Australian Astronomy

ASA Information Sheet No.13

Opposition of Mars
August 2003

Polar caps and other features on Mars are best seen at **opposition** when Mars is relatively close to Earth. At the opposition of Mars in August 2003 the planet will be closer than at any time in recorded history. This will be an exciting time to view the Red Planet. As well, scientists will take advantage of the planet's approach to launch three spacecraft to explore its surface.

What is an opposition of Mars?

As the Earth travels on its yearly circuit of the Sun it catches up with slower moving Mars every 780 days. When it does so, Mars is close to the Earth and opposite the Sun in the sky. This is called an opposition of Mars.

Why all oppositions are not equal

Figure 1 shows the dates of opposition over the next decade or so. To read it, note that the middle of each month is indicated for the Earth's path around the Sun. For example, opposition in 2005 will be in November, while in 2012 it will be in March. The effect of Mars' oval-shaped path around the Sun is also evident in the varying distance between Earth and Mars at different oppositions. This year's opposition will be exceptionally favourable as it will occur when Mars is at its closest to the Sun.

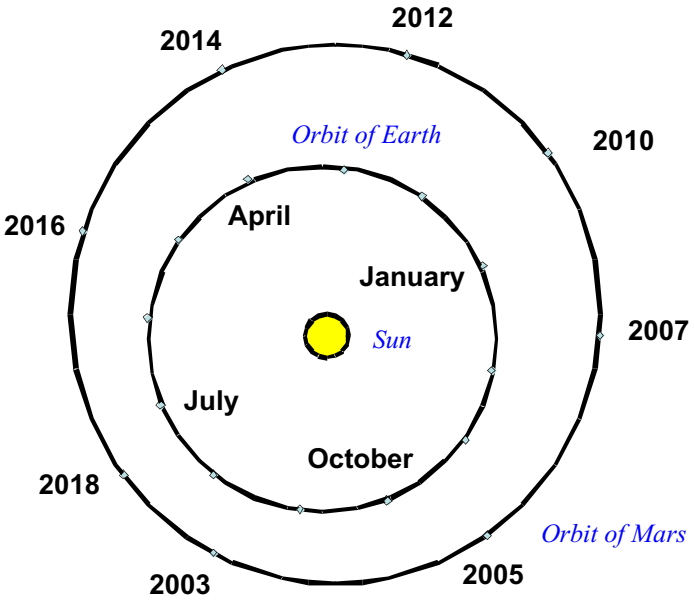

Figure 1 – Oppositions of Mars 2003 to 2018

This year at around 8 pm on 27 August Mars will be 55.76 million km from Earth. This is the closest Mars has come to the Earth in over 70,000 years. The distance is 3 million km less than in 1988, the most recent favourable opposition. However, it is only 20,000 km less than the distance in August in 1924.

In the future there will be a few oppositions when there will be even closer approaches between Earth and Mars. In 2287 Mars will be a little closer than this year while in 2729 it will be at its closest for the current millennium at 55.65 million km.

What can you see at an opposition?

Mars is a small planet, half the size of Earth. When it is distant from us, even through a telescope it appears as a tiny featureless reddish disc. At oppositions Mars is closer to us, its disc appears larger and features can be seen on its surface.

Figure 2
Mars at its 1924 opposition

These features include the polar caps and dark markings such as the one shown in figure 2, which is a drawing of Syrtis Major made in Sydney at the highly favourable 1924 opposition.

At some oppositions Mars has a dust storm raging on its surface. At such times the appearance of the planet can be disappointing.

The canals of Mars

The Italian astronomer Giovanni Schiaparelli observed Mars over many oppositions from 1877 and saw a series of channels or 'canali' on the planet. The 'canali' were mistranslated into English as 'canals' which has implications that are not in the Italian word. Schiaparelli's work inspired American Percival Lowell to set up an observatory in Arizona specifically to look for life on Mars. Lowell convinced himself that he had found it as he thought he was looking at a network of absolutely straight canals built by intelligent beings for the purpose of irrigation. Unfortunately, we now know that these canals do not exist.

What do we know of Mars?

Mars with its orange-red colour has fascinated people since ancient times. Its name derives from the Roman god of war.

Figure 3 - A Hubble Space Telescope image of Mars

The planet is similar to Earth in a number of ways. For example, a day on Mars is about the same length as a day on Earth. Also the tilt of Mars' axis is about the same as that of Earth so it has similar seasons. However, temperatures are much colder than on Earth: below the freezing temperature of water even in summer with average daily temperatures of about -60 degrees Celsius. The cold is due to lack of heating from the Sun and the lack of greenhouse warming from gases in the thin atmosphere.

Though there is no liquid water on the surface, close-up photographs of Mars reveal winding valleys and channels. These indicate the existence of running water in the past. Where is that water now?

Scientists using NASA's Mars Odyssey spacecraft, currently in orbit around Mars, have discovered large quantities of water ice under the planet's surface. They found that in regions of Mars surrounding the south pole the top one metre of soil has more than 50% water by volume. An instrument called the gamma ray spectrometer detected the water by searching for the signature of hydrogen in radiation coming from the planet. As hydrogen is an essential component of water and the hydrogen-rich regions are in the coldest regions of the planet, the scientists concluded that the hydrogen indicated the presence of water ice.

Spacecraft to Mars

In 1975 the Viking 1 and 2 landers became the first spacecraft to land on Mars and transmit images back to Earth from its surface. Between them they transmitted over 1400 pictures from the planet. The Mars Pathfinder spacecraft with its Sojourner rover landed in July 1997. The little rover explored the immediate area surrounding the spacecraft analysing rocks and taking pictures. Currently, there are two spacecraft circling the planet, Mars Global Surveyor and Mars Odyssey.

NASA scientists plan to launch two spacecraft to Mars in May and June of 2003. Mars Exploration Rovers 1 and 2 are expected to be able to travel kilometres away from the landing site at a rate of up to 100 metres a day. The European Space Agency will send Mars Express, which will contain a spacecraft to study the planet from orbit as well as a lander called Beagle 2.

Meteorites from Mars

There has not yet been a space mission to collect Mars rocks and return them to Earth. However, in recent years scientists have identified a number of meteorites - rocks from space that have survived the trip through the Earth's atmosphere - as having originally come from Mars. Of the 22,000 or so meteorites so far discovered 28 have been identified as Martian.

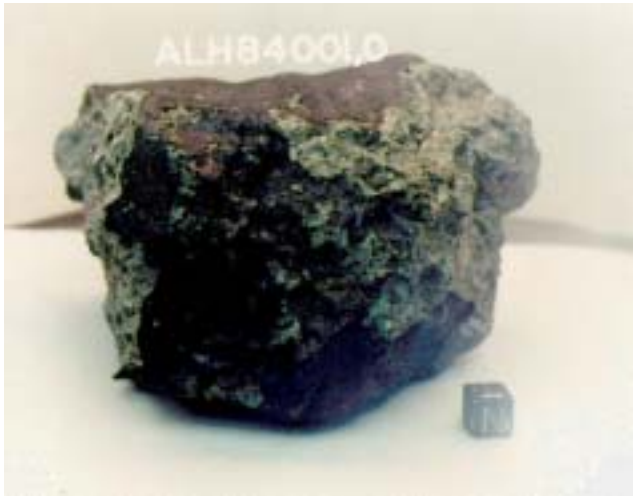

Figure 4 – Mars meteorite ALH84001
(Courtesy NASA)

Scientists believe that these meteorites were knocked off Mars during large meteorite impacts on the planet. They then circled the Sun for thousands or millions of years before reaching Earth.

The most famous Mars meteorite is ALH84001 (see figure 4) so named as it was found at Allan Hills, Antarctica in 1984. 12 years later NASA scientists announced that it showed evidence of microfossils indicating that primitive life had existed on Mars. Though the meteorite has been subject to intense study ever since, that result is still highly controversial.

Seeing Mars

Mars will be a very prominent object in the night sky in July, August and September. Not only will it be the brightest object in the night sky apart from the moon, but its reddish colour will make it easy to find. Though in July it will be rising in the east a few hours after sunset, each night it will be rising earlier so that by late August it will be rising around sunset. See figures 5 & 6 for the position of Mars in the sky in late August and early September.

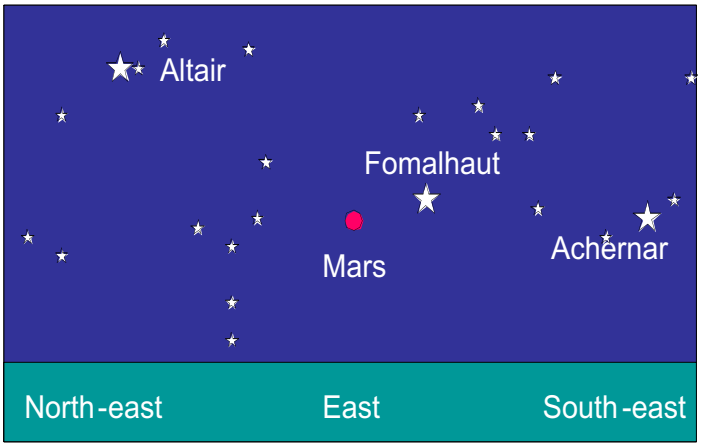

Figure 5 – Mars at its closest approach at 8:00 pm on 27 August 2003

To see Mars through a telescope during its close approach contact your local public observatory, amateur astronomical society or planetarium. Most of them are likely to hold viewing sessions. For example, Sydney Observatory will hold special Mars open nights from 20 August to 3 September.

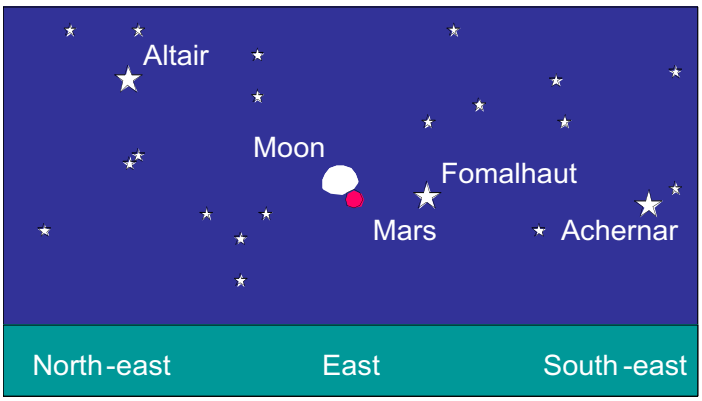

Figure 6 - Mars with the gibbous moon at 7:00 pm on 9 September 2003

More information

Mars meteorites: http://www.jpl.nasa.gov/snc/
Mars: http://seds.lpl.arizona.edu/nineplanets/nineplanets/mars.html
Mars spacecraft chronology: http://nssdc.gsfc.nasa.gov/planetary/chronology_mars.html

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