampling efficiency > 70% and SFR response at half sampling frequency < 0.4	sampling efficiency > 80% and SFR response at half sampling frequency < 0.3	sampling efficiency > 90% and SFR response at half sampling frequency < 0.2
MTF50 (50% SFR)	50% of half sampling frequency: [25%,95%]	50% of half sampling frequency: [30%,85%]	50% of half sampling frequency: [35%,75%]	50% of half sampling frequency: [40%,65%]
Reproduction Scale Accuracy	<+/- 3% of AIM	<+/- 3% of AIM	<+/- 2% of AIM	<+/- 1% of AIM
Sharpening (Maximum MTF)	<1.3	<1.2	<1.1	<=1.0
Noise ΔL* St. Dev (Luminance)	>6 count levels < 4	>5 count levels < 3	>4 count levels < 2	>3 count levels < 1

1. In rare cases, resolutions higher than 600 ppi may be needed to resolve fine details.

Prints and Photographs

Includes photographic prints, graphic-arts prints (intaglio, lithographs, etc.), drawings, some paintings, (e.g., water colors), and some maps.

Recommended Technologies

- Planetary scanners
- Digital cameras
- Flatbed scanners

Not Recommended Technologies

- Drum scanners
- Lighting systems that raise the surface temperature of the original more than 4 degrees F (2 degrees C) in the total imaging process

The intent in scanning photographs is to maintain the smallest significant details. Resolution requirements for photographs are often difficult to determine because there is no obvious fixed metric for measuring detail such as quality index. Additionally, accurate tone and color reproduction in the scan play an equal, if not more, important role in assessing the quality of a scan of a photograph.

The recommended scanning specifications for photographs take into account the intended uses of the four star levels. In general, 300 ppi at the original size is considered minimum to reproduce the photograph well at the size of the original. For photographic formats in particular, it is important to carefully analyze the material prior to scanning. Because every generation of photographic copying involves some quality loss, using intermediates, duplicates, or copies inherently implies some decrease in quality and may also be accompanied by other problems (such as improper orientation, low or high contrast, uneven lighting, etc.).

Notes

- "Prints and Photographs" encompass a wide range of technologies and processes that have been used to create reflective images. For many of these, subtle texture, tone and color differences are an essential part of their character. While it is not possible to preserve all of these subtle physical differences in digital form, we can approximate some of their unique qualities. It is for this reason that all master files from both color and black and white originals are to be imaged in 16 bit color at or above 3 star performance.
- The use of glass or other materials to hold an image flat during capture is allowed, but only when the original will not be harmed by doing so. Care must be taken to assure that flattening a photograph will not result in emulsion cracking, or the base material being damaged. Tightly curled materials must not be forced to lay flat.
- There are a variety of visible degradations that occur with photographs, many of which can be minimized using special imaging techniques. The application and use of these techniques are beyond the scope of this document but can be found in contemporary photography literature. Alternate imaging techniques are approved for FADGI imaging. The use of these techniques can result in multiple images of the same photograph. These images must be referenced as a group in file naming and embedded metadata. The group of files is considered the master image.
- If alternate lighting techniques are used and the resulting master file is a single image, the alternate imaging technique must conform to the FADGI specifications. If using alternate imaging techniques results in multiple files of the same original, one of the images must conform to the FADGI specifications, and this image must be identified as the base.
- FADGI allows the use of flatbed scanners when imaging photographs, but the user should be aware that images may render differently on a flatbed scanner than if imaged using a camera or

planetary scanner and traditional copy lighting. Additionally, when using a flatbed scanner, dust and dirt on the scanner glass and optical system can result in dust and dirt in the file.

- Dust removal is not allowed on master images, and digital dust removal techniques during the scanning process are also not approved.
- Color, tone enhancement or restoration is not allowed on master images.
- Photographic print processes vary widely in their response to digital sensors. A reference target should be imaged with each exposure and retained in the master file. Color and tone adjustments must be made to the target data, not the photograph.
- Adjustments to correct or enhance the image may be made to access versions, and noted as such in embedded metadata and file naming.