SKY & TELESCOPE

**TEST REPORT**

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*Sean Walker*



# A New Planetary Camera

*New webcams from the Imaging Source are generating quite a buzz.*

## DMK 21AF04.AS monochrome webcam & control software

**US price:** $390
The Imaging Source
7257 Pineville-Matthews Rd., Suite 2200
Charlotte, NC 28226
704-370-0110
www.astronomycameras.com

**The Spartan looks of the Imaging Source's DMK 21AF04.AS webcam belie its capabilities. Its little cube of a body, with sides just 2 inches (5 cm) square, has a C-thread lens mount, a ¼-20 threaded tripod socket, and a six-pin FireWire port. The symmetrical design makes the camera extremely easy to mount on a telescope, and at just 8 ounces (265 grams), it's lighter than many eyepieces. All *S&T* photos are by the author.**

SOLAR-SYSTEM photography underwent a revolution a few years ago with the introduction of computer video cameras (webcams) and software that automatically registers and combines thousands of images. These tools have enabled amateur astronomers to routinely capture images of the planets that rival those made by the Hubble Space Telescope.

A key component of this revolution is a camera that records many frames quickly to "freeze" air turbulence during each ultrashort exposure. Several premium webcams have recently been introduced to the astronomical market; see, for example, our review of the Lumenera SkyNyx 2.0 (*S&T:* June 2006, page 76). Now there's another: The Imaging Source's DMK 21AF04.AS monochrome CCD camera. It records up to 60 frames per second with much better results than you can ever get from an ordi-

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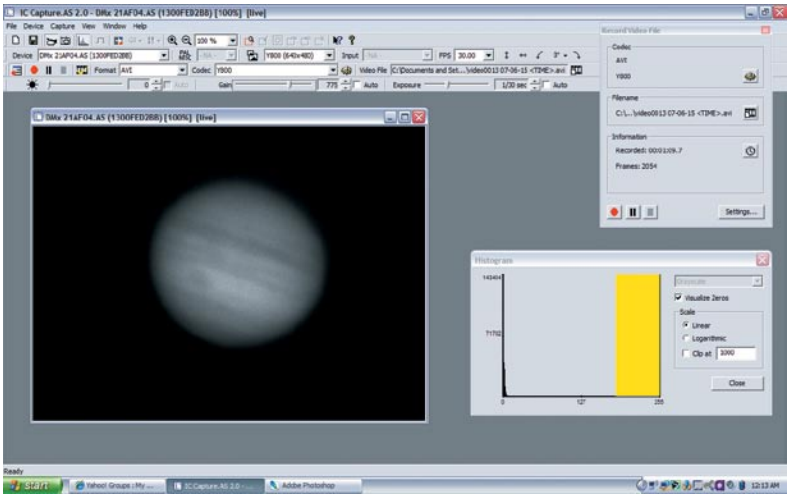
nary webcam like the kind sold at office-supply stores.

The $390 camera comes with a CD-ROM containing software drivers and the image-acquisition program *IC Capture.AS 2.0*. You'll need to purchase an IEEE 1394 (FireWire) cable to connect the camera to your PC or Mac. If your computer has a six-pin FireWire port you can buy a six-wire cable and power the camera directly from the computer. Most laptops I've seen have a socket for a four-pin FireWire cable. If that's true of yours, you'll also need an optional ($38.95) AC adapter to power the camera.

The four-pin cable I used was roughly 6 feet (2 meters) long — adequate for imaging directly at the telescope. FireWire has a maximum cable length of about 15 feet, but the Imaging Source sells FireWire "repeaters" that allow you to extend this distance up to 525 feet. The DMK has standard C-mount threads for attaching a lens or a C-to-1¼-inch adapter.



**One key to the excellent performance of the DMK 21AF04.AS is the control software, *IC Capture.AS*, included with the camera. This program is well designed and intuitive.**

## Installation and Setup

Setting up the camera is easy. You simply plug it into your computer, then install the software drivers and image-acquisition software. Everything went off without a hitch, and within minutes I had the camera producing a live video stream at 30 frames per second (FPS).

*IC Capture.AS* is very intuitive. Everything you need to record a high-quality video stream is directly at hand when you launch the program. Controls for exposure time, gain (sensitivity), and frame rate are clearly labeled and conveniently located on the toolbar across the top of the computer screen.

When you press the Record button a new window opens with additional controls, including Start, Pause, and Stop. The default record setting automatically gives each new video file a lengthy name that includes a clip number and the year, month, day, hour, minute, and second that the recording began. You can specify a less verbose file-naming scheme if you so desire.

A histogram plotting the number of pixels at each brightness level can be displayed in another window to monitor your exposure levels. It's important to avoid overexposing your image so that low-contrast features aren't obliterated. I found that my best video clips were recorded with the histogram topping out at about 180 of the 256 possible levels provided by the camera's 8-bit images.

The software also has controls labeled Format and Codec. The former refers to the video format. PC users should select AVI, since this one is widely used by programs that process astronomical video clips.

Codec is short for compression/decompression and refers to the algorithm that minimizes the file size when

**WHAT WE LIKE:**

- Fast frame rates up to 60 per second
- Low noise
- Easy to set up and use

**WHAT WE DON'T LIKE:**

- Cable not included

**Even with the DMK camera set at maximum gain, images were relatively noise free, as seen in a single frame *(left)* from an AVI video clip of Venus shot through an ultraviolet filter. A raw stack of 2,000 Venus images recorded last June 15th *(center)* was processed with *RegiStax 4* (www.astronomie.be/registax) to create a final composite *(right)*.**



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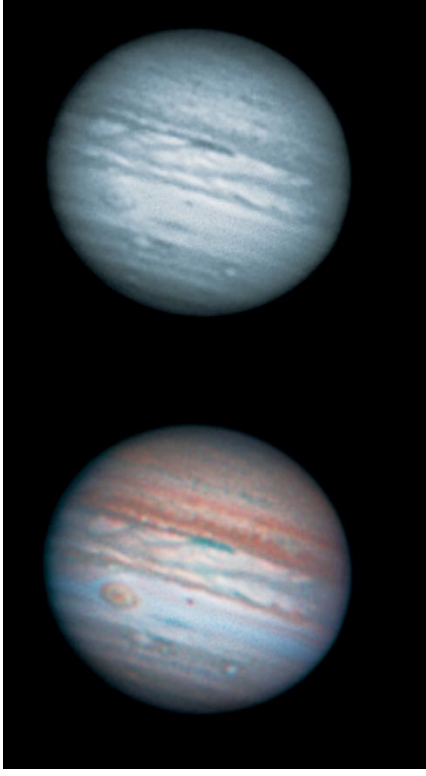

Video rates as fast as 60 frames per second are particularly useful on nights of mediocre seeing, when sharp views appear only fleetingly.

RIGHT: This image of the Moon was recorded with a 12½-inch Newtonian reflector operating at f/20 under average conditions. Just 50 sharp frames out of 2,000 were needed to create this view of the lunar region dominated by the 71-mile-wide crater Maurolycus.

FAR RIGHT: Jupiter was a tough target in 2007 from the author's 43° north latitude. Even so, this tricolor composite (lower image) was obtained with a 12½-inch Newtonian reflector operating at f/31 last June 15th. Each color channel is a stack of 300 frames out of 1,200 made through red (upper image), green, and blue (next page) filters recorded at 30 fps.

writing video data to your computer's hard drive. *IC Capture.AS* automatically detects all codecs on your computer and lists them in a pull-down menu; it's important to use one compatible with your image-processing software. The highest-quality videos for planetary imaging should use little or no compression, but the help file isn't clear on this — it suggests using the codec LEAD MCMP/MJPEG, which performs well on slower computers. While this is functional, the codec for uncompressed video is Y800.

## First Light: No Luck

The sky was clear when I first set up the camera, so I decided to shoot Venus, which was then well up in the western sky.

Since the planet is so bright, I tried recording at the camera's maximum 60 fps. But when I selected this rate the live image on the computer monitor became a chaotic jumble of lines like what you get on an old TV with bad reception. A quick read through the help file didn't provide a solution.

After verifying that everything was in order, I decided to post a question about my problem on the Yahoo! user group devoted to the camera (http://tech.groups.yahoo.com/group/DMKCCD-cameras). Then I switched to a slower frame rate. I captured 4,000 frames of Venus at what I thought was 30 fps, but as I watched the frame count, I realized that the camera was recording at only 15 fps. I suspected my laptop might be the culprit and called it a night.

The next morning I had an answer to my question on the user forum. A representative from the Imaging Source explained that Windows XP doesn't handle FireWire efficiently, since the current peripheral standard for PCs is USB 2.0. When a USB 2.0 device is plugged into a PC, the operating system detects it and allots memory to the peripheral ports, ensuring optimum performance. This isn't the case when a device is connected via FireWire.

The Imaging Source offers a free program called *FireWire Performance Manager* to assign the necessary memory. Once I installed this add-on, the camera ran properly at 60 fps.

If you're running Windows XP and already have an accessory plugged into a USB port, such as a mouse, you won't have a problem when you connect the DMK camera, because your PC will have allocated memory for the FireWire port. You shouldn't have a problem if you use a Mac or a PC running Windows Vista either.

## Second Light: Success!

Once I overcame this minor hurdle, the DMK camera performed like a champ. Its Sony CCD chip is sensitive from ultraviolet to near-infrared wavelengths, with a peak response at roughly 510 nanometers in the green. This wide spectral range is excellent for imaging planets.

I was especially interested in testing the camera on Venus with an ultraviolet filter that transmits only a small amount

**S&T RATINGS**

| | |
|---|---|
| Camera | ★★★★½ |
| Software | ★★★★½ |
| Overall | ★★★★½ |

★★★★★ Sensibly perfect. No meaningful improvements possible.
★★★★ Any shortcomings will go unnoticed in normal use.
★★★ Problems noticeable but do not seriously affect performance.
★★ Problems noticeable during normal use — performance compromised.
★ Problems so severe that the equipment is virtually unusable.

Ratings are intended to convey performance compared with equivalent equipment and should not be used to predict the relative performance of instruments having markedly different designs or specifications.

**Bottom-line summary:**
*The Imaging Source DMK 21AF04.AS is a well-designed, versatile camera that is a natural progression for planetary astrophotographers looking to upgrade from a consumer webcam. The camera-control software* IC Capture.AS *seems to be a mature program itself, complementing the camera perfectly.*

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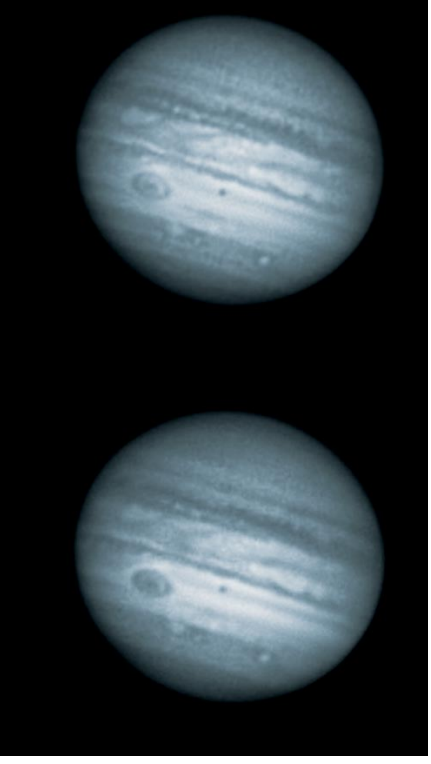
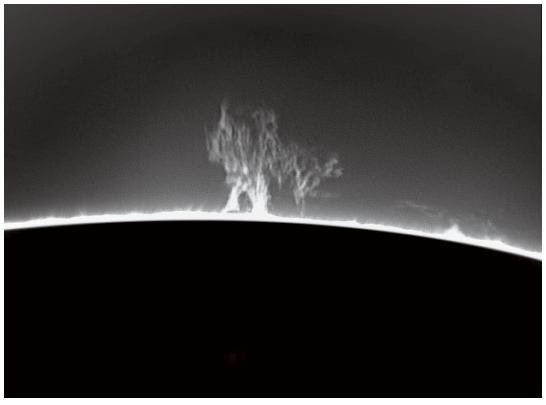
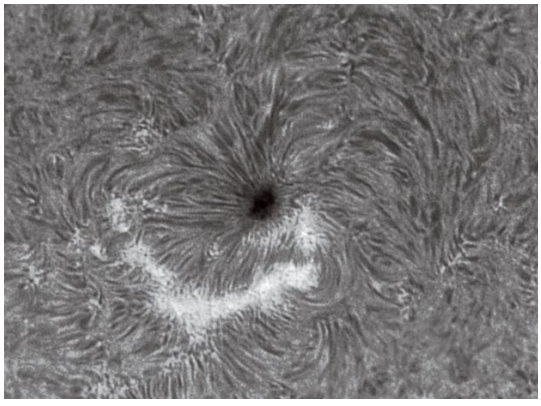






ABOVE: As explained in the text, the DMK camera's 8-bit grayscale output requires separate exposures to record different solar features visible in hydrogen-alpha light. But one image of faint prominences around the limb and another of the bright disk can easily be merged into a single view with conventional image-processing software.

of visible light but reveals details within the planet's atmosphere (see "Revealing the Clouds of Venus," page 96). I was able to record at 30 fps with the camera's gain set to maximum. While the video appeared somewhat noisy, it was far better than what I've recorded with other high-end cameras. When processed with *RegiStax* the resulting view of Venus was sharp, smooth, and contrasty.

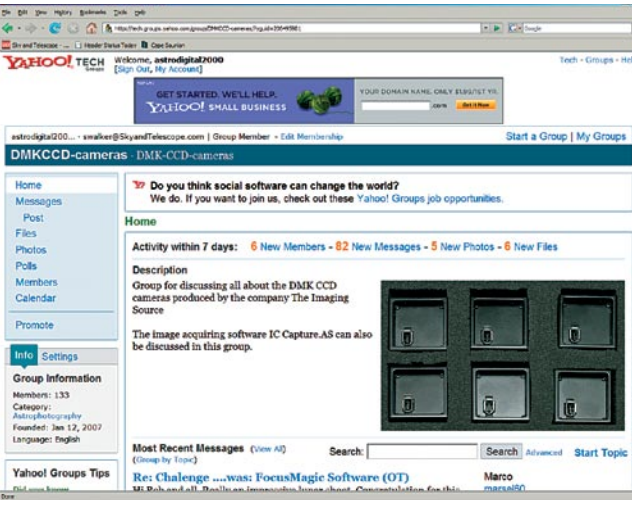
The Moon, with its bright high-contrast features, was a perfect test subject for the camera's maximum frame rate. I had no problems recording at 60 fps, and while the seeing wasn't particularly good that night, the low noise levels in each frame allowed me to stack only 50 frames out of 2,000 to achieve a very sharp, smooth image. To get an equally good view with my Philips ToUcam Pro 740 required stacking hundreds of frames.

One excellent feature of *IC Capture.AS* is its ability to crop the imaging frame with the ROI (Region of Interest) tab and thus avoid recording massive areas of black space around planets. Although black space may not add many bytes to a digital image, it still accounts for some, and when multiplied by thousands of frames, it's easy to record multigigabyte AVI files.

When imaging Venus, I often used an ROI of 320 × 320 pixels. This squeezed roughly 6,000 frames into a 630-megabyte AVI file — large, but not unwieldy.

Having used a 12-bit camera before, I was a little concerned about the limited sampling resolution inherent in the DMK's 8-bit images. But after using the camera, I feel that the only case where more bit depth would have been helpful was when imaging the Sun in hydrogen-alpha light. With 12-bit video, you can record both surface features and prominences in the same video clip. With the DMK and other 8-bit cameras you have to shoot one clip with short exposures to record the Sun's bright disk, and another with longer exposures to record the faint prominences along the limb. The results of both videos are easily combined in *Adobe Photoshop* — really not much of a problem at all.

After several weeks with the DMK camera, I feel that it offers the best performance-to-price ratio available today for planetary imagers. It produces images almost as good as those from cameras costing more than twice the price. I can't wait to shoot Mars at opposition with this little guy! ✦




## Support Network

Support forums have become so popular on the Internet that many manufacturers now have user groups dedicated to their products. The members are generally helpful and encouraging to newcomers, which fosters a sense of community.

I've often found these websites (primarily Yahoo! Groups at http://groups.yahoo.com) to be more helpful than traditional customer-support avenues. Chances are other users have encountered problems similar to yours and can quickly suggest solutions. In many cases these forums contain information that will make your first night under the stars with a new camera or telescope a more rewarding experience than if you were starting out on your own.

Welcome to customer service in the 21st century!

*Assistant editor* ***Sean Walker*** *records our neighbor worlds from his backyard observatory in Chester, New Hampshire.*



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