JANUS
THE NEWSLETTER OF EWELL ASTRONOMICAL SOCIETY

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Editorial:

Welcome to the June edition of Janus. Despite recent relaxations to the lock-down, Covid-19 remains a significant threat. As a result, all EAS meetings and observing sessions have been cancelled until further notice. As an outdoor event, I guess it might be possible to hold the annual picnic in some form, but numbers would have to be limited. Time will tell, but there will certainly be no meetings before September.

On a positive note, the weather has remained excellent for observing throughout May. Saturn, Jupiter and (as usual) the Moon all attracted attention during the month. In addition, the high incidence of clear nights over an extended period allowed keen observers to follow the phases of Venus. Mercury and the ISS were also observed, as members took maximum advantage of the conditions.

Starlink satellites were not seen during May. The launch of the next batch of 60 satellites, planned for 22 May, was postponed to June to allow Space-X to focus on the much higher profile launch of their reusable Dragon capsule on 30 May. The launch of the capsule, carrying two NASA astronauts, marked the first time NASA astronauts had launched from US soil since the Space Shuttle was retired in 2011. It was also the first time a private company had flown astronauts to orbit. The capsule successfully docked with the ISS the following morning, completing the first leg of a historic journey.

The spacecraft, which had never flown humans before, performed very well, but the astronauts still need to return home safely at the end of their tour.

John

The Solar System June

MERCURY: begins the month as an evening object, having recently passed greatest elongation E. It is, however, not observable – it will reach its highest point in the sky during daytime and is no higher than 8° above the horizon at dusk. By the end of the month, it will soon pass in front of the Sun at inferior solar conjunction. It is not readily observable, being very close to the Sun, at a separation of only 4° from it.

VENUS: will soon pass in front of the Sun at inferior solar conjunction. It begins the month not readily observable, being very close to the Sun, at a separation of only 4° from it. By the end of the month, it is emerging into the morning sky as it approaches greatest elongation W, and is visible in the dawn sky, rising at 03:08 (BST) – 1 hour and 40 minutes before the Sun – and reaching an altitude of 9° above the E horizon before fading from view as dawn breaks around 04:18.

MARS: is visible as a morning object throughout the month. It begins the month visible in the dawn sky, rising at 02:02 (BST) – 2 hours and 48 minutes before the Sun – and reaching an altitude of 15° above the SE horizon before fading from view as dawn breaks around 04:03. By the end of the month, it is visible in the dawn sky, rising at 00:44 (BST) and reaching an altitude of 27° above the SE horizon before fading from view as dawn breaks around 04:08.

JUPITER: begins the month as a morning object, becoming accessible around 01:20 (BST), when it rises to an altitude of 7° above the SE horizon. It will then reach its highest point in the sky at 04:15, 17° above the S horizon. It will be lost to dawn twilight around 04:21. By month's end it is approaching opposition, but remains visible in the morning sky, becoming accessible around 23:15, when it rises to an altitude of 7° above the SE horizon. Reaching its highest point in the sky

at 02:10, 17° above the S horizon, it will be lost to dawn twilight around 04:18.

SATURN: is visible throughout the month as a morning object. At the beginning of the month, it is visible in the dawn sky, rising at 00:20 (BST) and reaching an altitude of 18° above the S horizon before fading from view as dawn breaks around 03:58. By the end of the month, approaching opposition, it becomes accessible around 23:53, when it rises to an altitude of 10° above the SE horizon. It will then reach its highest point in the sky at 02:35, 18° above the S horizon, before being lost lost to dawn twilight around 03:56.

URANUS: recently passed behind the Sun at solar conjunction. Throughout the month, it is not observable – it will reach its highest point in the sky during daytime and is 7° below the horizon at dawn.

NEPTUNE: is currently emerging from behind the Sun and, throughout the month, it is not observable – it will reach its highest point in the sky during daytime and is no higher than 19° above the horizon at dawn.

MOON PHASES:

First Quarter	30 May
Full Moon	5 June
Last Quarter	13 June
New Moon	21 June
First Quarter	28 June

Note: There is a Penumbral Lunar Eclipse 5-6 June which may be partially visible.

Astronomy under COVID 19 – Collected Observations – Gary Walker

Well, the Astronomy Gods are clearly on our side, as we have had an unprecedented number of clear days and nights since Lock-down began on 23 March, with runs lasting for at least a month. I have seen in the Daily Mirror newspaper, at least two suggestions for doing stargazing, and there was even one item on the BBC News too, (inevitably, as the last item on the news, of course!)

Due to the many restrictions imposed to combat the Covid-19 virus, I have been unable to access the library, but I have now obtained a smartphone. After a few minor issues with the technology, this has allowed me to continue submitting details of my observations – carried on as usual - although I do find it very hard to type on!

During April and May I have been observing a variety of objects including around 60 galaxies in the Virgo Galaxy Cluster - and elsewhere - 2 comets, more satellite constellations and, like many others, Venus.

In late April, I observed that Betelgeuse was as bright as Aldeberan - back In February it was faint enough that, with the naked eye, the orange colour was hardly visible.

At the same time, the Sun remained “dead” in white light, but a bit more active in Ha light.

Space-X Constellations

On 26 April at around 10.40 pm, I observed another collection of satellites from the Starlink constellation passing just above Leo and fading away into the Earth shadow. The satellites were of the same magnitude as the star Delta Leonis, or Zozma, which is magnitude 2.6. So, these were a bit fainter than the ones I observed at the end of March, which were approximately Magnitude 1.6.

A tale of two Comets

I have been hunting for two comets Comet C/2019 Atlas and Comet C/2017 Panstarrs - in the case of the latter, since the start of last September! For some reason, until recently, I had always failed to see them, so they must have been too faint.

However, on the nights of 19 and 20 April, I saw both comets, within a few minutes of each other, by using the “Goto” with my 8” SCT. Both comets appeared as similar, fairly fuzzy, balls. Comet Panstarrs was slightly more condensed, whilst Comet C/2019 Atlas, was a bit larger and more diffuse. Both comets were fairly close to each other in the NW sky. With the addition of these two comets, I have now seen a total of 37.

I continued observing these 2 comets throughout April. Panstarrs, appeared as a dim, fuzzy ball, with a sharp centre (probably, the "false nucleus"), and is probably around Magnitude 8-9. Comet Atlas is more diffuse and harder to see. This is not helped by the fact that there are 2 Comets named Atlas -

the one that I have been observing is in the constellation of Camelopardis - BUT there is another Comet Atlas, only a short distance away, in Cassopia. When entering coordinates into my GPS, I found that I had inadvertently entered those for the one in Cassopia - that one is only magnitude 14, so it's much harder to see!

In actual fact, there are at least FOUR comets with the same name (Atlas) in the sky, at present. This is because a number of comets have been discovered by a robotic series of asteroid-hunting telescopes and, of course, all will get the same name. This is also true of Panstarrs, which is another such robotic system. As a result, there are also a number of Comets around all called Panstarrs. That, of course, makes it really confusing and irritating!

On 9 May I was still following Comet Panstarrs, which continued to be like a dim, fuzzy ball, brighter in the centre. However, I lost Comet Atlas although, oddly enough, it was close to Comet Panstarrs, high in the NW sky.

There are several other comets that are waiting to enter the wings, such as Comet Swan, and a couple of others, but they do not seem to be living up to expectations.

Actually, it is not unusual to have several comets crawling around the sky at the same time, but it is very rare to have a really brilliant naked eye Comet with a long tail, sufficient to terrify the Ancients! To get a truly "Great Comet" a number of factors have to come together. One is that the Comet should be well placed in the sky (Halley's Comet in 1986, was not). Also, the nucleus should be active (as it was in the case of Hale-Bopp, in 1997) and preferably producing a lot of dust, rather than just gas. The comet should ideally be visible in a dark sky.

The brightness of comets is notoriously difficult to predict and many just run out of steam (remember Comet Kohoutek of 1973-4), whilst others may do the opposite. As David Levy pointed out, "Comets are like cats: they do what they like, and they both have tails!". They are certainly not like planets, whose magnitudes, angular sizes, phrases, and positions are known accurately for many years ahead. Indeed, most of the 37 comets that I have seen just appear as dim fuzzballs in my telescope, without tails, and only about 3 of them appeared like the stereotypical Comet known to everybody.

I also revisited old friends like Messier 13, the best globular cluster in our skies. With my 8" SCT, it shows up much like it does in images.

I continued to follow Comet Panstarrs throughout May (as I expect you all did!). On 27 May, it still appeared as a very dim fuzzball via my 'scope. It is moving about half a degree every 24 hours. I tried again the previous evening to find Comet Swan, but it was very low in the NW, and I failed to see it.

Venus

I observed Venus at various times throughout April and May. Between 2 and 6 April, it passed by the Pleides star cluster and had a close conjunction, just brushing the bottom part of the cluster, on 3 April. This sort of event is best seen in binoculars, as the Pleiades is one of the very few astronomical objects that is far better seen that way - indeed a telescope is useless in this situation! Even at the lowest magnification, the Pleiades cannot fit into a normal telescope field of view - but with any binoculars, they fit beautifully and easily within the field of view.

By 20 April it was morphing into a fat crescent, and I was looking at it in the deep blue daytime sky. A week later it was a beautiful crescent in any telescope and set to continue to become thinner and larger in angular size, over the next month. Once again it was close to a new moon - a conjunction. Strangely enough, I have seen every such conjunction this year, from January to April!

On 9 May, I looked at Venus again. It was now a beautiful large, thin crescent, easily visible at any magnification. Even in my 11 x 80 binoculars I could see it as a tiny crescent. I was observing it around 4pm, the best time to see it, and I could see changes in the shape of the phase, even over only a few days. At this point, the phase was about 20%.

Venus presents the largest angular size of all the planets. Incidentally, the changes in the phases of Venus were noted by none other than the great Galileo, and these changes

were one of the proofs of Copernicus' theory that the Earth and other planets went around the Sun, rather than everything revolving around the Earth as others believed.

I observed Venus again on 14 May, and it was now a very beautiful, very thin, very large crescent, easily visible even at 62x. It was visible in binoculars as a very tiny crescent too, with the appearance of a 1 or 2-day-old New Moon. On 18 May, in the twilight sky, through my 'scope, it was like a large letter "C" in appearance, because the crescent was now so large and thin.

I saw Mercury via my 'scope on 20 May, close to Venus, thus making it easier to find! As usual, Mercury only presented a tiny angular size – i.e. 6' arcseconds in size, so even at high magnification, it only appeared tiny. However, I could just make out the gibbous phase.

Even at its closest, Mercury is never more than 12' arcseconds in size. This is usually only seen in its Transits across the Sun, even then it appears tiny. Its present size is not much larger than Mars, when it is furthest away from Earth.

Venus, on the other hand, is now up to 52' arcseconds - actually, Venus will attain the largest angular size of all the planets at nearly 60' arcseconds, which is even larger than Jupiter ever gets. This is because, of all the planets, Venus comes the closest to Earth at "only" 25 million miles away! Mercury's closest approach, on the other hand, is at least twice this distance, and it is also much smaller than Venus. Venus is now at its most beautiful, as a large and thin crescent, only 6% in phase.

In the twilight of 24 May, I saw the beautiful sight of a very New Moon only about 5% phase, with Venus well off to the NW. It was exactly the same phase and of the same illumination as Venus (Venus was c. 3%). I estimate that the naked eye New Moon was about the same size as Venus at 62x via my 'scope. Earlier on, in the afternoon I saw Venus again via my scope, as a wire - thin crescent.

Jupiter – 27 May

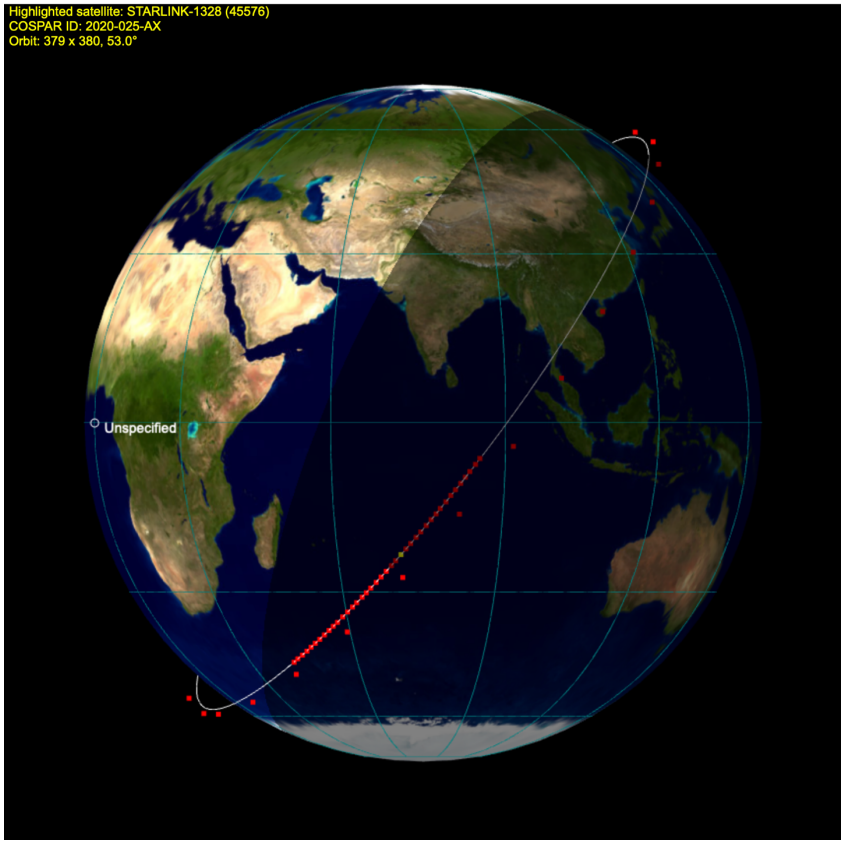
I saw the planet Jupiter again in the early hours and noted that the Northern Equatorial Belt was fairly wide, but the Southern Equatorial Belt was narrower.

The phases of Venus- Peter Scott

The picture below is a composite of 4 separate images taken on 4 nights between 19 April and 14 May using a Skymax 127 + Imaging Source CCD + 2x Barlow. Each separate phase image was the result of stacking 30 seconds of video using Registax and then combining the resulting images using GIMP software.

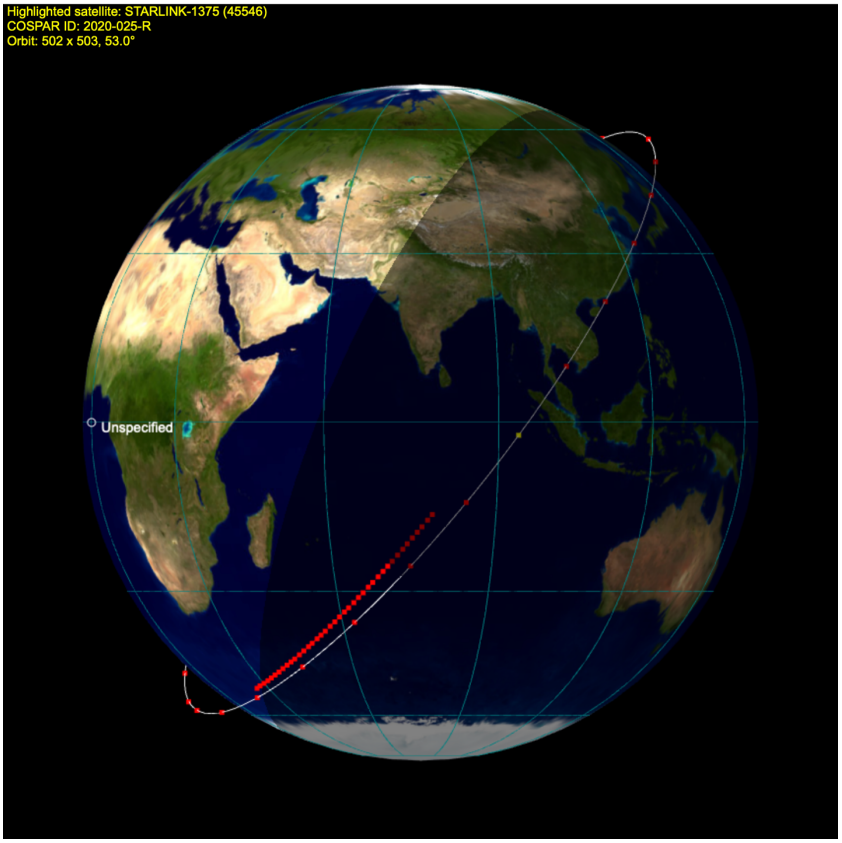
More on the the Starlink Constellation – John Davey

Last month, I wrote about some of the problems which SpaceX's Starlink satellites have caused for astronomers, particularly shortly after they are launched. The two images below (courtesy of Heavens Above) help to explain why this is the case. They show the position, on 3 June, of the 60 satellites launched on 22 April into 2 separate orbital planes, with 30 satellites in each plane.

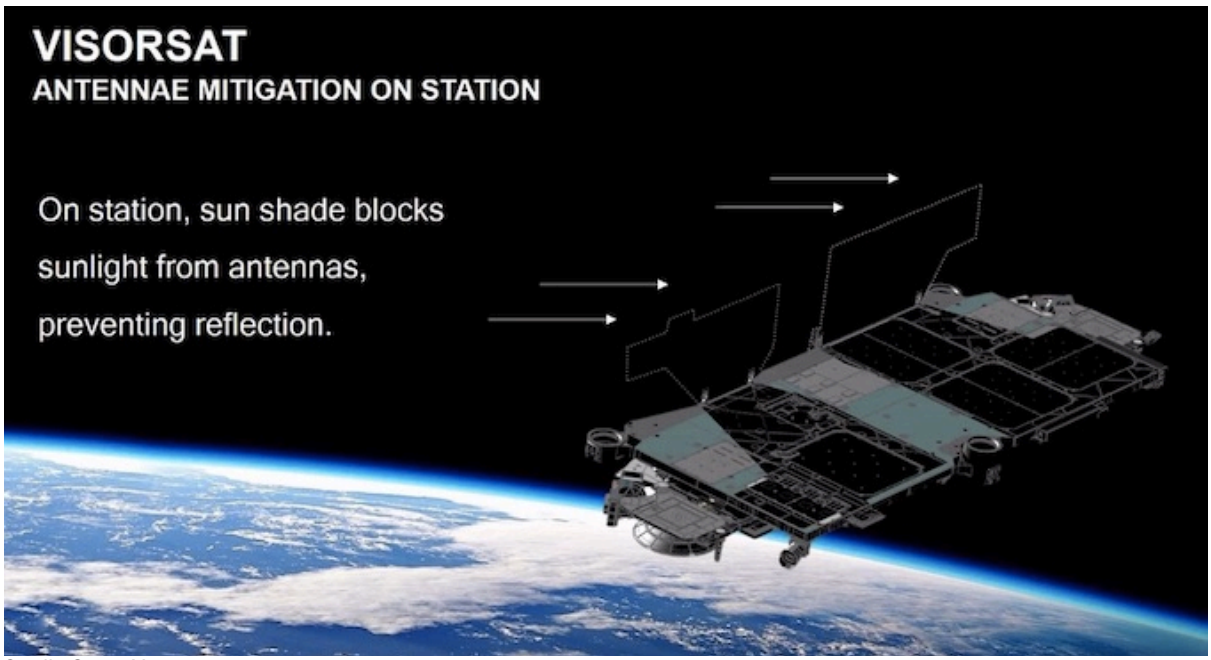


The satellites in the orbital plane in this image are still being deployed from their initial orbit at an altitude of around 380km. Notice, in particular, that there are a large number which are still closely spaced. These closely spaced satellites are responsible for the "chains" which have been observed by many astronomers.

In contrast, the satellites in this image - which are in a different orbital plane - have reached their operational orbit of around 500km and are much more widely spaced. Due to their greater altitude, they will also appear less bright.



As I mentioned previously, following criticism of the disruption to astronomers caused by their Starlink satellites, SpaceX decided to test the effects on satellite brightness of a darker coating applied to one of their recently launched satellites. Preliminary data indicated a "notable reduction" in the brightness of that satellite (dubbed "DarkSat") – a factor of two and a half fainter, equating to about 1 magnitude in astronomical units. However, because of the adverse effects on thermal control of the satellite, the company is now moving forward with a solution which involves fitting an RF transparent foam sunshade (or visor) over the satellite's antennas to prevent them reflecting sunlight, whilst allowing them to function normally. SpaceX believe the foam will actually be darker than the coating they tried previously, but it will not cause the same overheating problems. Satellites carrying the foam visor have been christened "VisorSat", and the technology will be evaluated on the next batch of satellites due to be launched on 3 June. The concept is depicted in the image below.



Credit: SpaceX

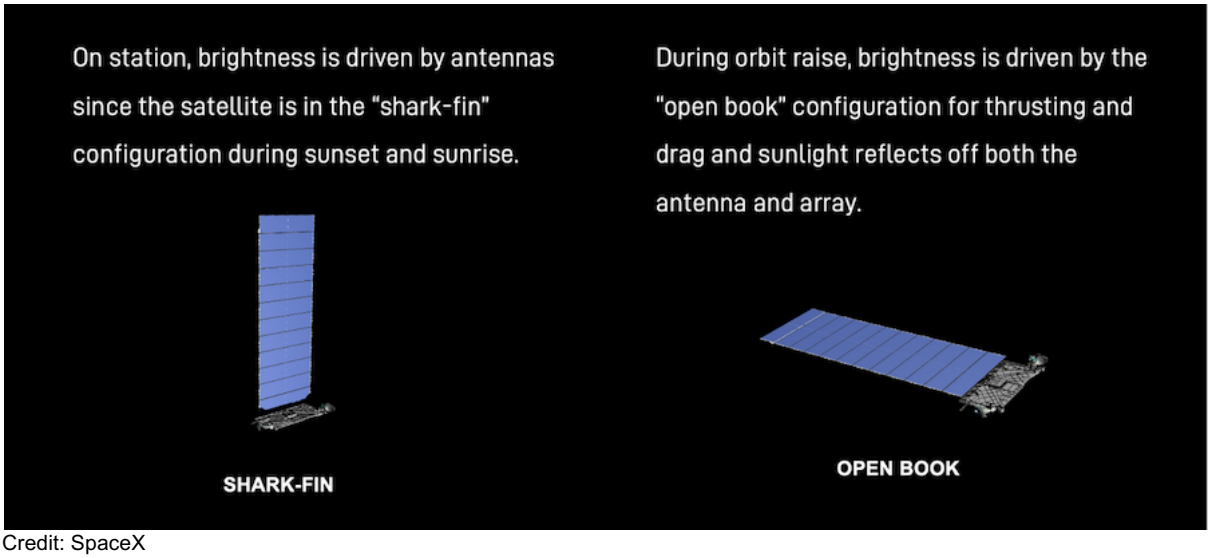
So, when are the satellites brightest, and why?

The Starlink satellites are brightest soon after a launch, when they are flying at an altitude of around 300km. Once deployed from the Falcon 9 rocket, the spacecraft unfurl their solar array wings to generate electricity, then activate their ion thrusters to begin climbing into their higher operational orbit around 550km. During this orbit-raising phase, lasting many weeks, SpaceX commands the satellites to fly in a special attitude, or orientation so as minimise drag on the satellites. This minimises both propellant use and the time taken to reach the satellites' operational altitude.

According to SpaceX, this low-drag and thrusting flight configuration resembles an "open book", where the solar array is laid out flat in front of the vehicle. The satellites roll to a limited extent about the velocity vector for power generation, always keeping the cross-sectional area minimized while keeping the antennas facing Earth enough to stay in contact with the ground stations. When the satellites are in the "open book" configuration at lower altitudes, sunlight reflects off the craft's solar arrays, making them more visible from the ground.

Once the satellites reach their operational orbit, SpaceX flies the spacecraft in a different configuration called the "shark-fin" attitude. In this orientation, the solar panel points away from the Earth.

The two configurations are depicted in the image below.



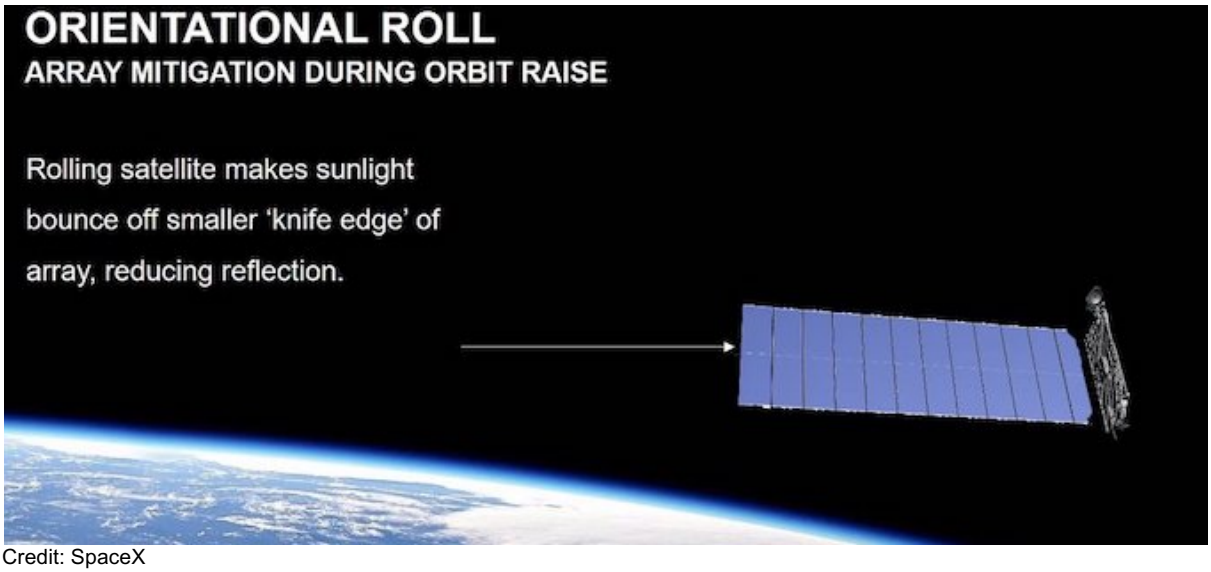
Credit: SpaceX

The new sun visor is designed to reduce brightness once the Starlink satellites are on station at their operational altitude and will have minimal effect during earlier phases. SpaceX therefore plans to introduce a different technique to address brightness concerns during the early weeks of each satellite's life, when the spacecraft are flying closer to Earth.

The technique can be implemented on satellites which have already been launched, and involves the satellites being commanded to fly at a different attitude, making them less bright when viewed from Earth. Satellites will be rolled so the vector of the Sun is in-plane with the satellite body, i.e. so the satellite is orientated like a knife-edge to the sun. This should reduce the light reflected towards Earth by reducing the surface area illuminated by the Sun. The new roll manoeuvre can be implemented both when the satellites are climbing to higher altitude, and when they pause in an intermediate orbit to align with their operational planes within the Starlink network.

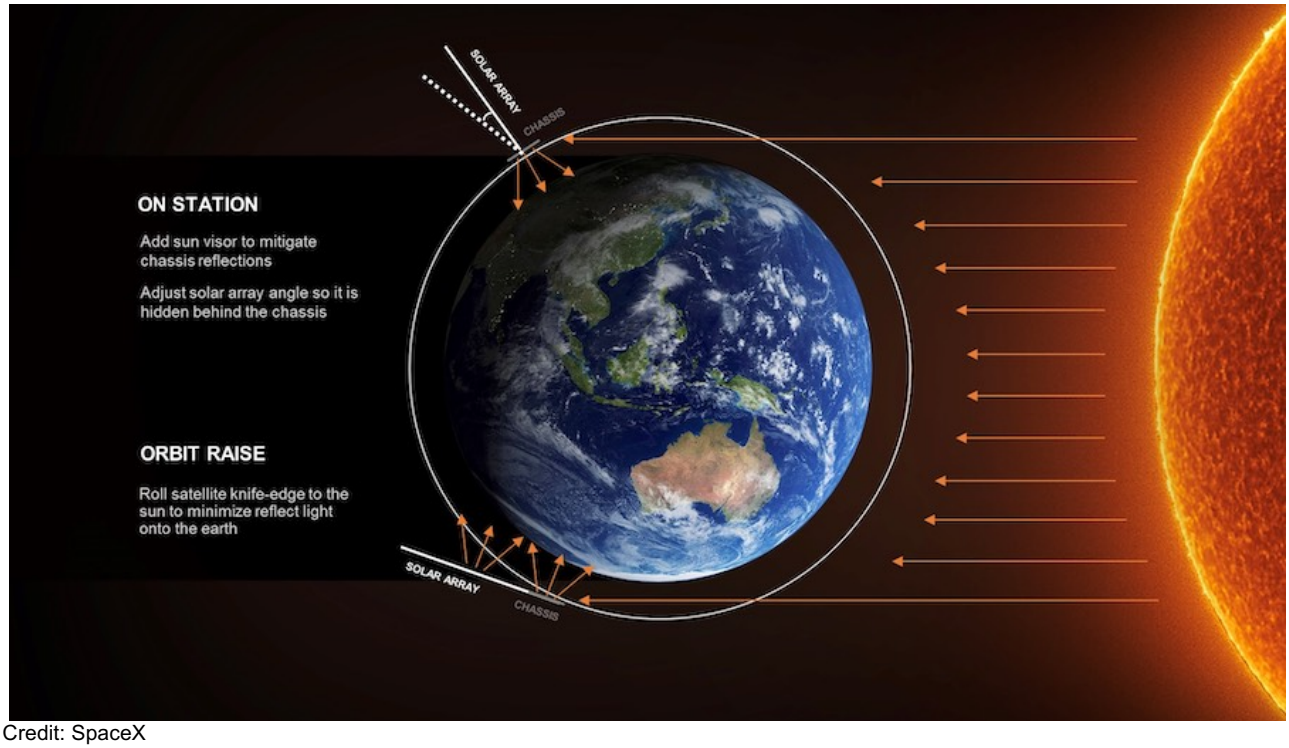
An operational downside of the new "orientation roll" manoeuvre is that it will lead to a reduction in the amount of power generated by each satellite's solar panel as well as reducing contact time between the spacecraft and ground controllers. The change also points the satellite's star tracker cameras at the Earth and the Sun, thereby reducing its attitude knowledge, potentially causing some instability. As a result, there will be occasions when the satellites cannot roll all the way to true knife edge to the Sun resulting in the occasional set of Starlink satellites in the orbit raising phase of flight being temporarily visible for one part of an orbit.

The concept of the "orientation roll" is illustrated here:



Credit: SpaceX

This diagram illustrates when the Starlink satellites are most visible, shortly after sunset and shortly before sunrise, and shows how the changes are implemented.



Credit: SpaceX

The overall objective of the changes, described by SpaceX as “quite simple”, is to make the satellites invisible to the naked eye within a week of launch, and to minimise their impact on astronomy.

Satellites that were launched without the sun visor may be retired and will re-enter the atmosphere and burn up within three or four years. They will be replaced with improved satellites.

Time will tell as to whether these latest changes will solve the problems astronomers have experienced to date and, if they do, whether they have an adverse effect on the spacecraft themselves.

Other LEO Satellite Constellations – John Davey

Much has been written about Starlink, but it isn’t by any means the only large constellation of satellites in LEO that has been mooted. Details are scant on many of them, but I came across the following table recently. It gives outline details for a number of proposed constellations of more than 50 satellites. Some I have heard of, others I haven’t. I will be trying to find out a bit more about them, but my first inclination is to dismiss the 6 nanosatellite ones (Flock, Sky & Space Global Pearl, Fleet IOT, Danu, Aerial & Maritime and Astrocast) as being too small to worry about. At the other end of the scale, Kuiper, Oneweb and EarthNow will rival Starlink in size if not numbers – although Oneweb is unlikely to be a problem, having apparently gone bankrupt.

Constellation Name	No. of spacecraft	Mass	Nationality
Starlink (SpaceX)	4483	100 - 500 kg - Minisatellite	United States
Kuiper (Amazon)	3236	500 - 1000kg – Small satellite	United States
Oneweb	600	100 - 500 kg - Minisatellite	United Kingdom
EarthNow	500	100 - 500 kg - Minisatellite	United States
Flock	330	1 - 10 kg - Nanosatellite	United States
Aleph-1 (Nusat)	300	10 - 100 kg - Microsatellite	Argentina
Hongyan	300	10 - 100 kg - Microsatellite	China
Telesat Ka	292	10 - 100 kg - Microsatellite	Canada

Sky & Space Global Pearl	206	1 - 10 kg - Nanosatellite	Australia
Kepler Constellation	142	10 - 100 kg - Microsatellite	Canada
Fleet IOT	102	1 - 10 kg - Nanosatellite	Australia
Danu	101	1 - 10 kg - Nanosatellite	Spain
Kepler GEN-2	90	10 - 100 kg - Microsatellite	Canada
Aerial & Maritime	80	1 - 10 kg - Nanosatellite	Mauritius
Astrocast	66	1 - 10 kg - Nanosatellite	Switzerland
BlackSky Global	60	10 - 100 kg - Microsatellite	United States

(Data source: *Seradata Space Trak 3)* @2020.4.26)

I hope to be able to provide more details on the potentially more worrying ones in a later article.

Up Next:

NEXT MEETING:

Date to be advised – check EAS web site.

NEXT USER GROUP:

Date to be advised – check EAS web site.

This is an informal session for members to meet and discuss anything related to their telescopes and sky events and, if weather permits, to go up on the roof for observing. Enter via the Main Entrance opposite the Car Park

NEXT DENBIES OBSERVING SESSION:

Date to be advised – please check EAS web site.

AD HOC OBSERVING AT WARREN FARM:

These will be at short notice when the weather is favourable. Please watch our Whats App feed for alerts.