



## Mars Section

## Mars in 2016: Second interim report

This report covers the period up to 2016 June 30, over one month past opposition. On that date the areocentric longitude  $L_S$  had reached  $178^\circ$ , implying the end of winter in the southern hemisphere and of summer in the north. Spring in the south begins at  $L_S = 180^\circ$ . We shall therefore soon be in the period where regional and planet-encircling dust storms become more likely.

At latitude  $+52^\circ$ , Mars had a meridian altitude of just  $16^\circ$  at opposition. However, although the best observations have come from Australia, South Africa and South America, the planet has not gone unnoticed in the UK, skirting rooftops and tree lines. On several occasions, and especially when the sky cleared late in the day, observers were surprised to encounter periods of very good seeing. For the imaging fraternity the low altitude has been more difficult to compensate for, but several observers have managed commendable results.

The Director enjoyed several nights of good steady seeing when the large disk of the planet allowed many fine details to be observed: some of his drawings may be published later. But the UK weather, having sporadically cooperated earlier in the year, became totally overcast and dismally wet throughout much of June. In that entire month I counted just six partly clear evenings when Mars could be viewed from my observatory, although I never lost a single chance to watch the planet. Some of those opportunities were in mere gaps between clouds. Nonetheless our international team of 58 observers between them covered every night in May and June.

The 2016 apparition of Mars was seasonally similar to those of 1999<sup>1</sup> and 2001.<sup>2</sup> These two oppositions were very different from one another in that the second produced a planet-en-

circling dust storm whereas 1999 did not. The surface features greatly resembled their appearance in 2014: recall that there was no planet-encircling storm to redistribute dust since the previous apparition.<sup>3</sup>

The last such event took place in 2007,<sup>4</sup> while long-term historical statistics show the chance of one happening is one perihelion in every three. (In 1999<sup>5</sup> I calculated a figure of 32% for the earlier observations up to and including the 1992–'93 apparition, representing events in eight martian years out of the 25 where the spring and summer seasons had been sufficiently well observed to check for an encircling storm.) The planet undergoes decades where there is much activity, and others where there is relatively little.

The early part of the observations in 2015–'16<sup>6</sup> saw the retreat of the NPC and the build-up of white cloud. The orographic clouds over the martian volcanoes were beautifully seen in the months prior to opposition, but by the time of the planet's closest approach the slopes of *Olympus Mons* were cloud-free. In the south we saw the formation of the S. polar hood, and at opposition the *Argyre* basin stood out as a brighter area within its boundary. *Hellas* has shown some local dust activity, but by late June it had not yet produced any significant storm.

The most striking point in comparison with 1999 and 2001 is that we are now seeing the planet mapped in much finer detail than previously: in 2001 the webcam revolution had yet to arrive! Modern observations reveal the variable N. polar clouds now covering the N. polar cap to be highly complex. A number of these clouds have recently been followed in the N. polar region, including at least one cyclonic example. The latter type has now been seen to recur at

precisely the same seasonal date over several martian years.

One oddity from the last apparition was the settling of a small area of bright yellow dust on the NW flank of *Elysium*. (This was quite different from the bright white orographic afternoon cloud seen to be associated with the *Elysium Mons* volcano, within telescopic *Elysium*.) The NW border of *Elysium* has historically been marked by a faint half-tone, but since the late 1970s a well-marked triangular darkening of the *Aetheria* desert has arisen there.

The dust appears to have settled at the E. edge of the *Aetheria* darkening. Is the region at last returning to normal? The bright yellow fallout area did not develop further, and yet around opposition in 2016 it became so strikingly bright (and easily the brightest feature of the disk in red light) that the Director thought it was a dust storm starting: as a precaution he issued an email alert on Jun 26 to Section members, followed by a BAA e-bulletin.<sup>7</sup> But the following week showed this to have been a false alarm, and the area slowly returned to its normal brightness.

The bright yellow feature is well shown in an animation kindly prepared by Toshiro Mishina:<sup>8</sup> there seemed to the writer to be tiny day-to-day changes, an impression also gained from orbiter (MRO) images, but this is debatable. In any case we have added another phase-sensitive marking to our list.

Our recent reports have mentioned how several half-tone features have darkened when far from opposition, due to the presence of rough terrain, while the opposition brightening of the cloud-free slopes of *Olympus Mons* is well-established. The mystery here is how a fresh deposit of settled dust could show a phase effect

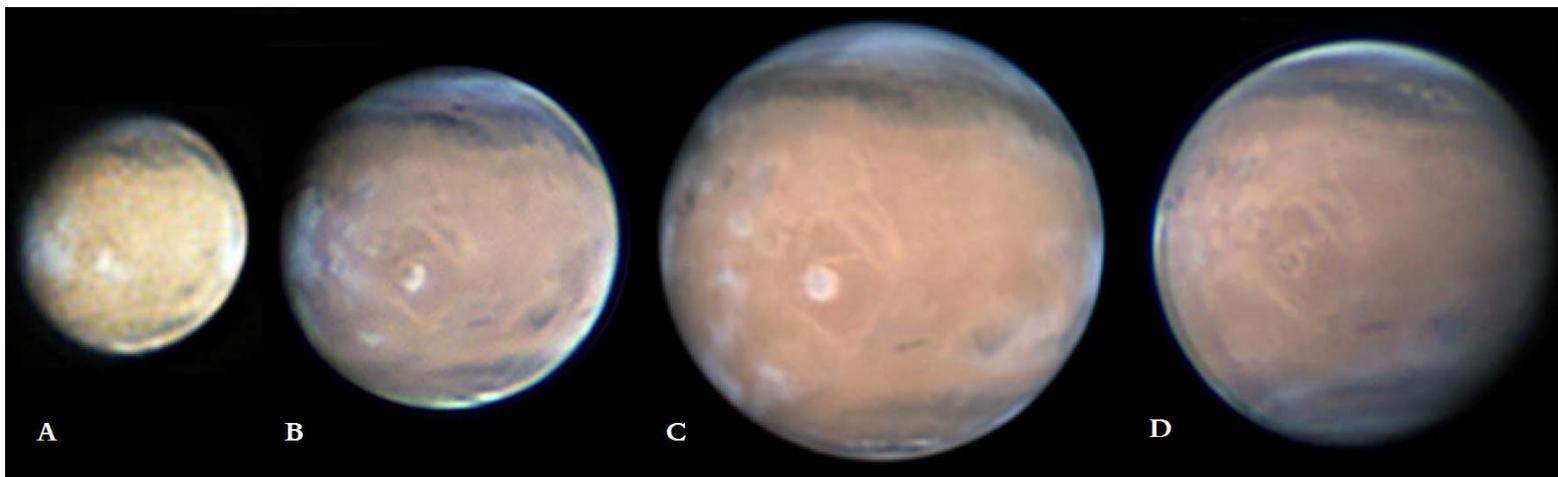


Figure 1. The seasonal behaviour of the orographic cloud over *Olympus Mons*. Images have south uppermost and are not to scale. All images in Figure 1 are at a similar CM longitude, though not quite at the same local time upon the planet. The slopes of the volcano have become cloud-free in (D).  
 (A) 2016 Mar 25, 11:21UT,  $L_S = 128^\circ$ , CM=  $148^\circ$ , 250mm DK, ASI224C camera, P. W. Maxson (AZ, USA).  
 (B) 2016 Apr 20, 02:54UT,  $L_S = 140^\circ$ , CM=  $146^\circ$ , 355mm SCT, ASI224MC camera, C. Foster (S.Africa).  
 (C) 2016 May 12, 16:45UT,  $L_S = 150^\circ$ , CM=  $148^\circ$ , 369mm refl., A. Wesley (Australia).  
 (D) 2016 Jun 22, 17:18UT,  $L_S = 173^\circ$ , CM=  $156^\circ$ , 355mm SCT, ASI224MC camera, C. Foster (S.Africa).



as strongly as rough terrain. (By comparison, the Seeliger Effect for the rings of Saturn, another opposition brightening phenomenon known since the 19th century,<sup>9</sup> is easily understood by simple geometry.) On Jun 22 the Director finally had an excellent view of the *Elysium* region with his 410mm Dall-Kirkham, when at  $\times 410$  the bright yellow western edge of telescopic *Elysium* was readily seen visually, though less strikingly than the near-opposition images portrayed it. By then, the orographic cloud over *Elysium Mons* was no longer active.

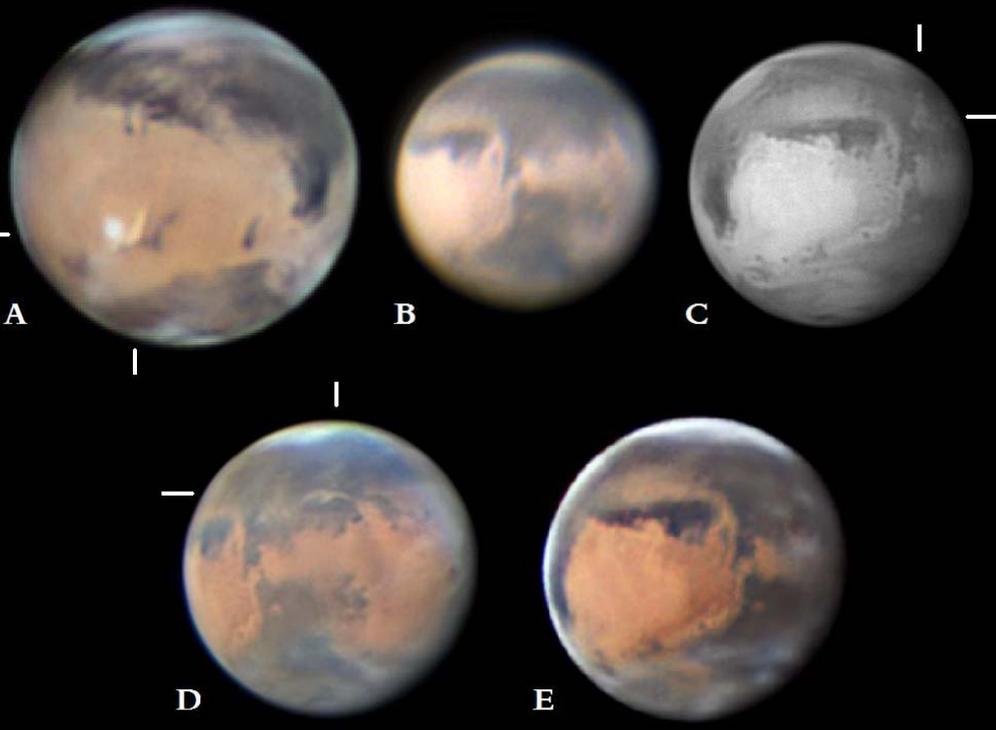
*Hellas* showed weak sporadic dust activity during May–June. A small storm arose on Jun 15 over *Valles Marineris* and southern *Margaritifer Sinus*. This event, like a similar one observed by E. C. Slipher from 1922 Jul 9 onwards,<sup>10</sup> had dispersed within a few days. Some 200 Section members were again notified by email on Jun 16, although no BAA e-bulletin was issued for this event.

The Director offers his thanks to those contributors who have provided data for a total of 234 days out of the 307 since the start of the apparition, back in late August of last year. We publish a handful of images typical of the many received (Figures 1–2). A further report will be written later. By the time this *Journal* appears in print, southern spring and the dust storm season will be well underway.

**Richard McKim, Director**

### References

- 1 R. J. McKim, *J. Brit. Astron. Assoc.*, **117**, 314–330 (2007)
- 2 R. J. McKim, *ibid.*, **119**, 123–143 & 205–211 (2009)
- 3 R. J. McKim, *ibid.*, **125**, 295 (2015)



**Figure 2. Dust: surface deposits and atmospheric activity.** Images have south uppermost and are not to scale. (A) shows a yellow dust fallout streak (indicated) in western *Elysium*, which was then exhibiting strong opposition brightening. (B)–(E) illustrate the development of atmospheric activity over *Margaritifer Sinus* to *Valles Marineris*. (B) shows the area before the event began, and (C)–(E) show small dust clouds over southern *Margaritifer Sinus* [indicated in (C)] with (D) at higher CM longitude showing in addition a small yellow cloud (indicated) in the W. part of *Valles Marineris*. (E) shows the latter cloud developed somewhat, adjacent to white cloud along the morning terminator.

(A) 2016 May 22, 04:16UT,  $L_S = 156^\circ$ ,  $CM = 240^\circ$ , 305mm SCT, PGR Flea3 CCD camera, E. Morales (S.America).

(B) 2016 Jun 5, 2:39UT,  $L_S = 164^\circ$ ,  $CM = 026^\circ$ , 355mm SCT, ASI224MC camera & dispersion corrector, P. Edwards (UK)

(C) 2016 Jun 15, 01:34UT,  $L_S = 169^\circ$ ,  $CM = 348^\circ$ , 355mm SCT, red light image with ASI120MM-S camera, D. A. Peach (Barbados, W. Indies).

(D) 2016 Jun 15, 05:57UT,  $L_S = 169^\circ$ ,  $CM = 052^\circ$ , 355mm SCT, ASI290MM camera, G. Jolly (AZ, USA).

(E) 2016 Jun 16, 03:46UT,  $L_S = 170^\circ$ ,  $CM = 001^\circ$ , 305mm SCT, PGR Flea3 CCD camera, E. Morales.

- 4 R. J. McKim, *ibid.*, **122**, 207–219 & 271–278 (2012)
- 5 R. J. McKim, *Mem. Brit. Astron. Assoc.*, **44**, 144 (1999)
- 6 R. J. McKim, *J. Brit. Astron. Assoc.*, **126**, 4–5 (2016)
- 7 BAA e-bulletin no. 918 (2016 Jun 28)

- 8 See the BAA and the Mars Section websites: <http://www.britastro.org> & [www.britastro.org/mars](http://www.britastro.org/mars)
- 9 A. F. O'D. Alexander, *The Planet Saturn*, Faber & Faber, 1962, p. 440
- 10 R. J. McKim, *Mem. Brit. Astron. Assoc.*, **44**, 43–44 (1999)

## Prizes awarded in Plymouth's Sir Patrick Moore astronomy competition



Young people from across Plymouth have been awarded prizes in the city's annual Sir Patrick Moore astronomy competition.

Deputy Lord Mayor, Cllr Sam Davey, invited the winning students to receive their prizes and take tea at the Lord Mayor's Parlour.

Students were given engraved medals, and astronomy equipment sponsored by the NASUWT teachers' union. The six runners up received pairs of astronomical binoculars and Callum Puckering, aged 15, was awarded a 63 Dobsonian telescope as the first prize.

The *Sky at Night* magazine donated copies of their recent publication *Sir Patrick Moore's Guide to the Moon* for each of the winning students so they can enjoy Sir Patrick's legacy of exploring and marvelling at the wonders of the night sky.

The competition is organised by BAA member Martin Edmonds, who said: 'Sir Patrick devoted his life to encouraging people to share his love of astronomy. He passed away in 2012, but through his hundreds of books, and the people he encouraged, he is still inspiring young astronomers around the world today.'

*Left: Students received their prizes from the Deputy Lord Mayor of Plymouth, Cllr Sam Davey. Photo by Martin Edmonds.*