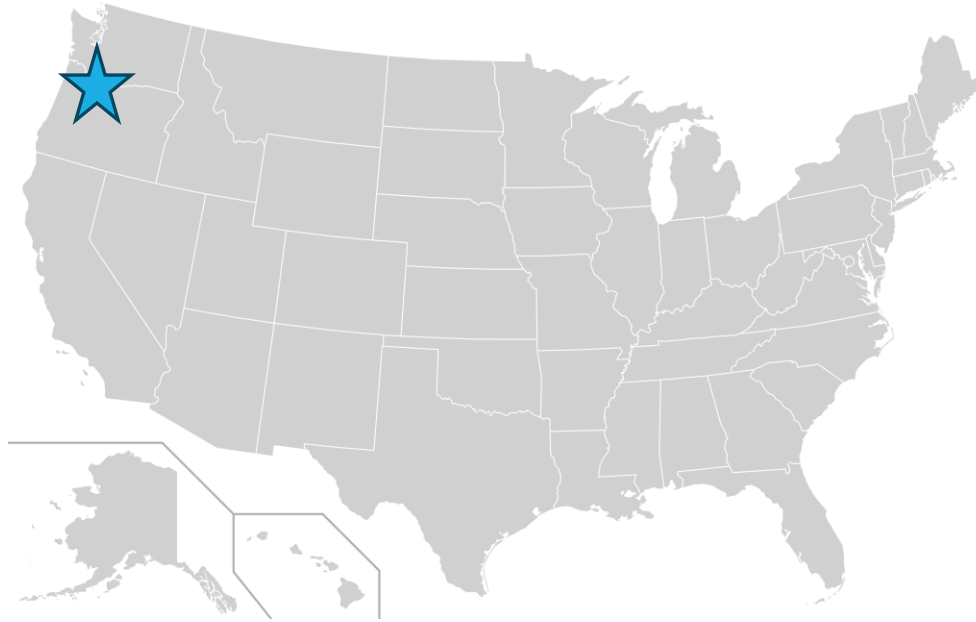
HOW REMOTE IMAGING WORKS

From Setup to Daily Workflow

KEVIN MOREFIELD

ABOUT ME



I currently live in Portland, Oregon in the US

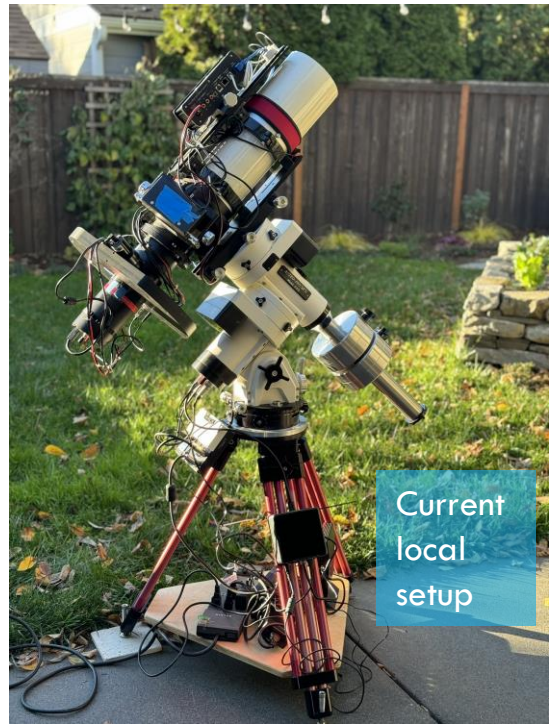
- Bortle 7
- Latitude 45
- Rain and clouds from November to April

Two hour drive to Bortle 2 skies

Retired in 2017 from marketing job in finance

College degree in photography

Used my father's Unitron 60mm at about age13 years



FSQ106, AP Mach2, QHY600m
FLI Centerline, Chroma filters, Paramount Helium tripod

MY IMAGING EXPERIENCE

Started Imaging in 2014

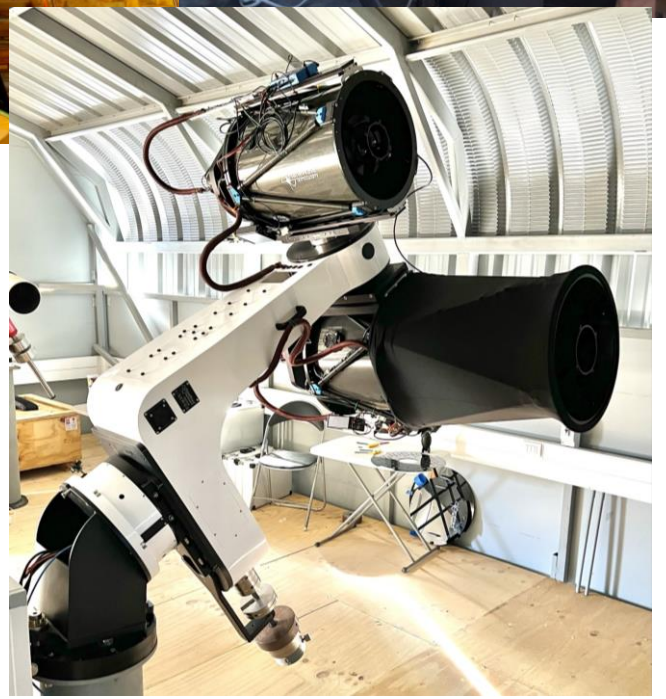
- Televue 127is, Paramount MYT, SBIG STT8300

First Remote installation 2016 at Sierra Remote Observatories

- First setup: CDK14, Paramount ME2, SBIG 16803 Camera
- Final setup: CDK14, Planewave L-350, QHY600M

Moved to Obstech in Chile November 2022

- CDK17 + DeltaRho350, Planewave L-600, QHY600M and ATIK APX60



WHY I CHOSE REMOTE

- I could not get enough data traveling to the closest dark sites
- I wanted better seeing
- I was moving to an even worse location due to rain and clouds
- This was how I planned to spend my time in retirement

My Telescope in Operation

LIMITATIONS OF THIS SESSION

- Can't teach you how to run a remote observatory in 40 minutes
- But I can give you a feel for how it works and the challenges you will face
- I'm going to talk about using commercial remote sites
- If you are thinking about creating your own remote observatory you will need to deal with many topics beyond my scope here as well as everything I talk about

The Moon over El Sauce

WHY GO REMOTE?

Darker Site
- Generally Bortle 2-3

Better Seeing
- The best locations are <1” frequently
- Most sites will offer at least 1.5” seeing

Fewer Clouds = More nights

More data
- Allows you to advance your processing skills

Sleep
- Automation and a secure location allows you to relax
- Almost all of your activity will be during the day

Planewaves at El Sauce with Chilescope in the Background

HOW TO KNOW YOU ARE READY FOR REMOTE

You have reliable equipment
- You need to know your setup will operate nightly without intervention

You have accomplished all night automation
- Target Selection
- Plate solving
- Meridian flip
- Focus
- Filter choice
- Shutdown and parking

You have time available to process the data

You are OK with the cost

All of this should be proven first in your back garden or local imaging site!

If this is you while imaging, you are ready

RELIABLE EQUIPMENT MEANS…

- Telescope is capable of maintaining collimation
- Mount will maintain polar alignment
  - Has a home position, slew limits
- Focuser has no slippage and has predictable backlash
- Cable management:
  - Prevents snags in any position
  - Secures USB and power connectors so they maintain connection
- Camera is tilt corrected
- Filter wheel to camera connection is sealed so dust cannot enter
- USB and Power can be turned on and off remotely
- PC is set to restart on power up

ALL NIGHT AUTOMATION SOFTWARE

Two fundamental choices; single night automation and multi-night automation

Multi-night options:

-ACP

-Voyager Advanced

-NINA-Target Scheduler plugin

Single night options:

-ACP

-Voyager

-NINA

-SGP

-CCDAP

With multi-night there is no requirement to log in for days or even weeks

Single night: you setup a set of objects to shoot tonight with a plan for what exposures and filters to use for each object

Multi-night: You have a ranked list of objects and the software decides what is optimal to shoot at any given moment

Frequently review the subs and let the control program know which were not acceptable so it can re-shoot

I use Voyager with a custom sequencer that works like Voyager Advanced or NINA Target Scheduler

COMMON CONCERNS

How will I turn equipment on and off?

- Most commonly, equipment is not turned off
- I leave my equipment on and connected 24/7
- If you do want to power up/down use a unit like the Pegasus or the IP power switch

How will I connect to the PC that controls my telescope?

- A remote desktop tool like Google Remote desktop is normally used
- Direct VPN into the local PC is another option
- I use RemotePC, which costs $35 per year, because I like how it works with my phone and Ipad as well as my processing desktop
- Microsoft RDP may also be an option
- TeamViewer has been a problem for some

COMMON CONCERNS

Flip-flats are an option but keep in mind that you will be pointed up with the cover open all night for ~250 nights a year

How will I keep my mirror or lens clean?

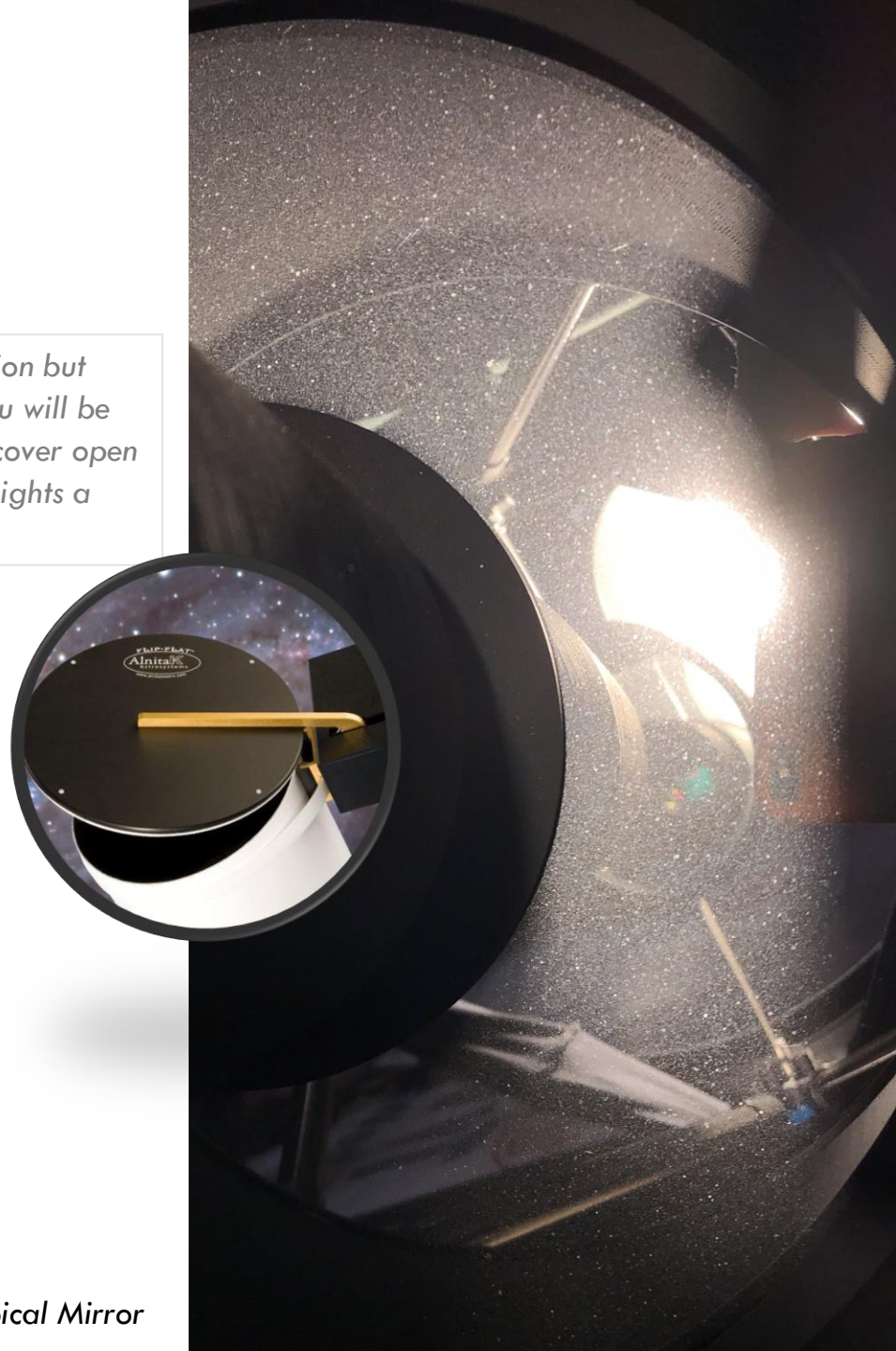
- Your mirror will get dirty and it's OK!
- Onsite staff can often clean for you if needed
- Once per year is fine

How will I keep my filters clean?

- You must be sure the area between the FW and the camera is sealed
- Again cleaning once a year is fine
- Flats work!

What about flats?

- Most common solution is sky flats
- Some use flat panels but sky flats are more common
- Professional observatories don't have flat panels the size of a house…



Typical Mirror

EQUIPMENT SECURITY

I'm sure it has happened, but I've never heard a story of theft or vandalism at a commercial remote site

- I have heard of theft at a star party however

Buildings are locked and some sites have 24/7 staffing

Living in the city, I worry more about equipment in my back garden!

Two facts work in our favor:

- The sites are very remote
- Random thieves would have trouble selling most of this equipment

In the US, I was able to add my equipment to my home insurance policy

- That wouldn't work for equipment in a different country

RE-BOOTS, DISCONNECTS, ETC…

Two crucial pieces of equipment

- IP based power switch
- USB/12v power switch

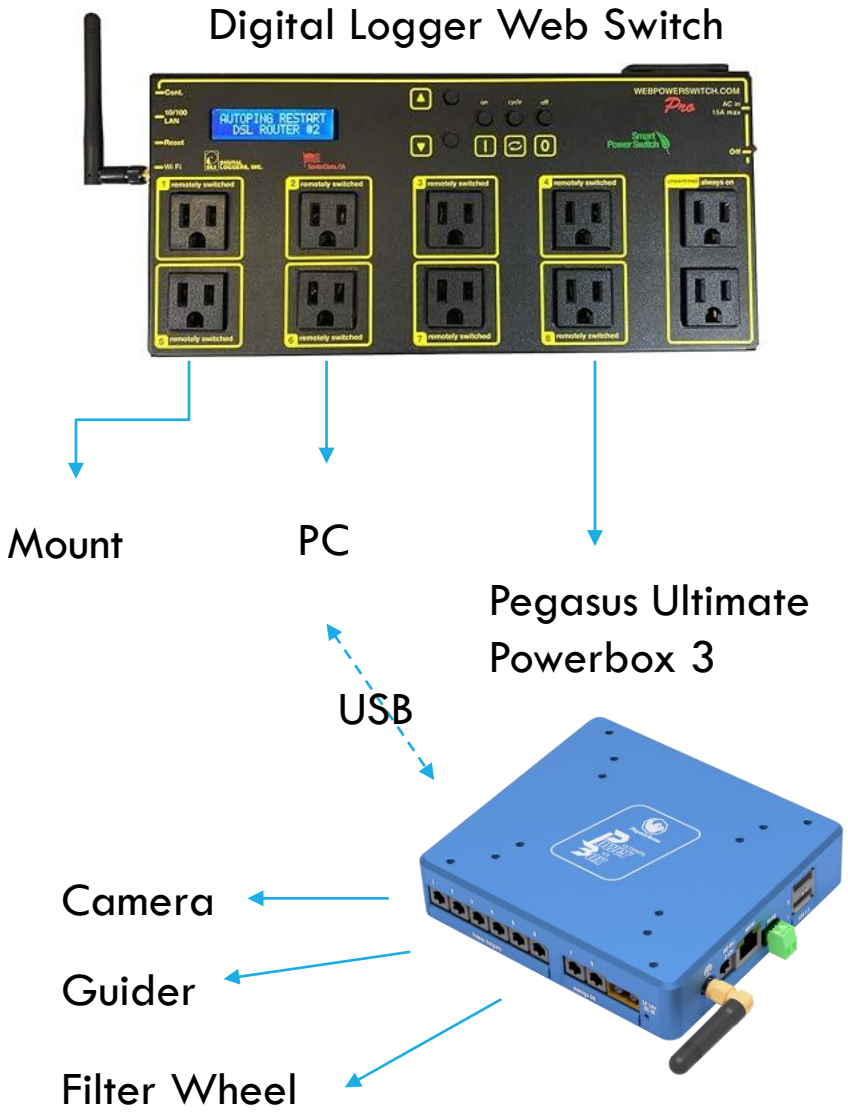
The IP switch is accessed directly via VPN and operates outside the local PC

The USB/12V switch sits on the OTA and is controlled by the local PC

The PC can be re-booted by cycling power on the IP switch

Camera, filter wheel, etc. can be restarted with the USB/12V switch

If the local internet fails the site manager will need to fix it



CABLE MANAGEMENT IS KEY

PC on the pier and USB/12V switch on the OTA

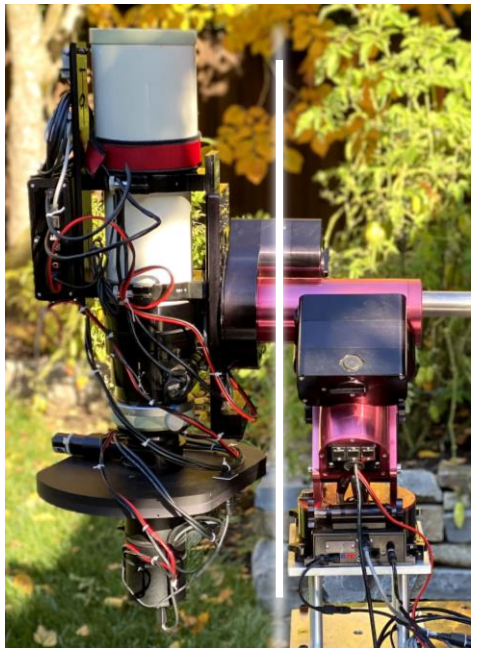
- Only one 12V power cable and one USB3 cable through the mount
- If through-the-mount is not possible this minimizes cables to manage

De-stress the USB connections to keep them in contact and prevent them wearing out

Ensure that the OTA can move to any possible position without a cable catching

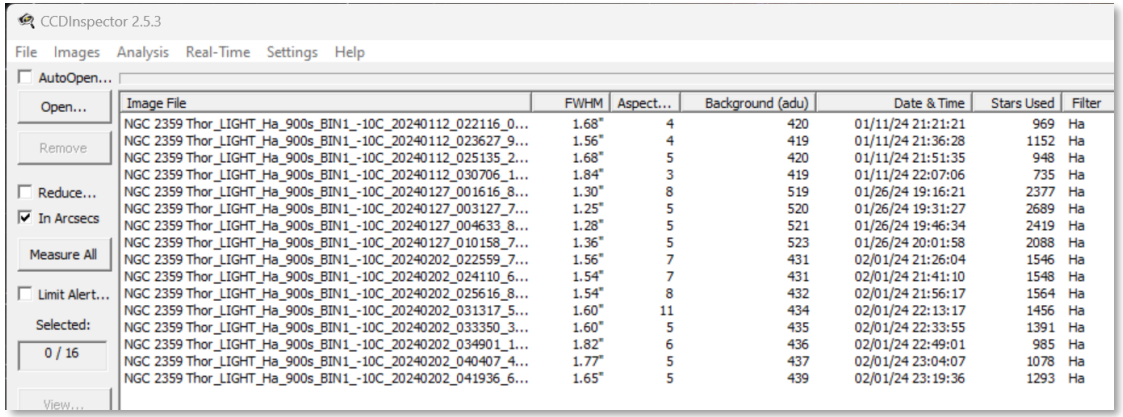
Ensure the rotator can move to all positions without pulling

Secure the cables so no weight pulls on the power or USB port



If possible, use through the mount cabling to prevent snags

MY DAILY WORKFLOW



1. Connect to the Remote PC
2. Review the subs from last night with CCDInspector, PI Sub-frame Selector, Blink, or other tools
   - I reject based on a FWHM threshold, higher for RGB, lower for Luminance
   - If CCDI finds significantly fewer stars on a sub I reject it
   - Generally, I let PI assign low weights to the low SNR subs
3. After rejecting the bad subs I upload the good ones to my cloud account
4. I then update the program for the evening's session if needed

Every few days I will download the subs to my processing computer and run WBPP to check:

- Is framing correct?
- Are there artifacts to deal with?
- Did I pick the right filter and integration length?

Managing data acquisition takes 5-10 minutes most days

PROCESSING COMPUTER

You will have more projects and larger stacks of subs with remote imaging
- This means processing speed is more important

Multi-core processors are important
- AMD Ryzen 5950 with 16 cores is a good example
- Intel i7-13700K also offers 16 cores

64 -128 gbs of fast RAM

NVME SSD drive large enough to hold your open projects

NVIDIA based GPU to run AI programs like BlurX, StarNet, etc.
- After setting up your system to use the GPU, AI processing times are 10X faster
- The more CUDA cores the better

You can compare Pixinsight Benchmark speeds of various combinations here:
https://pixinsight.com/benchmark/

Computers with these specifications are often labeled as video editing, rendering, or modeling desktops

DATA MANAGEMENT

I have a 2TB SSD in the small onsite computer

- After uploading to the cloud, I keep the completed subs on the observatory computer until my project is completed

At home I have 4TB SSD on the processing computer

- Subs for uncompleted project remain on this fast storage till I finish the image
- Many projects span multiple years so they can add up

I have a 4x10TB NAS with RAID5 to keep the data long term

- This acts as storage and backup

With a full frame camera I can get several GBs of data each night

Intel NUC

A Network Attached Storage (NAS) box with enterprise level drives is a good idea for long term storage

WHAT DOES IT COST?

Rent can range from 150€ to 2000€ + monthly

- Depends on the site and telescope size

Shipping and import taxes outside of the EU (or your Country) may be substantial

- VAT is 20% in Chile and Morocco
- Additional government fees of 3-6%
- Shipping and handling
- For Chile I assumed 30% total on top of equipment cost

Less expensive sites may charge for service

Consider the travel expense to maintain or upgrade your equipment

TREVINCA SKIES REMOTE ASTRONOMY

SRO Sierra Remote Observatories

OBSTECH

ATLAS SKIES

e-Eye Extremedura

REMOTE SITE SAMPLE COMPARISON GRID

Site	Country	Approximate Monthly Cost	How Dark? SQM	Bortle[6]	Seeing	Clear Nights
Trevinca Skies	Spain	150€[1]	21.8	3	1" (website)	220
E-Eye Extremadura	Spain	300€[2]	21.8	3	<2" (website)	250
Atlas Skies	Morocco	370€ - FSQ106 420€ - CDK14[3]	21.9	2	0.4"-1.4" 0.84" median (from owner)	220
Obstech (El Sauce)	Chile	850€ [4]	~22	2	<=1" Summer- Winter is much worse (my experience)	320
Sierra Remote	US, California	750€ for small scope. Large scope is double or more[5]	21.78	3	<=1" Summer - Winter is much worse (my experience)	290

1 – Source: User of the site. Price includes Insurance and VAT.
2 – Source: User of the site. Paid quarterly.
3 – Source: Site manager. VAT not included. Is VAT owed for non-Moroccan?
4 – Source: Website.
5 – Source: Website. My bill for CDK14 was considerably more that this.
6 – Bortle assessment is my guess to help visualize things. SQM to Bortle is not a direct translation

Source of the information is generally the remote site's website. In some cases I've used direct experience of my own or other users of the site.

Disclaimer: This information is approximate and abbreviated. My intention is to display the kinds of variables you will use to decide on a site. Please contact the locations directly to gather data for your decision

MORE CONSIDERATIONS WHEN CHOOSING A SITE

Internet speed and reliability

- Some are so slow you must pre-process and stack remotely
- Some are gigabit fiber

Staffing

- What services are available and included?
- What services is an additional fee?
- What is the skill level of the staff?

Ease of access

- Will I want to go onsite?
- How long will it take to get there?
- What are the onsite facilities?

Weather and Skies

- Seeing, darkness, and cloudless nights are not the only factors
- Humidity and transparency are as bad as clouds
- Smoke can also be a summer issue

QUESTIONS?

https://www.astrobin.com/users/morefield/

Instagram: @Morefield