

A wide-field photograph of the night sky, featuring the Milky Way galaxy. The galaxy's core is visible as a bright, hazy band of light stretching across the center of the frame. The surrounding space is filled with numerous individual stars of varying brightness and colors, including some prominent blue and purple stars. The overall background is a deep, dark black, punctuated by the light of the stars and the galaxy.

NIGHTSCAPES

3 types of astrophotography

1. Deep space - use a high powered telescope. Galaxies, andromedas etc



2. Night Sky - the main subject is the night sky usually with the milky way. May or may not have a base such as land, trees, etc but it is very dark.



3. Nightscape - the night sky, usually with the milky way, forms a backdrop for a foreground subject which is light painted or lit up with moonlight. The result is a more interesting photo that has a sense of depth to it and more impact than just a photo of a starry sky.



COMMON EQUIPMENT USED

- Camera: preferably full frame - less noise. DSLR or mirrorless with manual controls that can shoot in RAW format.
- Wide angle lenses. 12-35 mm. Preferably with aperture no smaller than f2.8. Fixed focal length the best but zooms are ok.
- A sturdy tripod with a good tripod head.
- Filters: Night Sky / light pollution reduction. Filter out yellow/orange tint.
- Spare batteries and memory cards.
- External shutter release - corded or wireless.
- Lights: torches, LED panels. 1/2 cto (colour temperature orange) gel Part No. 205 to put over front of torch to warm the light.
- Lens warmer.
- Chair for star trail shooting.
- Hot beverages!



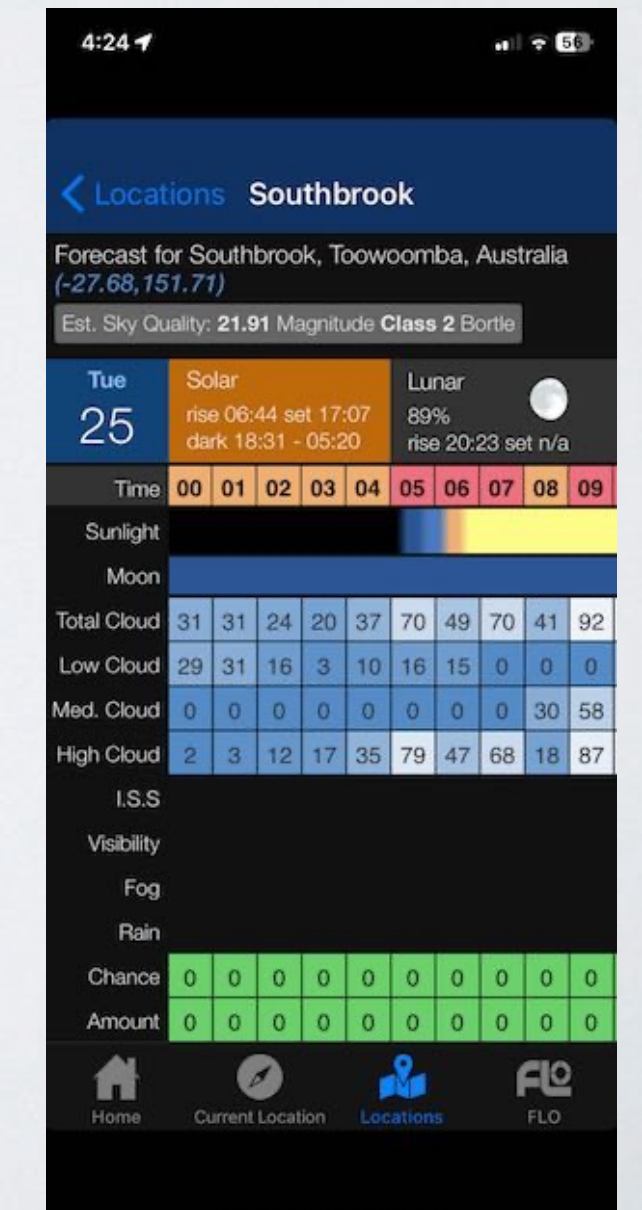
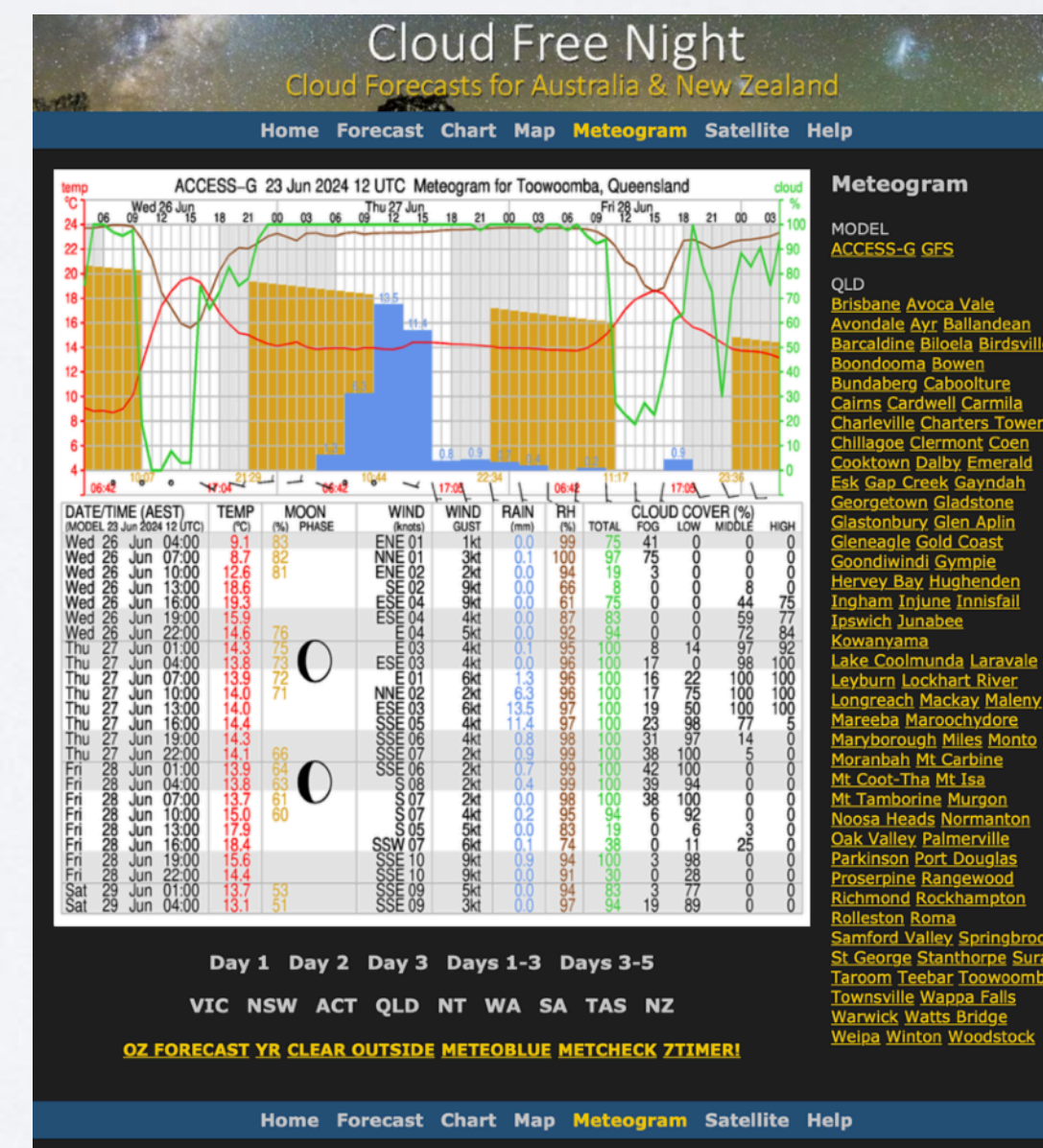
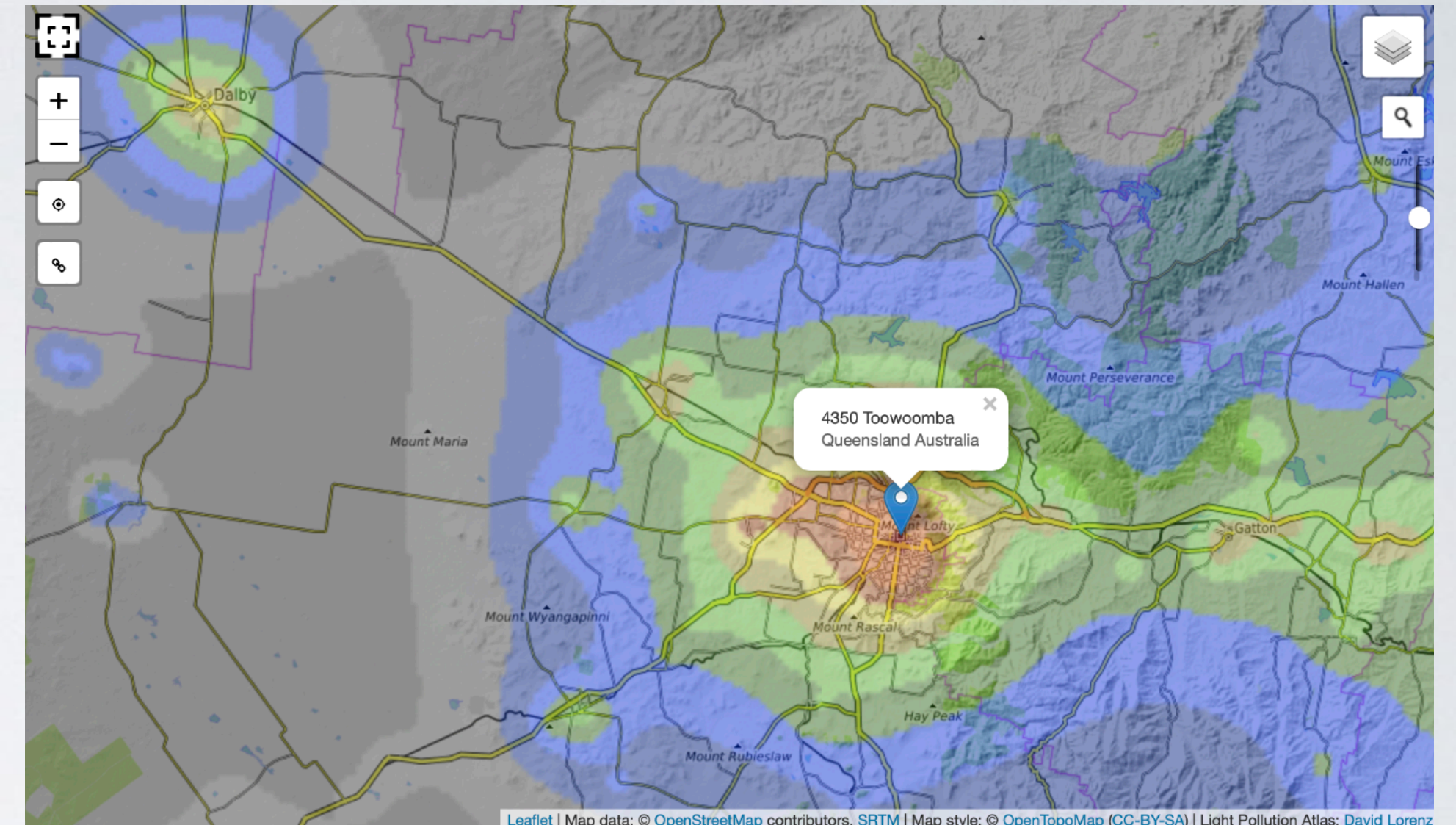
HANDY APPS

- PhotoPills. App for IOS and Android. Shows position of milky way and many other things.
- Stellarium - App for IOS, Android (free), Windows and Mac for locating milky way.
- Stacking software: Sequator for PC, Starry Landscape Stacker for Mac.
- Camera manufacturer app for remotely controlling camera. Not necessary if you have a remote control although it can be used in conjunction with the remote controller for previewing images taken depending on the camera brand.



BASIC REQUIREMENTS FOR NIGHTSCAPE SHOOTING

- A dark sky:
 - the darkest sky possible is necessary for high quality astro photos.
 - If you can't see the milky way with the naked eye it will be hard to capture it on camera.
 - Bortle rating: Class 1-9.9 being the most extreme light pollution.
 - Websites for dark sky areas:
 - <https://darksitefinder.com>
 - <https://www.darkskymap.com/nightSkyBrightness>
- Cloud free sky:
 - Cloud free best but sometimes clouds can add interest and impact to a photo.
 - Websites and apps for cloud forecasting:
 - <https://www.cloudfreenight.com/map.html#cloud>
 - <https://clearoutside.com/forecast/50.7/-3.52>
- Moon phase:
 - Needs to be either in a New Moon phase i.e. no moonlight visible OR after moonset and before moonrise.
 - Moonlight will wash out the stars and in fact a long exposure at night with even a partial moon can look like daylight. A New Moon ensures there's no visible moon and the Milky Way appears as bright as possible.



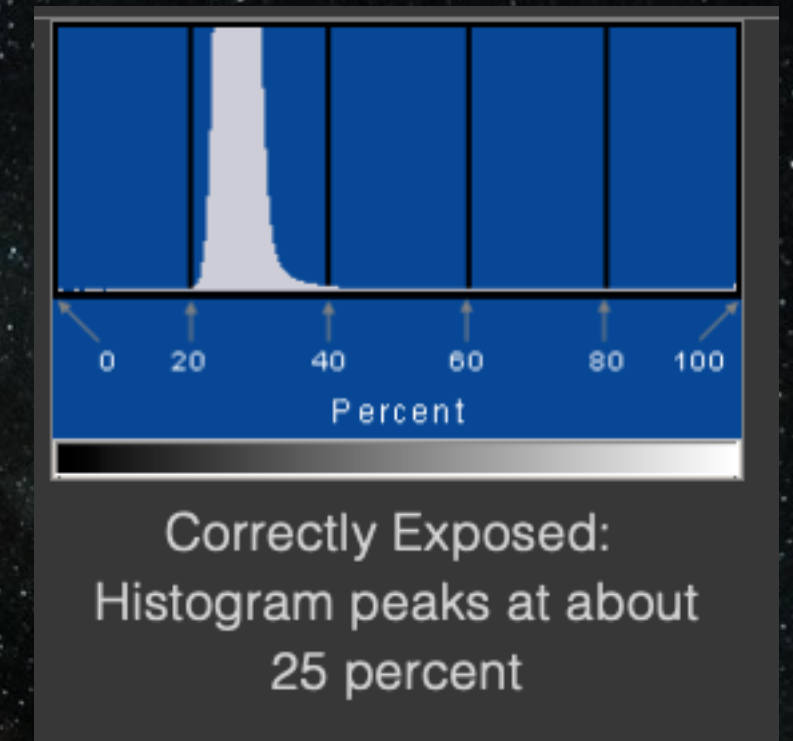
NIGHT SKY/MILKY WAY CAMERA SETTINGS

Most commonly used settings:

- Put camera into Manual exposure mode. Set shutter speed to Bulb or if the camera has long shutter speeds available of 10 - 25 sec use those. Shutter speed is dependant on focal length of lens. Wider the angle of view the longer the shutter speed.
 - NPF rule: takes into account the megapixels of your camera. Photopills app calculates this for you.
 - 500 rule. Classic rule. Fails with most recent cameras.
- Put your camera on a sturdy tripod and turn OFF image stabilisation.
- Turn off long exposure noise reduction.
- Set widest aperture possible, eg f1.4 - f3.5.
- Set ISO to 3200 - 6400.
- Set White Balance to 3200K - 5000k. 3200K is more blue and 5000k is more yellow. 3800k is suitable for most moonless, dark sky situations.
- If using a zoom set it to wide angle:
 - Full frame camera 14mm - 24mm
 - APSC (crop) camera: 11mm - 18mm
- Turn off auto focus so lens is in manual focus mode. See slide "How to focus".

NIGHT SKY/MILKY WAY CAMERA SETTINGS CONT...

- Ensure you're shooting in RAW (for maximum image manipulation and noise reduction).
- Enable mirror lock up if using a DSLR (not applicable to mirrorless cameras). Use either a cable release, a remote release or 2-5 second self timer delay to eliminate camera shake.
- Compose the photo and take test shots - adjust exposure etc if necessary. Use the histogram to check exposure.
- When ready to take final photos disable live view - this is to reduce heat and therefore noise and/or hot pixels.
- Make sure your head torch or any other light source near the camera are turned off.
- Optional: once composed, put the lens cap back on the lens (or cover the lens being careful not to touch the focus ring). Take an exposure using the same settings as above. Once you have finished your captures in this location, before you move do this again. This is called a "dark frame" and can be used in processing to reduce noise.



STAR TRAILS CAMERA SETTINGS

Most commonly used settings:

- Put camera into Manual exposure mode. Set shutter speed to Bulb or if the camera has long shutter speeds available of 10 - 30 sec use those. Shutter speed is dependant on focal length of lens. Wider the angle of view the longer the shutter speed.
- Put your camera on a sturdy tripod and turn OFF image stabilisation.
- Turn off any high ISO or long exposure noise reduction.
- Set your aperture to f2.8 or 3.5.
- Set shutter speed to 30-90 seconds.
- Set ISO to the lowest possible ISO where you get a good exposure but also retain the colours of the stars. Stars are NOT white, they are colourful as they burn at different temperatures and therefore have different colours. If your trails turn out white, you have overexposed the stars. Recommend starting at 640 ISO.
- Set White Balance to 3800K - 4800k. The "Fluorescent: preset should be ok.
- If using a zoom set it to wide angle:
 - Full frame camera 14mm - 24mm
 - APSC (crop) camera: 11mm - 18mm
- Turn off auto focus so lens is in manual focus mode. See slide "How to focus".
- Ensure you're shooting in RAW (for maximum image manipulation and noise reduction).
- Enable mirror lock up if using a DSLR (not applicable to mirrorless cameras). Use either a cable release, a remote release or 2-5 second self timer delay to eliminate camera shake.
- Point the camera south, preferably at the South Celestial Pole. Compose the photo and take test shots - adjust exposure etc if necessary. Use the histogram to check exposure.
- When ready to take final photos disable live view - this is to reduce heat and therefore noise and/or hot pixels.
- Make sure your head torch or any other light source near the camera are turned off.
- Optional: once composed, put the lens cap back on the lens (or cover the lens being careful not to touch the focus ring). Take an exposure using the same settings as above. Once you have finished your captures in this location, before you move do this again. This is called a "dark frame" and can be used in processing to reduce noise.
- When you're ready to start your trails use a wireless or wired remote camera controller to trip the shutter and then lock the remote so that the camera takes 30 second exposures continuously. Could also use the time-lapse feature of your camera if it has one.

LOCATION RECONNOITERING

- Always, if possible, go to the location of your nightscape subject during daylight to check for hazards such as holes, ditches, tripping hazards etc.
- Determine the best place to take photos of your subject from and check for any problems, eg overhead power lines, street lights, floodlights or building lights.
- Use Photopills to see where the milky way and its core will be in the scene at different times of the night.



HOW TO COMPOSE

- Composition of astro photography is fairly subjective.
- As with other photographic genre the usual rules of composition apply: rule of thirds, rule of odds, avoid having the horizon in the middle of the frame etc.
- Avoid distractions, street signs, lamps, posts, electricity lines where possible. If unavoidable can be removed in post.
- Look for interesting subjects to place in the foreground. Photos of the stars are nice but more impact and appeal can be achieved by having a strong focal point in front of them.
- Try taking photos at ground level or up high rather than at eye level to increase interest.
- Light your subject for maximum impact - see section on “Light Painting”



HOW TO FOCUS

- In most cases astrophotography requires the use of manual focus (some recent cameras have a “star” feature that enables them to focus on stars or they have amazing low light focussing).
- Methods of manual focussing on stars:
 - Autofocus on a lit subject, eg house or street light, and then put the lens on manual focus.
 - Use EVF (if mirrorless) or live view on rear screen or focus peaking if available. Magnify the image and move the magnified area around to include large and bright stars and focus on those.
 - Hyperfocal distances - difficult mathematics required.
 - Daytime focussing: focus on a distant subject and mark that on a lens with tape.
 - Infinity marks on lenses usually aren't accurate so don't rely on them. Most lenses for mirrorless cameras don't have distance scales as they are focussed by wire.



RULES

There are a number of "rules" that have been made up over the years to aid in Night Sky photography. All of these are ways to determine the maximum shutter speed based on the sensor size of your camera and lens focal length before you start to see the stars move in your image (called trailing). In general though, unless you are using a lens that is less wide than a 35mm, a good exposure time will be around 20 seconds.

- 500 Rule - Camera must be set to 3200 or 6400 ISO, aperture f/2.8 (or faster).

See: <https://www.lightstalking.com/500-rule>

On full frame sensors calculate 500 divided by your focal length EG: $500 / 17\text{mm} = 29.4$ seconds

On Canon crop sensors calculate 500 divided by (focal length \times 1.6) EG: $500 / (17\text{mm} \times 1.6 \text{ eq } 27.2) = 18.4$ seconds
On Nikon crop sensors calculate 500 divided by (focal length \times 1.5) EG: $500 / (17\text{mm} \times 1.5 \text{ eq } 25.5) = 19.6$ seconds

- 600 Rule - Sometimes the 500 rule doesn't work for your camera, the image might come out under exposed. Give the 600 rule a try. Just change the above to 600 instead of 500

See: <https://www.lightstalking.com/600-rule/>

- NPF Rule - A very complex equation and only recommended if you find the 500 or 600 rules don't work for you, or if you want to get as accurate shutter speeds as possible. Look into this in your spare time. Photopills will calculate this for you after you've input the focal length of your lens and the camera model you have.

See: <https://www.lightstalking.com/npf-rule/>

LIGHT PAINTING

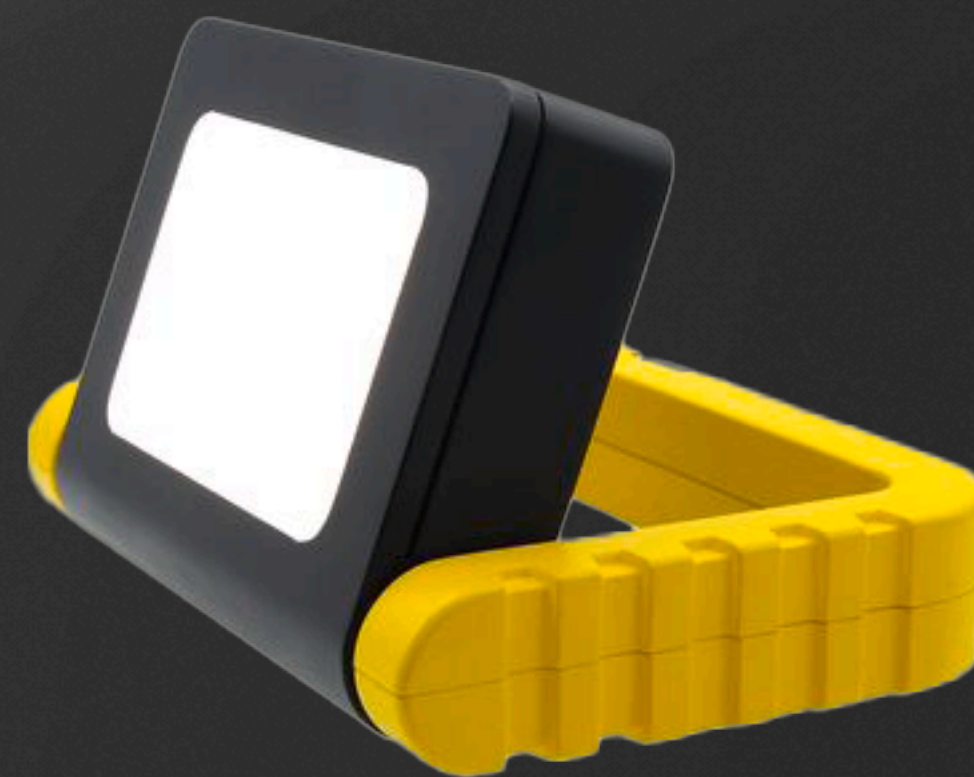
- Light painting is generally considered to be the addition of a continuous light source into an image which is used to illuminate a scene or portions of it. The keyword being continuous.
- Can you use a flash?
 - Can be manually fired to add light to a scene but it's not considered as light painting but more a form of strobing. There is also less control of the light with a flash.
- What do you need for light painting?
 - A constant light source - this can be a torch, worklight, light bar, or light panel.



Light bar



Video light panel



Worklight



Torch

HOW TO TAKE NIGHTSCAPES

Nightscape photography combines a light painted foreground subject with a starry night sky.



HOW TO TAKE NIGHTSCAPES

There are two main ways to photograph a nightscape.

- 1) The first technique is simple, quick and easy but the image quality is not optimum.
- 2) The second technique is complicated and time consuming but image quality is high and allows for creativity and artistic expression.

The process for the **first (easy) technique** is as follows:

3. Light up the foreground subject with a fixed light source such as a light panel. Light panel should be at high brightness so the subject is easily visible.
4. Compose the photo including the area of the night sky that you wish to be included in the scene.
5. Turn off the light shining on the foreground.
6. Focus on the stars.
7. Turn the light on the foreground subject back on and depending on the power of the light set it to 2-3% brightness. Also set the white balance to 3800K, but this can be set to other levels depending on how warm or cool you want the light to be.
8. Follow procedure as outlined previously in the “Night Sky/Milky Way Camera Settings” section.
9. Take a test shot and check for exposure and sharpness and adjust if necessary by changing the ISO/aperture or shutter speed.
10. When happy take the final photo.

HOW TO TAKE NIGHTSCAPES

The process for the **second (more complicated) technique** is as follows:

1. Light up the foreground subject with a fixed light source such as a light panel. Light panel should be at high brightness so the subject is easily visible.
2. Compose the photo including the area of the night sky that you wish to be included in the scene.
3. Turn off the light shining on the foreground.
4. Focus on the stars.
5. Follow procedure as outlined previously in the “Night Sky/Milky Way Camera Settings” section.
6. Take a test shot and check for exposure and sharpness and adjust if necessary by changing the ISO/aperture or shutter speed.
7. Take 10-15 photos of the night sky using a remote control or with the time-lapse feature of the camera if it has one. Should be no more than one second between photos to make it easier for stacking of the photos.
8. Turn the light on the foreground subject back on and focus the lens on the foreground subject being very careful not to move the camera.
9. Set the aperture to F5/5.6, the ISO to 500, the white balance to 3600-3800K and the shutter speed to 10-15s.
10. Using a remote control fire the shutter while painting the foreground subject with a torch or light panel. Do the light painting at an angle to the subject to avoid flat lighting. Keep taking photos and light painting until you're satisfied that you will have enough to combine into a well lit subject.

Below are multiple photos of the night sky: each exposure is 13s at f2.8, ISO 6400, 3800K using camera's timelapse or interval timer function. 14 - 24mm Sigma zoom at 14mm, Nikon Z6.

Railway bridge on Condamine at Cecil Plains. From 7.50 pm on 27th October, 2019.



Below are multiple photos of the bridge and foreground: each exposure is 10s at f5, ISO 500, and auto white balance. 14 - 24mm Sigma zoom at 14mm, Nikon Z6. Taken using Nikon's Snapbridge app in remote control mode.

Railway bridge on Condamine at Cecil Plains. 7.52 pm on 27th October, 2019.



Final result after stacking sky and combining with light painted blended foreground images.



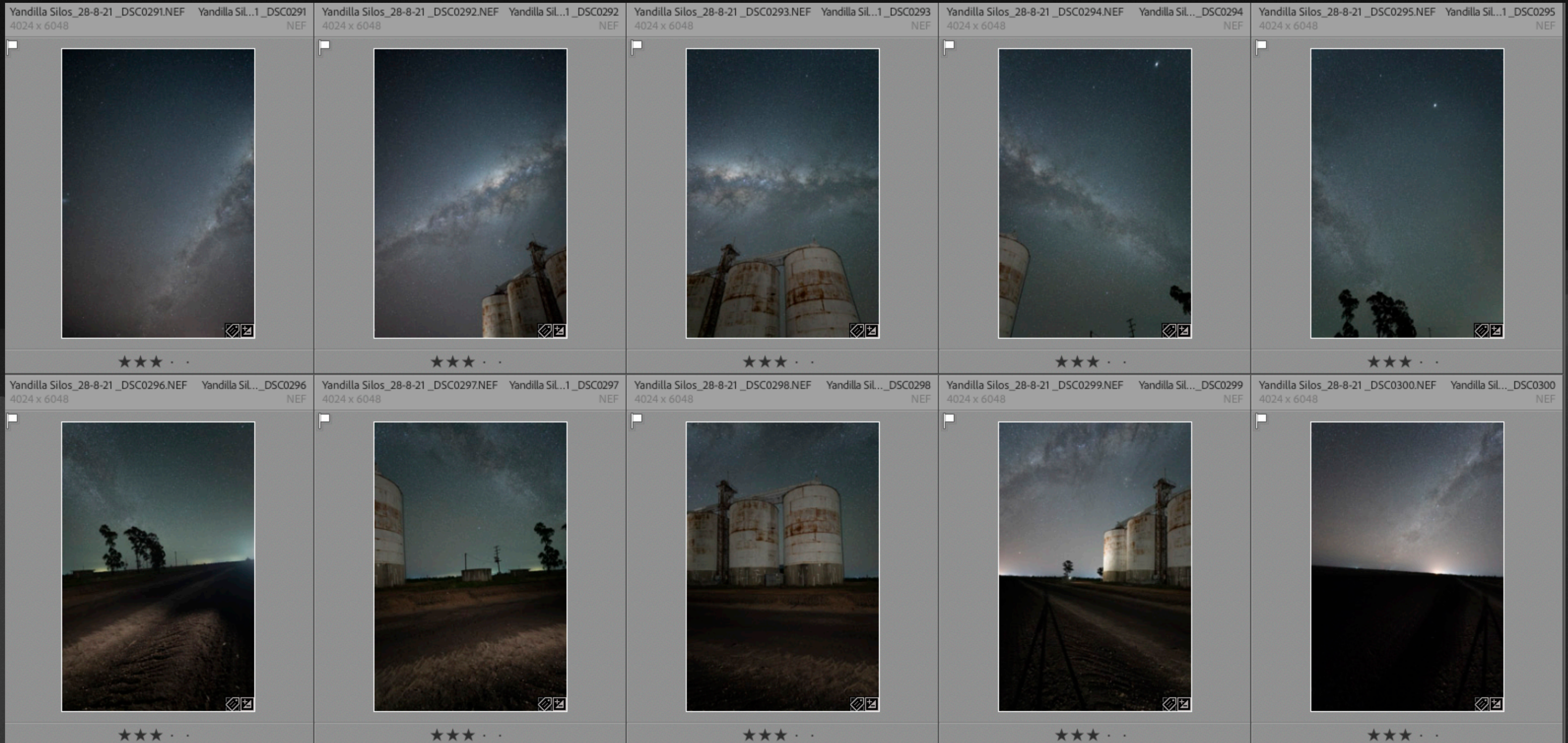
ASTRO PANORAMAS

- Astro panoramas can capture a much greater area of the night sky than single frame images without the distortion of foreground objects that comes from using an ultra wide angle lens, e.g. 12mm - 16mm. They have less noise than single frame images and the final pano photo will have more detail.
- Equipment: same as for single frame astro images. There are specialised non motorised panoramic heads and motorised programmable heads that can be used for greater accuracy and ease of use.
- Find the Nodal Point of the lens being used. This point is the ideal point to rotate your camera around to eliminate parallax when stitching images together. (Search for Youtube videos).
- Technique:
 - use same settings as for a single frame astro photo.
 - ensure the camera and tripod are level.
 - take a series of photos of the scene shifting the camera between each frame and overlapping each by at least 50%. All of the frames of the panorama need to be as close together time-wise to minimise star movement between the images.
 - Usually too difficult to light a foreground subject with light painting so instead light panels are set up to light the subject while all the pano shots are being taken.
 - Include plenty of space on sides and top of milky way to compensate for cropping that occurs when stitching.



10 individual frames to be stitched together to form a panorama

Metadata: 20mm f1.8 lens. 6s at f2.0. ISO 6400



The stitched and edited panorama



On Line Resources

There are a number of resources on line to make your astro experience more enjoyable.

Photopills: App for mobile. Also has online calculators:

- 500 Rule Calculator <https://www.photopills.com/calculators/spotstars>
- Hyperfocal Calculator <https://www.photopills.com/calculators/hyperfocal-table>
- Guide <https://www.photopills.com/articles/milky-way-photography-guide>

Richard Tatti: Australian astrophotographer

<https://www.youtube.com/channel/UC-KNiVo4X76cJIMphHIEdA>

<https://www.nightscapeimages.com.au/>

Lincoln Harrison Photography

<https://www.lincolnharrison.com/>

Lonely Speck: Astrophotography tutorials, tools, gear and inspiration

<https://www.lonelyspeck.com/>

Capture the Atlas <https://capturetheatlas.com/milky-way-photographer-of-the-year/>

<https://capturetheatlas.com/how-to-photograph-the-milky-way/>



<https://youtu.be/jtXW-4BDLTU?t=348>





THANK YOU
AND HAPPY NIGHTSCAPING