

# Essential imaging tasks for cloudy nights and sunny days

By Ron Brecher



The Dark Shark, a complex of several objects in Cepheus, is located around 650 light years from us, and about 15 light years from snout to tail. (Images by Ron Brecher)

## Astrophotographer Ron Brecher shares how he prepares for imaging the night sky when its treasures can't be seen

**I CAN'T BE THE ONLY ONE** who has lost a perfect imaging night after an unexpected computer shutdown triggered by an operating system update right in the middle of an imaging run. This is just one example of an obstacle that can defeat our attempts to image the night sky. All of our equipment — computer and software, mount, camera, filter wheel, autoguider and focuser — needs to run reliably and repeatedly.

There can be long gaps between imaging sessions. The Moon impacts deep-sky imaging for half of every month, and there's more weather variance than even the average

mail carrier can handle — rain, snow, clouds, wind, extreme cold, extreme heat, fog and forest-fire smoke.

Since clear nights are limited, I perform a lot of essential imaging tasks during the daytime, or on nights that are unsuitable for imaging. This preserves the best nights for sitting back and enjoying the view while the camera gathers photons.

These tasks fall into a few categories: equipment maintenance and optimization, calibration frame collection and planning imaging runs.

## Maintain and optimize equipment

Almost all equipment maintenance and optimization can be done on a partly cloudy or hazy night. Some tasks can even be done during daylight hours.

If you have a portable imaging setup, practise setting up the mount on nights when you're not imaging. Practise achieving polar alignment quickly and accurately, and also practise balancing the payload. One important thing to keep in mind is good cable management. During the day, you can work out the best way to prevent your cables from throwing off your mount's balance. Then use that cable management approach every time. Even in a permanent observatory, periodic tweaking of polar alignment is necessary.



Focusing on the camera for a minute — mediocre nights can be used to optimize autoguider settings. A moonlit, but otherwise clear, night is a good opportunity to train electronic focusers to compensate automatically for changing temperature. Users of monochrome cameras with filters can use these nights to determine filter offsets, small automatic focus adjustments to maintain focus when the filter is changed.

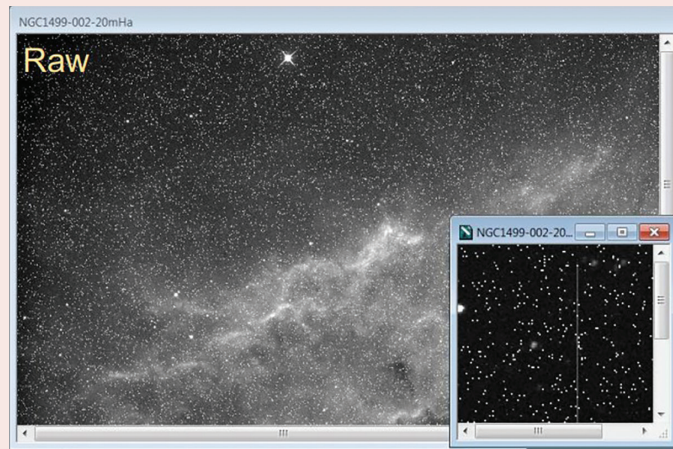
Autoguider woes can stop a night of imaging in its tracks. Use less-than-ideal nights when stars are still visible to work out the kinks. There is no precious data at stake during these nights, so don't worry about the main camera. Instead, try to dial in the best settings for auto guiding — then save them in the guiding software, write them down or take a screen shot.

Many mounts permit you to train them to remove the repeatable, so-called "periodic error" in their tracking. Periodic error is repeated with each cycle of the mount's gears, due to tiny mechanical imperfections. If the periodic error has been recorded by the mount's periodic error control (PEC) software, it can be automatically played back to greatly improve the mount's performance. For many mounts, periodic error correction only needs to be set up once, and this can be done on any night where you can consistently see stars, even if the sky is very hazy or brightly moonlit.

Well-managed cables are important for consistent tracking. Here, two refractors are mounted on a Paramount MX. The larger scope is a Sky-Watcher Esprit 150. The other scope is a Takahashi F5Q-106. Balance is consistent as the mount moves through the night, and there is no risk of a cable getting caught on another piece of equipment.

A few occasional hardware tasks can and should be done during the day under good lighting. Optics need to be cleaned once in a while — I clean the objectives of my well-used telescopes about once every year or two. Most mounts that contain gears require periodic cleaning and regreasing; I relubricate my Paramount MX every three years, and I use a grease suited to my locale's very cold winters. If you have a camera that uses a desiccant cartridge to keep the sensor chamber dry, don't forget to recharge or replace it every so often, in keeping with the manufacturer's instructions.

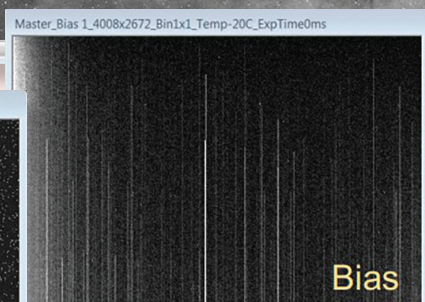
There are a couple of schools of thought on updating and optimizing computers. Some keep the operating system and all software and equipment drivers current, updating every time a new version is released. Others take an "if it ain't broke, don't fix it" approach, leaving things alone when they are running well. If you decide to upgrade regularly, delay a few weeks before updating to the latest software or driver version to see if any problems are reported. Always ensure you have an easy way to undo any changes. This means regular, complete backups. I'll talk about trying new software in a moment. →



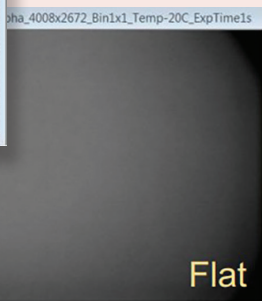
Flat, dark and bias (or flat dark) frames are used to clean up each sub-frame prior to aligning and combining. You can see the difference they make in this image of the California Nebula (NGC 1499).



Dark



Bias



Flat

## Collect calibration frames

Image calibration is critical for getting the best possible results from your astrophotographs. This process removes dark noise generated by the camera's electronics, such as dark current and readout noise. This is done using dark frames and sometimes bias frames. Calibration can also correct uneven field illumination due to dust motes and vignetting from using flat frames. Bias, dark and flat frames can all be acquired during the day, on any cloudy night or at twilight before or after an imaging run.

Since dark and bias frames are acquired with no light reaching the sensor, ensure that the lens cap is on and

the whole setup has no light leaks. Since dark noise is relatively stable, these calibration frames can be used over and over again. I update my dark and bias calibration frames about once a year.

Flat frames typically require more frequent updating, as new dust motes can appear at any time. Camera movement relative to the telescope between imaging sessions can change the illumination profile, necessitating acquisition of new flats. The three most common methods for acquiring flats can be done during the daytime (using a T-shirt or electroluminescent panel) or at dusk or dawn (twilight method).

Calibration can make dust shadows vanish like magic, as you can see in these before (left) and after (right) images of NGC 6939.

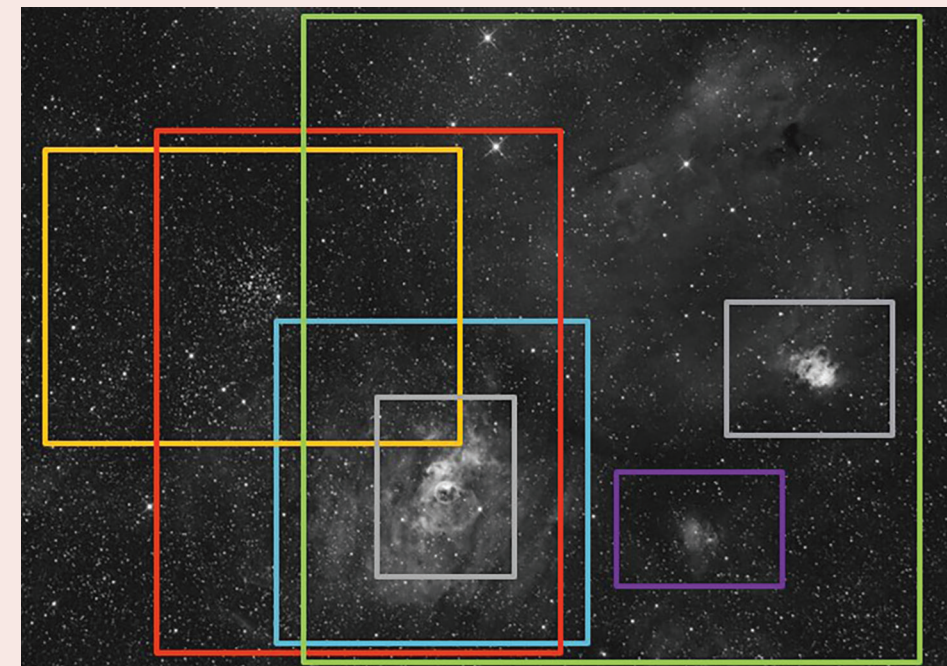


## Plan for the future

So-so nights are a great time for figuring out how you are going to spend the next clear night and for experimenting with new ideas and techniques. Here are a few hazy-night projects you can try.

When the night isn't suitable for imaging, but I can still see stars, I will try short exposures on a few different objects that are candidates for future imaging runs. I might try different framing options, including rotating the camera.

Once you have optimized your setup as described above, see how long you can expose without autoguiding and still get round stars. While autoguiding can be useful, many properly tuned mounts can track accurately enough for unguided imaging. Going autoguider-free has a number of advantages over using an autoguider — including one less thing to go wrong. Autoguiders can lose their guide star and halt an imaging run. Many factors influence how long you can image and still have round stars. Some of the most important are mount mechanical quality, polar alignment accuracy, periodic error correction (PEC), rigidity of the overall system and a correctly balanced payload.



## Stick to the script

Once all your equipment-control software is running properly, you may feel the urge to experiment with a scripting tool. These tools can automatically direct all your equipment throughout an entire imaging session, allowing you to do other things like observe through the eyepiece, chat with friends or even get some sleep. It's OK to indulge this urge, but not on a good, clear night! You can do these experiments just as effectively during the day and not miss a photon of imaging time. Just make sure you back up your system first, as discussed above. With that precaution, scripting is a worthwhile exploration for serious imagers. Some of the more popular scripting tools are CCD Commander (which I use), CCD Autopilot and Sequence Generator Pro. All have free trials available and are easily found online. They differ in their capabilities and system requirements, so review specifications carefully.

If you have an observatory — or you have ever wanted to get out of the cold or a swarm of mosquitoes — look into a setup to control your imaging computer remotely. Tools like Microsoft Remote Desktop, AnyDesk or TeamViewer allow you to see your imaging computer's screen and control it from any internet-connected device. You can use it on your mobile phone to check on your equipment from your tent at a star party or, as I do, to check on my observatory from inside the house when it is -30 C outside. Of course, this capability can all be set up and practised during the day.

Above right: Consider different ways of cropping your image to best show the features you want to highlight. There are many objects to choose from in this image of the Bubble Nebula region of the sky in Cassiopeia, like Messier 52 and NGC 7538.

## Conclusion

Good imaging nights are few and far between for most of us. When those fine nights come around, we want to be prepared to take full advantage of them, but often end up trying to diagnose problems or fix errant settings. This is unfortunate, because

most setup and troubleshooting can be done during the day or on nights that aren't ideal for imaging. By really getting to know your equipment and software, and practising an accurate, repeatable equipment setup, you'll be ready to seize the night. \*