Observing Tips

Observing and Drawing Mars

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[Note from Dave Chapman, RASC Observing Committee Chair: This is the fifth in a series of observing articles contributed by RASC members. With Mars at a close opposition in July 2018, now is the perfect opportunity to provide the visual observer with a guide to equipment and methods. For future columns I am looking for practical content contributed by active observers—please email me at observing@rasc.ca with your ideas.]

Introduction

The first question I usually get when I talk about observing Mars is: why bother, when all those spacecraft and rovers are there, returning images with detail you could never see with your telescope? The answer is simple: every two years, when Mars is close enough to Earth that amateur telescopes can resolve surface detail and weather on Mars, visual observers are smitten by the possibility of seeing something new. The dark markings (albedo) on the surface can change as they are covered and uncovered by blowing dust, and clouds grow and move around the planet; dust storms move across the face of the planet, sometimes obscuring large portions or even the entire surface; polar caps shrink or grow with the season. Indeed, many times scientists are notified of events happening on Mars by amateur astronomers.

Below, I will not cover the particulars of the 2018 apparition of Mars: for those, see the excellent article by Murray Paulson in the Planets and Satellites section of the current *RASC Observer's Handbook*, and the foregoing article. Rather, I will share the approach and methods that have proven fruitful for me over 40 years of observing and recording each appearance of Mars in our skies.

Observing Mars—Equipment

As the articles mentioned above point out, the planet remains at some distance from Earth until late northern hemisphere spring, presenting a small disk diameter for the observer to work with. Your telescope therefore has to be capable of high magnification without exceeding the limits of the instrument. Since atmospheric conditions vary greatly, they further limit what the telescope itself can deliver. Average resolution of fine detail is limited to 1 arcsecond or greater, often as much as 3 arcseconds due to air movement, both at high altitude (from jet streams and frontal systems), and from ground effect (turbulence from structures radiating heat after daytime solar heating). Degradation of transparency due to clouds of various types and altitude also greatly influences the ability to resolve fine detail on the planetary surface.

Most instruments available to amateurs today have short focal ratios, the industry having responded to the increased demand for small telescopes that are very portable, and to deep-sky imagers who want fast objectives with a wide field of view. Now there is a plethora of telescopes having focal ratios $f/5 - f/7$, both refractors and Newtonian reflectors. The exceptions are Schmidt-Cassegrains at $f/10$ and Maksutov-Cassegrains at $f/12 - f/15$. To provide the long effective focal lengths required for planetary viewing with currently available eyepieces, we must use magnification amplifiers such as Barlow lenses and Tele Vue PowerMates™ (see Figure 1). These devices optically double or triple (or more, up to 5x) the effective focal length of the telescope. With a 2x Barlow, the observer with a 100-mm refractor with a focal length of 500 mm has now a telescope with an effective focal length of 1000 mm, so a 10-mm eyepiece will give 100x instead of 50x. Besides getting higher magnification, the observer enjoys the advantage of greater eye relief, which reduces eye fatigue. Not only will you enjoy the view better, you will observe more detail.

Figure 1 — Magnification amplifiers: a Barlow lens and two PowerMates™ (all illustrations by the author).

Be careful not to exceed the magnification limit for the size of the objective (2x the aperture in millimetres or 50x the aperture in inches) or the image will be degraded. Choose magnifications according to viewing conditions—some nights will allow very high magnification and others will not. Generally 200x is tops for small to medium instruments and 300x for large telescopes. As a guide, you should strive for an apparent disk diameter close to 0.5°, that is, the diameter of the full Moon seen without optical aid. For example, in a high-quality 150-mm telescope, the maximum magnification of 300x would magnify the 10″ disk of Mars (late April and late November) to 1.7 full Moons; at 12″ (mid-May and late October) the same magnification gives 2 full Moons; and at 24″ (near opposition in late July/early August), 4 full Moons. Using a magnification of 200x will yield smaller disk views, but still enough to see a sufficient amount of detail, atmospheric seeing and transparency willing. Obviously, telescopes of all apertures will give the best views in July and August.

A word about resolution of fine planetary detail: many believe that Dawes' limit (116 divided by the objective diameter in millimetres) gives the maximum resolution in arcseconds for their instrument. That is true for point objects like double-star separations but does not hold true when it comes to high-contrast, linear details. For example, the Cassini division in Saturn's rings (about 0.35 arcseconds) is clearly seen in high-quality 80-mm and 100-mm telescopes. When conditions are right and Mars is close, you can see amazing detail, once you learn how to see and what to look for.

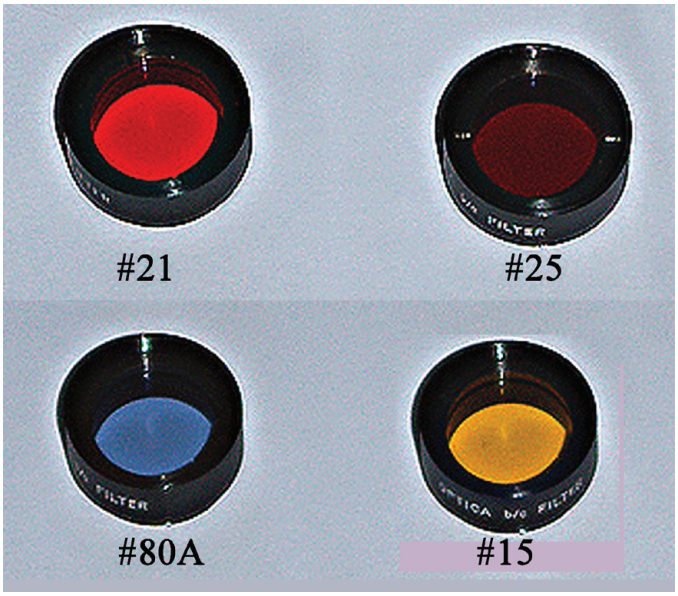

Figure 2 — An assortment of Kodak Wratten dyed-glass colour planetary filters.

Turning to visual planetary filters for eyepieces, for decades Mars observers have used dyed-glass colour filters, mainly Orange #21, Red #25, and Light Blue #80 (Kodak Wratten series); red and orange to accentuate surface albedo markings and dust clouds, light blue to enhance atmospheric clouds. Yellow #15 is used to cut through some of the haze and dust present in our own atmosphere. Dyed-glass filters act by blocking all but the actual color of the filter itself. Modern filters are multicoated, allowing sharper, cleaner definition of planetary detail. Be aware that filters block some light from the image, so choose the filter that works best for your telescope and eyepiece combination.

Over the years, I have found the Tele Vue Mars Bandmate™ filters to be very effective (unfortunately, they have been discontinued, but may be available used). The Mars Type-A is a dual-band filter with different dielectric coatings on each side of the substrate. The dual-band nature of the filter permits green and red through, while rejecting all other visible colors. The effect is to enhance detail on the Martian surface, while preserving the natural colour of the polar caps and the rest of the surface. Since this filter provides a most natural view, it is highly recommended for public viewing. The Mars Type-B filter has a high-efficiency, single-band dielectric coating that achieves penetrating views of the Martian surface. Initially I use the "B" filter for maximum resolution of the dark albedo regions, switching to the "A" filter for an integrated view.

Drawing Mars

The reasons for recording your observation as a drawing are twofold: first it trains your eye and brain to truly **observe**—as you look at different features and portions of the disk, you learn to pick out subtle variations in the darker features, thin indistinct markings in the desert areas, yellow dust clouds, and white atmospheric clouds, hazes, and fog. Second, as you progress, you learn proper placement of features in relation to one other. Start with the most prominent polar cap and gauge feature placement using a centre line on the disk as a second reference. Work carefully, outline the major features, and shade them according to what you see, blending with your finger and using the eraser to lighten areas, I usually outline clouds with a dashed line and dust with a dotted line—these can be refined later when you finish the sketch indoors.

As Mars rotates 14.6° per hour, you should strive to complete your sketch in 15–20 minutes to avoid distortion of the overall drawing. Take note of the start and stop times in order to calculate the central meridian of your drawing. Write down the date, location, observer, instrument, magnification, filters, seeing, transparency, and any noteworthy features or circumstances.

I have designed an observing form that I print as needed (see Figure 3). If anyone wishes a copy (PDF file), email me and I will send one. I use a clipboard with a red light, sketch the surface markings using a soft pencil (type B), then use my eraser and fingertips to smudge and blend. For colour, good-quality pencil crayons work well—blend the colours as you did with the pencil. Dark areas often appear greenish to the eye but that is mainly a contrast effect against the pink/orange background that fooled early observers into thinking there was vegetation on Mars. Dust clouds are yellowish and atmospheric clouds white.

Figure 3 — Tele Vue Bandmate™ Mars filters (discontinued).

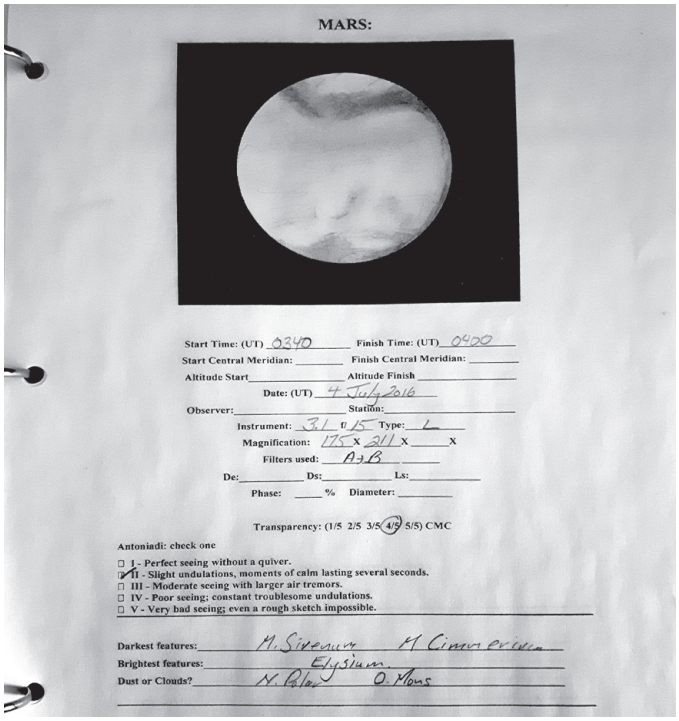

Figure 4 — The author's custom Mars observing form (email denisfell872@gmail.com to request a copy).

Drawing is easier when you are seated, allowing your eye to stay centred on the disk, thus reducing fatigue. Consider either a lawn chair or a dedicated, adjustable observing chair, I seldom use a diagonal on my refractors, as it reverses the image and just adds another piece of glass to absorb light, especially when using Barlows and PowerMates™.

If you have not done planetary drawing before, to prepare yourself, place an image of Mars across the room so it will be about the size you expect see in your telescope, and practice making drawings. Soon you will become more adept at rendering what you see on paper. Continued practice will allow you to hone your skills, and you will produce a drawing that you are happy with. Figure 5 shows a series of steps that illustrate the development of a drawing.

In previous times, I used a set of maps at the telescope to orient myself to the area I was observing, but I have found there are very good apps for mobile devices for use at the telescope. For the iPhone and iPad, look for Mars Globe on the iOS App Store (there is a MacOS version as well, called Mars Atlas). For Android devices, look for Physical Mars on Google Play. These will provide up-to-the minute data and information about Mars, along with globe views.

Final Image Treatment and Sharing

Once indoors, when you have all the data recorded and the drawing cleaned up, you can scan it into a graphic editing program and use the computer to adjust levels and contrast, and to apply selective blurring tools to achieve a look similar to

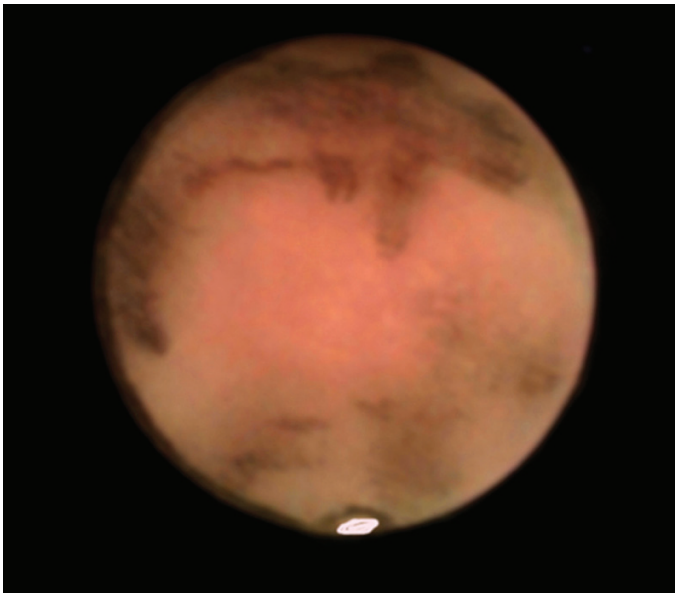

Figure 5 — An example of a final drawing, with colour.

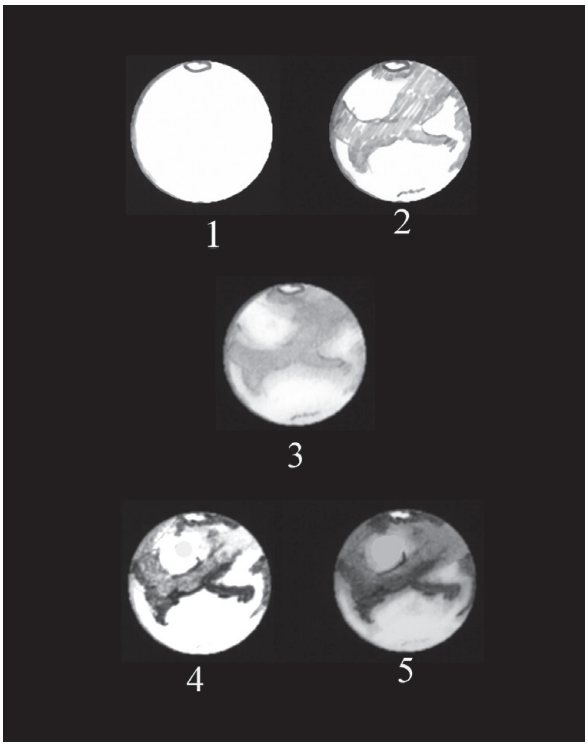

Figure 6 — The stages of drawing Mars at the eyepiece.

that in the eyepiece. Clouds and polar caps can also be brightened. I usually do two versions, one for a permanent record in my logbook and one for posting to online observers' groups and social media.

Links to sites where you may upload your image and view the work of others:

Yahoo Mars Observers Group
groups.yahoo.com/neo/groups/marsobservers/info

ALPO 2018 Mars apparition
www.alpo-astronomy.org/jbeish/2018_MARS.htm

ALPO Japan Mars
http://alpo-j.asahikawa-med.ac.jp/Latest/index.html

International Mars Observers
www.mars.dti.ne.jp/~cmo/ISMO.ht

As always, I welcome questions or comments on this topic, email at denisfell872@gmail.com. Enjoy Mars 2018 and share your drawings and experiences. ✶

Note: The Tele Vue Mars Bandmate filter series has been discontinued, but Orion Telescopes has a Mars filter with the same capabilities as the old T-V Mars 'A' filter. (https://www.telescope.com/125-Orion-Mars-Observation-Eyepiece-Filter/p/5599.uts)

Denis Fell has been observing and drawing at the eyepiece since 1971, and joined the RASC in 1974. He is well known for his Mars drawings over the years, some of which have been published in the ALPO Journal *and the RASC* Observer's Handbook. *Denis is retired, and observes and draws through 80-mm refractor and 203-mm reflector from Wetaskiwin, Alberta.*

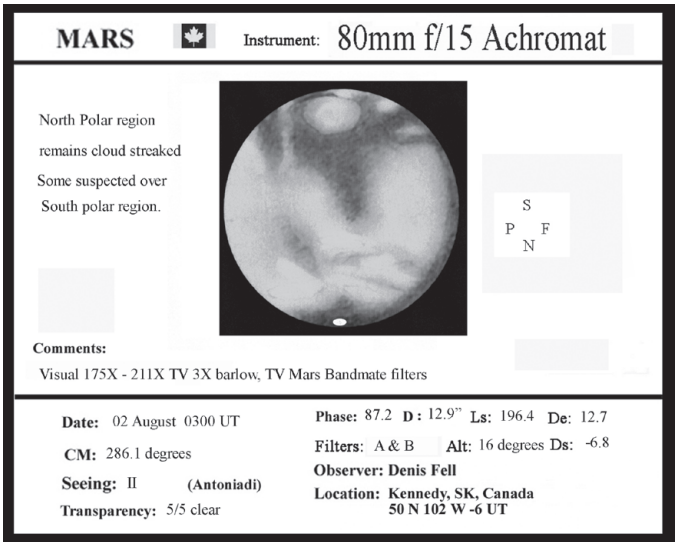

Figure 7 — Final monochrome drawing with observing details, for logbook and sharing.

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