There's more to your digital images than meets the eye.

Your image files are probably hiding a lot of information about themselves that you will never see unless you go looking for it.

In computer terms, the hidden information goes by the general title of "metadata". Simply stated, metadata is data about data. In the case of image files, the primary purpose of such metadata is to help imaging applications work with the images, but metadata can also have other uses as well.

Currently, digital images may have three general categories of metadata. The first two categories: camera system generated data and user generated data are part of the image file itself. The third category is not actually part of the image file, but is stored on the memory card that contains image files and refers to the files.

Early image file formats didn't have all this "secret" information. Let's talk about how image file formats and metadata have evolved.

Camera system generated data.

I started working with digital images in the early days of digital imaging at Kodak during the mid-1980s. At that time, image file raw data was stored on large reels of magnetic tape. To be able to read the image data later, we need to write the image size data (pixels wide, pixels high, number of channels) on a slip of paper. If we lost the written image information we couldn't open the files. The early Scitex CT (continuous tone) format worked in much the same way.

To make image files easier to use, a number of different image file formats were developed that incorporated the necessary information needed to open the file. Targa (.TGA) was one such format developed by Truvision for use with their display cards. These early formats remained fairly proprietary and were really designed just to work with the developer's applications or hardware.

To get around the limitations of these proprietary approaches, in the mid 1980s Aldus (a company absorbed by Adobe years ago) and Microsoft worked with scanner and printer manufacturers to develop TIFF, a tag based file format that was designed to promote the interchange of digital image

data. The TIFF format was based on existing practice and the information fields were defined primarily with desktop publishing and related applications in mind. Most importantly, the format was designed to be easily updated with new information tags.

TIFF files were uncompressed, and the early consumer digital cameras all used their own proprietary compressed image file formats like the .KDC (Kodak Digital Camera) format used in early Kodak digital cameras.

The JPEG (Joint Photographic Experts Group) standardized on the discrete cosine transform compression method we now call "JPEG", but only specified the compression method and not the file format to use with it. This led to the development of several early JPEG file formats like the Colorsqueeze format introduced by Kodak in 1990 and PicturePress released by Storm Technologies.

The lack of image file format standardization continued to make it very difficult for imaging application writers and users alike and lead to the creation of the industry standard JFIF format in 1992. The JPEG File Interchange Format (JFIF) is a simplified file format that enabled JPEG compressed images to be exchanged between a wide variety of platforms and applications. JFIF was a step in the right direction towards standardization. However, it wasn't designed to incorporate the additional data that digital camera designers wanted to include.

To meet the desire to include more information, JEIDA (Japan Electronic Industry Development Association) developed the Exif (Exchangeable image file format) specification in 1996. The aim was to insure data compatibility and exchangeability thus providing a frame work in which digital products could be used readily by ordinary consumers. Notice that Exif can serve as a "wrapper" for both JPEG and TIFF data. It rapidly became the standard file format for the image data recorded by digital still cameras and related systems that use removable memory medium.

The Exif metadata that is saved includes camera specific properties such as manufacturer, model and camera software version as well as image specific properties such as the date and time the picture was taken, pixel resolution, ISO speed rating, f/stop, compression, and exposure time. Of course, for the date and time information to be correct, you must remember to keep the clock in your digital camera set correctly.

User generated data.

Photojournalist and newspaper photographers were among the first to really take an interest in the developing field of digital imaging because their business was based on immediacy. Not having to develop and print traditional film images offered a way to get images to their publications fast. The problem was, newspaper photographers needed a way to keep the caption data they prepared "locked" to their images. They were used to transmitting their images by wirephoto – much like a fax machine – and the wirephoto receiver printed the photo and caption information on same sheet.

The International Press Telecommunications Council (IPTC) and the Newspaper Association of America (NAA) began working together in 1990 to solve the problem of keeping the image data and caption information together. In 1991 they released a standard, now known as "IPTC Headers", which included entries for captions, keywords, categories, credits, and origins.

Data stored on the memory card.

The third form of metadata we mentioned is not part of the image file, but is on the memory card and refers to the files on the card. It can be used control things like print order information.

The Digital Print Order format (DPOF) developed in 2000 by Canon, Kodak, Fuji and Matsushita allows the user of digital cameras to define which captured images on the storage card are to be printed, together with information on the number of copies or other image information. It usually consists of a set of text files stored in the 'MISC' directory under the media root directory on the storage card.

Why should we care about metadata?

Most of us use our digital camera's Programmed exposure mode when we take pictures and have no idea what shutter speed, aperture and ISO speed were used to make a picture. Looking at the Exif metadata will tell you. You may also want to add a description, photographer's name and copyright information. In addition, there are programs like Extensis Portfolio that can use the metadata information to create key words in an image database. I'll talk about image database programs in a future article.

Working with metadata.

To be able to explore the hidden metadata, you'll first need to find a program that can read it. Commercial programs like Adobe

Photoshop, Photoshop Elements and iView MediaPro will let you read most Exif data. There are many free programs you can find on the web that will also work. Do a Google search for Exif reader and you'll find programs like Exif Viewer for Macintosh OS-X and EasyExif for Windows.

About the only Exif data you might want to be able to edit is the date and time information if you had forgotten to keep your camera's clock set correctly. Most programs that let you read Exif data won't let you edit it. There are a few shareware Exif editor programs available – if you need one, search the web.

Be careful when you use imaging software to modify your images. Not all imaging applications are metadata friendly and may not preserve your data on saving! Photoshop seems to preserve Exif data, but be sure to test your own software to see what happens.

You might wonder how you can add your own metadata to your images. Adobe Photoshop supports the information standard developed by the Newspaper Association of America (NAA) and the International Press Telecommunications Council (IPTC) mentioned earlier and lets you add a variety of information to image file headers.

Other programs like Photoshop Elements and iView MediaPro will also let you add information.

Examples.

Figure 1 is the Exif data information from a consumer Minolta DiMage X digital camera photo viewed using the File>File Info>EXIF path in Photoshop.

Figure 2 is the Exif information about the same image file viewed using the free Mac OS-X EXIF Viewer application.

Figure 3 is the Exif information about an image made with a professional Canon EOS 10D digital camera. In addition to the standard information, Canon includes information about the camera serial number, camera owner and a lot of custom information about the camera's settings.

Figure 1 is the Exif data information from a consumer Minolta DiMage X digital camera photo viewed using the File>File Info>EXIF path in Photoshop.

PICT0005.JPG

File name: PICT0005.JPG
File size: 849678 bytes (1600x1200, 3.5bpp, 7x)
EXIF Summary: 1/855s f/6.6 ISO200 6mm

Camera-Specific Properties:

Equipment Make: MINOLTA CO.,LTD
Camera Model: DiMAGE X
Camera Software: V100-02
Maximum Lens Aperture: f/2.8

Image-Specific Properties:

Image Orientation: Top, Left-Hand
Horizontal Resolution: 72 dpi
Vertical Resolution: 72 dpi
Image Created: 2004:06:30 14:12:29
Exposure Time: 5/4277 sec
F-Number: f/6.6
Exposure Program: Normal Program
ISO Speed Rating: 200
Exposure Bias: 0 EV
Metering Mode: Pattern
Light Source: Unknown
Flash: Flash
Focal Length: 6.00 mm
Color Space Information: sRGB
Image Width: 1600
Image Height: 1200

Other Properties:

Resolution Unit: i
Chrominance Comp Positioning: Co-Sited
Exif IFD Pointer: 284
Compression Scheme: JPEG Compression (Thumbnail)
Horizontal Resolution: 72 dpi
Vertical Resolution: 72 dpi
Resolution Unit: i
Offset to JPEG SOI: 4084
Bytes of JPEG Data: 4277
Exif Version: 2.10
Image Generated: 2004:06:30 14:12:29
Image Digitized: 2004:06:30 14:12:29
Meaning of Each Comp: Unknown
Image Compression Mode: 4
File Source: DSC
Scene Type: Directly Photographed

Figure 2 is the Exif information about the same image file viewed using the free Mac OS-X EXIF Viewer application.

File name: IMG_2328.JPG
File size: 2863555 bytes (3072x2048, 3.6bpp, 7x)
EXIF Summary: 1/125s f/8.0 ISO400 35mm (35mm eq:56mm)

Camera-Specific Properties:

Equipment Make:	Canon
Camera Model:	Canon EOS 10D
Maximum Lens Aperture:	f/4.5
Sensing Method:	One-Chip Color Area
Lens Size:	19.00 – 35.00 mm
Firmware Version:	Firmware Version 2.0.3
Serial Number:	
Owner Name:	

Image-Specific Properties:

Image Orientation:	Top, Left-Hand
Horizontal Resolution:	180 dpi
Vertical Resolution:	180 dpi
Image Created:	2004:05:18 17:55:43
Exposure Time:	1/125 sec
F-Number:	f/8.0
ISO Speed Rating:	400
Lens Aperture:	f/8.0
Exposure Bias:	0 EV
Flash:	Flash, Compulsory
Focal Length:	35.00 mm
Color Space Information:	sRGB
Image Width:	3072
Image Height:	2048
Rendering:	Normal
Exposure Mode:	Manual
Scene Capture Type:	Standard
Exposure Mode:	Manual
Focus Type:	Auto
Metering Mode:	Center-Weighted
Sharpness:	Normal
Saturation:	High
Contrast:	High
Shooting Mode:	Manual
Image Size:	Large
Focus Mode:	One-Shot
Drive Mode:	Single
Flash Mode:	On
Compression Setting:	Fine
Macro Mode:	Unknown
White Balance:	Daylight
Image Number:	233-2328

Other Properties:

Resolution Unit:	i
Chrominance Comp Positioning:	Centered
Exif IFD Pointer:	196
Compression Scheme:	JPEG Compression (Thumbnail)
Horizontal Resolution:	180 dpi
Vertical Resolution:	180 dpi
Resolution Unit:	i
Offset to JPEG SOI:	2148
Bytes of JPEG Data:	11264
Exif Version:	2.21
Image Generated:	2004:05:18 17:55:43
Image Digitized:	2004:05:18 17:55:43
Meaning of Each Comp:	Unknown
Image Compression Mode:	3
Shutter Speed:	1/125 sec
Metering Mode:	Average
Focal Plane Horiz Resolution:	3443 dpi
Focal Plane Vert Resolution:	3442 dpi
Focal Plane Res Unit:	i
File Source:	DSC
White Balance:	Manual
Base Zoom Resolution:	3072
Zoomed Resolution:	3072
ISO Speed Rating:	Unknown
Digital Zoom:	None
Self-Timer Length:	0 sec
Canon Tag1 Length:	92
Flash Bias:	0.33 EV
Sequence Number:	0
Canon Tag4 Length:	66
Image Type:	IMG:EOS 10D JPEG
Custom Function:	Lens AF stop button – AF stop
Custom Function:	Safety shift in Av or Tv – Disabled
Custom Function:	Shutter curtain sync – 1st-Curtain Sync
Custom Function:	Fill flash auto reduction – Enabled
Custom Function:	Assist button function – Normal
Custom Function:	Mirror lockup – Disabled
Custom Function:	Menu button display position – Previous (Volatile)
Custom Function:	Superimposed display – On
Custom Function:	AEB sequence/auto cancelation – 0,-,+/Enabled
Custom Function:	RAW+JPEG recording – RAW+Large/Fine
Custom Function:	AF point registration – Center
Custom Function:	Exposure level increments – 1/3 Stop
Custom Function:	AF-assist beam/Flash firing – Emits/Fires
Custom Function:	Shutter button/AE lock button – AF/AE Lock
Custom Function:	Flash sync speed in Av mode – Auto
Custom Function:	Shutter release w/o CF card – Yes
Custom Function:	SET button function when shooting – Not Assigned

Figure 3 is the Exif information about an image made with a professional Canon EOS 10D digital camera. In addition to the standard information, Canon includes information about the camera serial number, camera owner and a lot of custom info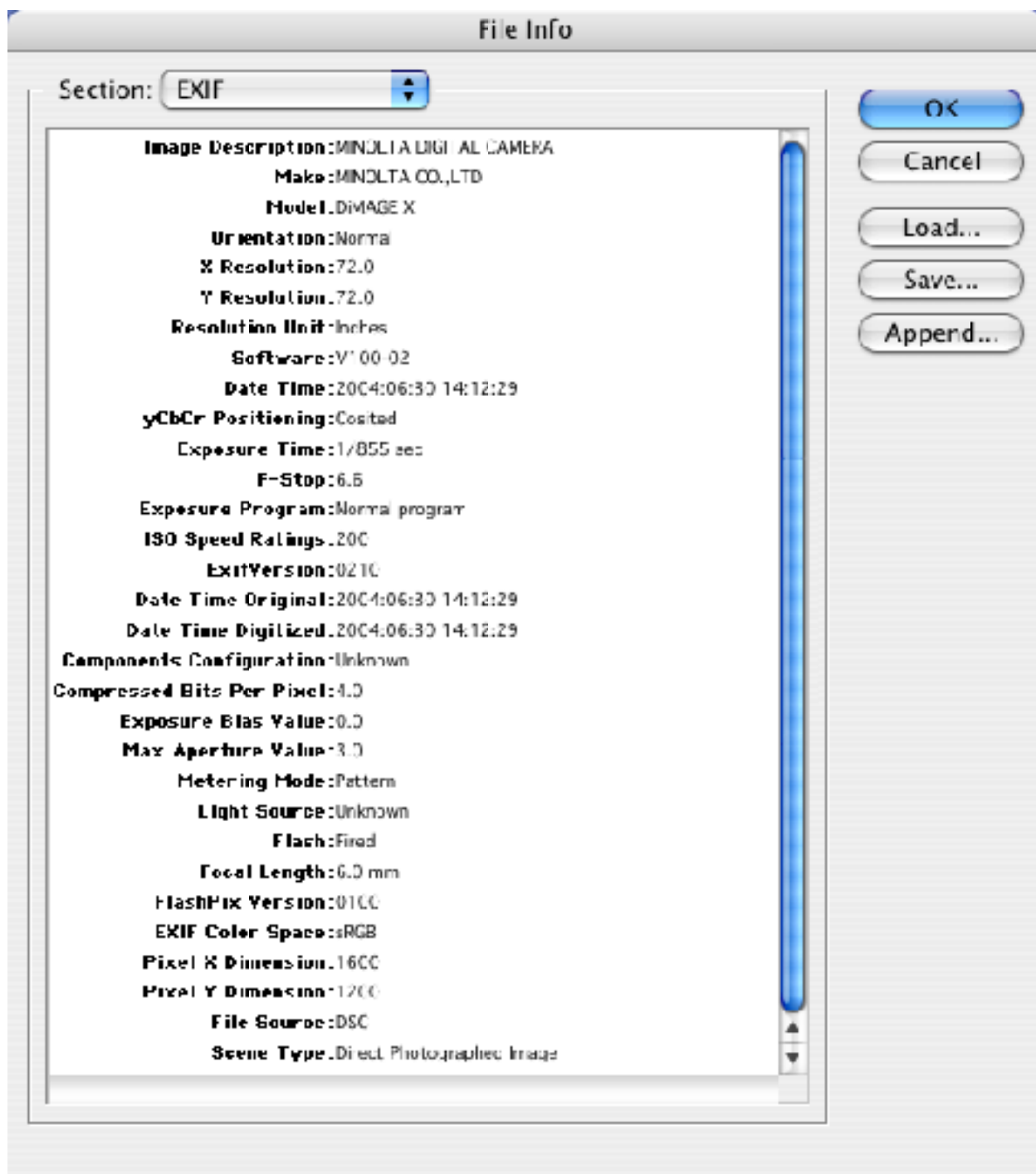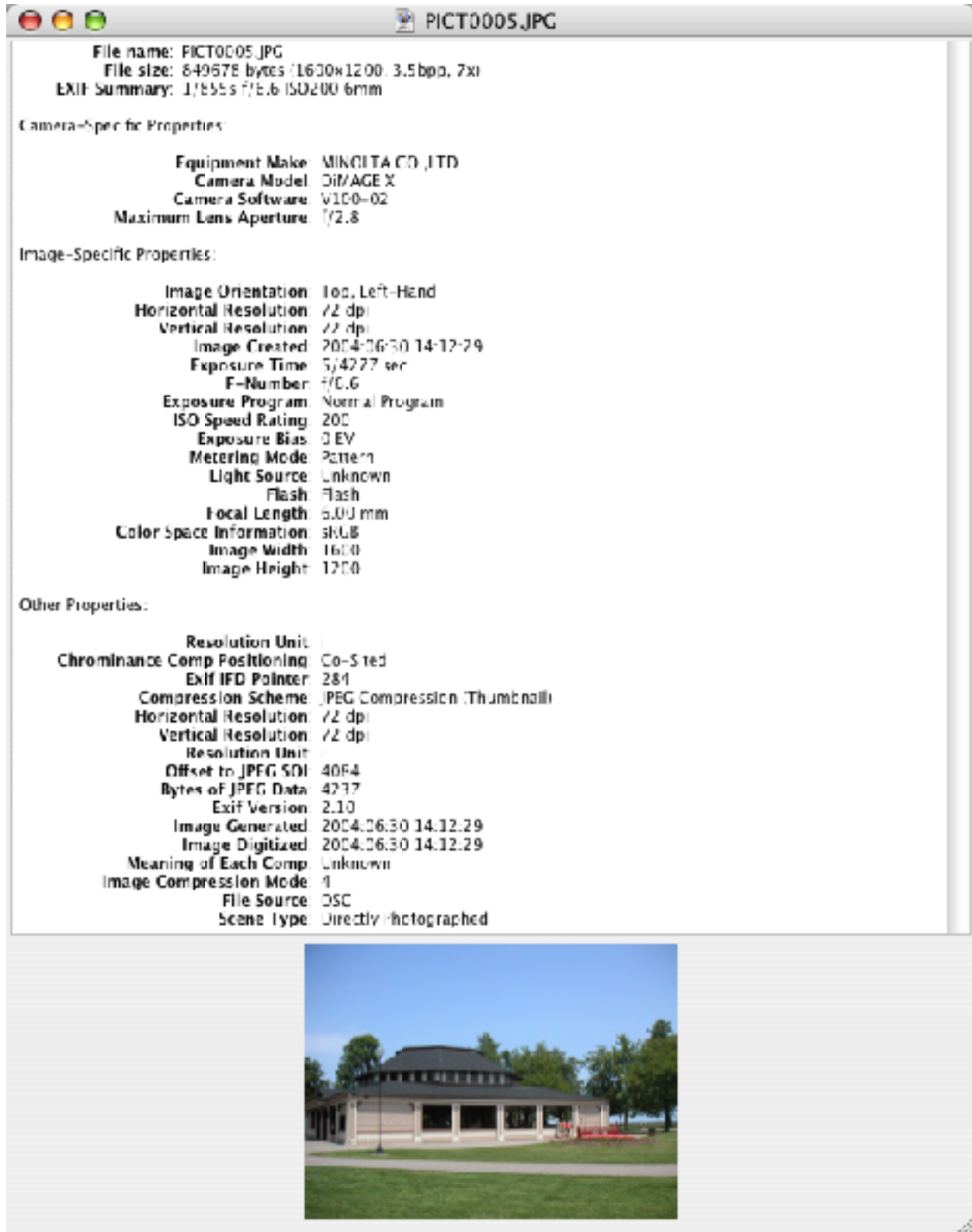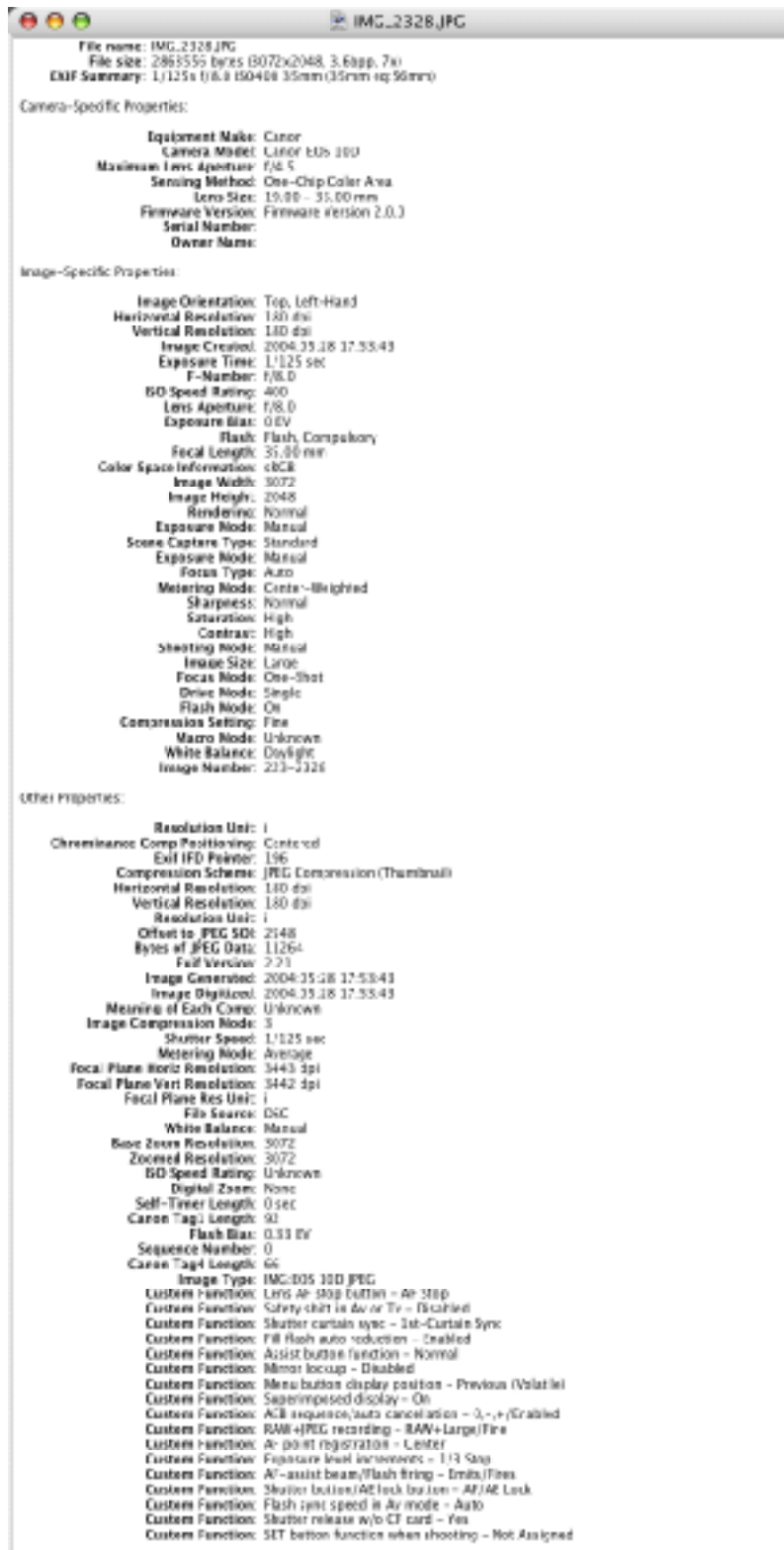rmation about the camera's settings.