

MallinCam's SkyRaider DS2.3 Plus

This device promises to be three cameras in one convenient package.



◀ The MallinCam SkyRaider DS2.3 Plus includes an autoguiding cable, a C- to-1/4-inch nosepiece, a lens cap, a 5-meter (15-ft) USB 3.0 cable, and a flash drive containing the camera's control software and drivers. There's also an attractive ballcap.

SkyRaider DS2.3 PLUS

U.S. Price: \$899.99
MallinCam.net

What We Like:
Camera versatility

Excellent quick-start guide

What We Don't Like:
Infrared-blocking filter not included

Blue LED affects images

CANADA'S MALLINCAM, best known for producing sensitive analog video-astronomy cameras, is now dipping a toe into the digital world. One of the company's recent offerings, the SkyRaider DS2.3 Plus, is promoted as a versatile camera able to handle three types of astronomical imaging tasks: long-exposure deep-sky, planetary, and video-assisted observing. That certainly piqued our interest. Could a single camera win the astrophotography trifecta? We contacted the company to borrow a unit and have a closer look.

The SkyRaider is a cylindrical camera weighing 15 ounces and is about as large as many of those 2-inch ultra-wide-field eyepieces coming out of Asia these days. It's built around a Sony 2.35-megapixel IMX302 color CMOS sensor with an array of 1,920-by-1,200 5.86-micron-square pixels. The camera employs a cooling fan to reduce thermal

signal. Also included are a 5-meter USB 3.0 cable to connect the camera to a computer, a 2-meter autoguiding cable, and a threaded 1/4-inch nosepiece for inserting the camera into a standard telescope focuser.

How about software, drivers, and a manual? There was no CD, but there was a flash drive containing *MallinCam-Sky*, the program to operate the camera, as well as its required drivers and a PDF of the instruction manual. The software on the flash drive is written for Windows systems, though Macintosh and Linux versions are available for download from the company's website. At this time, however, they only provide basic functionality compared to the feature-rich PC software.

The camera's 175-page manual is a little overwhelming, but fortunately it includes a quick-start guide that leads you through the basic process of install-

ing software and using the SkyRaider to take deep-sky and planetary images. I wish more manufacturers would do this. A folder on the memory stick is labeled "MallinCamSky Drivers" despite the fact that it also contains the camera control software and the manual. All these things are in a single compressed ZIP file that you manually extract and install using File Manager in Windows. An automated installation program is something MallinCam should consider.

When I saw the computer requirements, I got worried. The manual warns "performance is not guaranteed" if the camera is not operated with a computer having a 2.8-GHz dual-core processor, 2.0 GB of RAM, 200 MB of hard drive space, and a USB 3.0 connection. My laptop didn't meet all these specs, coming up short with a 2.2 GHz processor and USB 2.0. Would I have to round up another PC to properly test the SkyRaider? Fortunately, that didn't turn out to be the case.

My Toshiba laptop was more than powerful enough to run the *MallinCam-Sky* software and operate the camera in imaging and deep-sky video-observing modes; the USB 3.0 speed is mostly required to achieve the camera's fastest frame rates when imaging the planets.

Deep-Sky Imaging

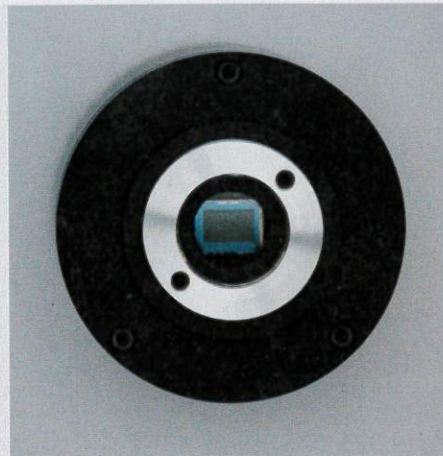
First light for the SkyRaider went smoothly. I mounted the camera on my

80-mm f/7 William Optics refractor to provide a generous field on the camera's modest chip. In the control software, at the top left sidebar menu list, is a hyperlink, "SkyRaider DS2.3 Plus." I clicked it and was almost immediately greeted by a video stream showing the bright star the telescope was aimed at. Focusing was easy using 2-second exposures, and within minutes I was ready to begin shooting deep-sky targets.

The camera's software includes many useful features. In addition to the sidebar, which contains 15 separate menu items, there's a command menu across the top of the screen that offers a multitude of image-processing tools. While it was a lot to take in on the first night, the quick-start guide helped steer me in the right direction.

Before taking images, I changed some of the preliminary settings. I selected the camera's highest resolution mode and set its bit depth to 12 bits to ensure the camera would record images with the largest available dynamic range. I also made sure the cooling fan was running to reduce thermal signal in the images, though I still needed to record and subtract dark frames from my shots to eliminate some false "stars" caused by heat.

The SkyRaider DS2.3 Plus can make single exposures as long as 16 minutes and 45 seconds. Since my sky was relatively bright, I began by choosing



▲ The camera features a 2.3-megapixel Sony IMX302 CMOS sensor, seated just behind the C-thread housing. Users may need to provide their own C-to-T-thread adapter to attach the camera to some telescopes and accessories.

2-minute exposures in the software's Trigger Mode (long-exposure) section. I then covered the telescope's aperture, and in the Dark Field Correction menu, commanded the software to take ten 2-minute dark frames. The software doesn't just take dark frames; it automatically stacks them to produce what the manual calls a "Dark Field" image. When the darks were done, I simply checked the box that would automatically apply this calibration frame to my pictures, and saved it for future use.

The rest was rather straight forward. I pointed the telescope at the galaxies M81 and M82, adjusted the histogram for a picture that wasn't too bright or too dark, and set up a sequence in the Trigger Mode window's options menu that would automatically expose and save 30 individual 2-minute frames. As the images began coming in, I could tell the camera was doing a credible job despite the light pollution. M81's delicate spiral arms were visible, if not prominent, while M82 displayed plenty of core detail.

The following night I was in the backyard again, this time with my 8-inch f/10 Schmidt Cassegrain telescope. The longer focal length of the SCT, even when equipped with an f/7 focal reducer, meant the SkyRaider's field was much smaller than with the refractor. But this works well for "close-



The rear panel of the camera includes a USB 3.0 port, an autoguiding port, and the cooling fan. To the left of the USB port is a blue LED power indicator. Users should cover the LED when recording deep-sky images.



▲ Capturing the Moon is easy with the SkyRaider DS2.3 Plus in video mode. The author recorded and stacked 300 full-resolution frames to produce this close-up of the lunar crater Theophilus and surroundings using an 8-inch SCT at f/20.

ups” of smaller objects like galaxies and planetary nebulae.

Despite the bright backyard skies and some haze, my processed pictures were comparable to what I can do under similar conditions with a DSLR. I was particularly impressed by the absence of thermal noise with Dark Field calibra-

tion enabled. The only problem I noted was some minor background artifacts that could later be corrected using flat-field calibration frames.

When using the camera at my astronomy club’s country observing site, I pushed the SkyRaider’s gain setting higher than in the backyard, but despite

that, the resulting pictures appeared smoother and easier to process. The background problems seen when imaging from home were gone, no doubt because pictures taken under dark skies don’t require as aggressive processing.

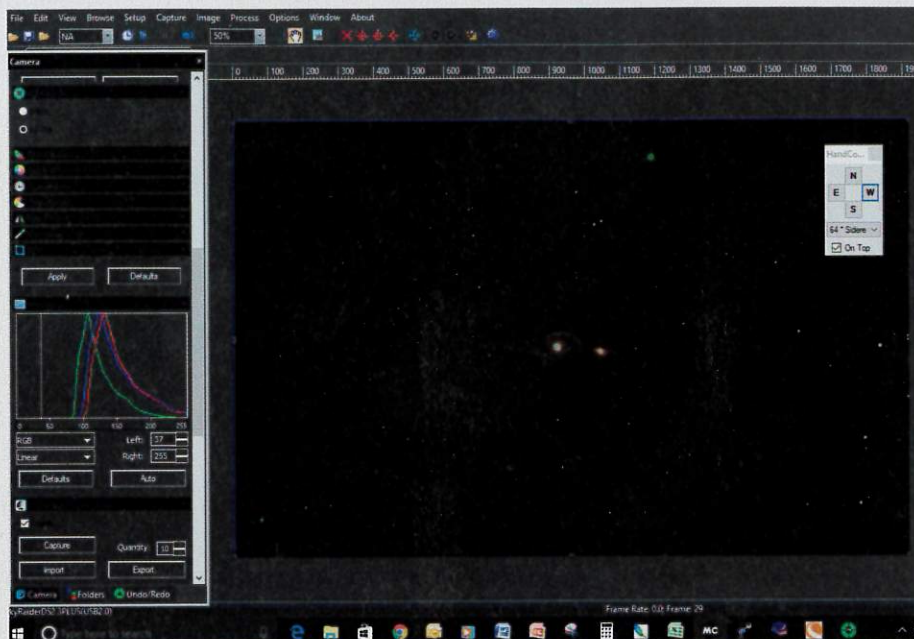
One problem I encountered was the appearance of large, blue, bloated “stars” in some frames. It appeared as if Neptune had somehow sailed into the field of the Whirlpool Galaxy! At first I was stumped as to its cause, but then it occurred to me these objects were suspiciously similar in color to the bright blue LED on the back of the camera, which comes on as soon as the USB cable is plugged in and flashes during exposures. Placing a piece of tape over the LED somehow caused the blue intruders to disappear.

Users should note that the SkyRaider DS2.3 Plus does not include infrared blocking on the CMOS detector, so an additional IR-blocking filter (not included) needs to be placed in front of the chip to ensure the best color fidelity in your images.

Planetary Performance

With the Moon and Jupiter coming into view, I tested the SkyRaider’s planetary imaging performance with the 8-inch SCT with a 2× Barlow lens. Taking images of the Sun, Moon, and planets with the SkyRaider is pleasantly simple. In *MallinCamSky*, switch to video mode in the Capture menu, click the Options button, and specify the resulting video to be saved in AVI format. Adjust the exposure time to avoid over-exposing your target, and when you’re focused, click the video record button near the top of the screen.

Although the image of Jupiter on screen looked good, here is where I encountered the limits of my USB 2.0 connection. While the camera’s specs state it can deliver up to 30 frames per second (FPS), when I clicked the record button, the camera began capturing a measly 3 FPS! This is alright for shooting the Sun and Moon, but for planetary work, the more video frames you can record in a short amount of time, the better, thus ensuring you get



▲ Long exposures are possible with the SkyRaider DS2.3 Plus when in Trigger Mode. The controls needed for image capture are grouped at the left of the screen. The bluish-green "star" at the top of this image of M51 was due to the blue LED on the rear panel of the camera.

enough sharp frames captured during fleeting moments of steady seeing before your target rotates too much.

One of the reasons for the SkyRaider's slowness (besides my USB 2.0 connection) is the camera's large sensor as compared to the tiny chips in many dedicated planetary cameras. There was a work-around, however, involving the *MallinCamSky's* Region of Interest (ROI) tool. I simply drew a box around the target planet with my mouse, clicked the apply button, and the program records a video of only the region within the box. This immediately increased the recorded frame rate to 10 FPS.

When I later processed my Jupiter and Moon images, I was quite pleased. Despite the relatively low frame rate, Jupiter was quite respectable given my average seeing conditions. Conclusion? The SkyRaider is capable of taking very good planetary images. Seeing will likely be the limiting factor for most imagers.

Video Observing

Finally, I put the camera to work as a video-observing tool. There are two ways to use the SkyRaider DS2.3 Plus for video-assisted observing. The first is the camera's video mode for planetary

imaging. This limits its exposure to 5 seconds or shorter. But *MallinCamSky* offers a helpful live-stacking function that will align and combine deep-sky video frames on the fly, and my experience with a similar feature on one of my analog video cameras led me to believe this would help with the image brightness on popular targets.

Bright deep-sky objects were easily captured in this video mode. And while the resulting pictures weren't pretty, they were just as good as those I can get with my analog *MallinCam Xtreme* video camera. Even 5-second exposures revealed the spiral structure of galaxy M51 without activating the stacking feature. The images were noisy, but good enough for casual video observing and would be sufficient for near-live viewing at public outreach events.

Getting better-looking video images requires switching to trigger mode and clicking the Loop button, which exposes frames continuously (and longer) but doesn't save the results. Exposures of 15 seconds to 1 minute still gave the feeling I was observing "live" and revealed fainter details with much less noise than those taken in the camera's short-exposure video mode.

After just a few outings I grew to like this camera a lot. It performed well with all three astrophotography tasks: long-exposure imaging, planetary imaging, and video observing. The SkyRaider allowed me to do lots of things and do them easily.

■ Contributing Editor ROD MOLLISE pursues faint fuzzies in the sky from rural Alabama using various scopes.



▲ Another fine example of the SkyRaider's capabilities under typical urban skies is this shot of M51, the Whirlpool Galaxy, that reveals its dark dust lanes and bluish spiral arms. The result uses 30 exposures of 2 minutes each shot through an 8-inch SCT at f/7.