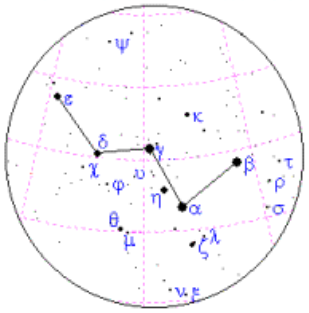


Wadhurst Astronomical Society Newsletter October 2017

MEETINGS

COMMITTEE MEETING

Members of the Committee are respectfully reminded that there is a meeting of the Committee at Jim's house on Tuesday 17th of October starting at 1930.

SEPTEMBER MEETING

Our September meeting was introduced by Phil Berry who pointed out that new security gates were being fitted at the entrance to the college but added that once the gates were in use, any car still in the grounds of the college when the gates are closed will still be able to leave owing to a detector coil beneath the road on the approach to the exit which will operate the gates.

After outlining the evening's programme Phil introduced our speaker, Barry Soden. Barry was a chartered engineer and a Support Scientist assisting in the design of instruments used on NASA satellites.

NASA disasters and their causes
Barry Soden

Barry started his talk by saying that NASA's achievements have been quite remarkable over the years but as in all organisations there are disasters from which an enormous amount is learnt.

Before NASA was formed. The United States Naval Research Laboratory ran a programme called Project Vanguard, intended to put an artificial satellite into orbit. The launch was delayed and in the meantime the Russians put Sputnik 1 into orbit 4 October 1957.

Unfortunately, the launch of Vanguard 3 shortly afterwards failed and following a build-up by the press, they then derided the launch.

In February, 1958 Explorer 1 was successfully launched by the US army, carrying a satellite with an instrument for measuring cosmic radiation which discovered the important Van Allen Belts.

Shortly afterwards, NASA was formed out of the Vanguard team and went on to perform some outstanding achievements with landing men on the Moon and returning them safely to Earth and much more.

There were several successful manned launches into space, but in 1967 a terrible fire occurred in the cabin of Apollo 1 during prelaunch checks when the crew, Ed White, Gus Grissom and Roger Chaffee died when an electrical fault caused a fire in the pure oxygen atmosphere enabling it to spread very rapidly. It was later found that the inside of the cabin filled with a high-levels of carbon Monoxide in a very short time, this mercifully rendered them unconscious before being burnt.

The crew of Apollo 1: Ed White- Command pilot, Gus Grissom – Commander and Roger Chaffee – Pilot – NASA image

Resultant fire damage of the cabin fire in Apollo 1 – NASA image

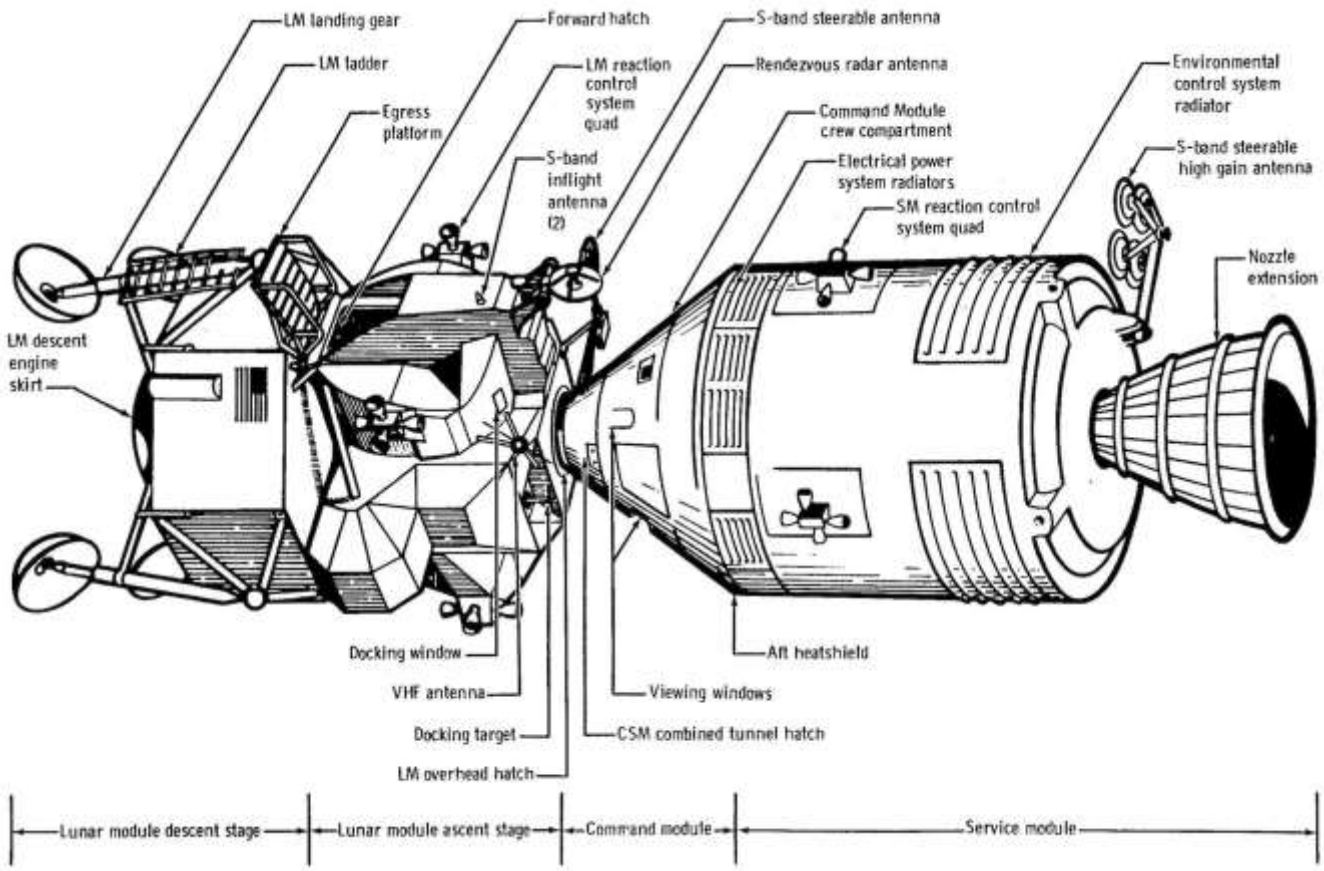
Following thorough investigations, a number of improvements were carried out on future missions. The atmosphere in the cabins was modified partly to reduce the spread of a fire, the wiring was insulated in a way that could not be easily damaged, a reduction of combustible materials and better methods for the crew to escape. Following these improvements, the safety of the crew was greatly increased.

Barry now looked at events that took place aboard Apollo 13, the incredible way NASA brought the crew back to Earth and what was learnt.

NASA had already achieved a number of hugely successful manned missions to the Moon when Apollo 13 was launched in 1970, which included a Lunar Lander to take the men about the surface.

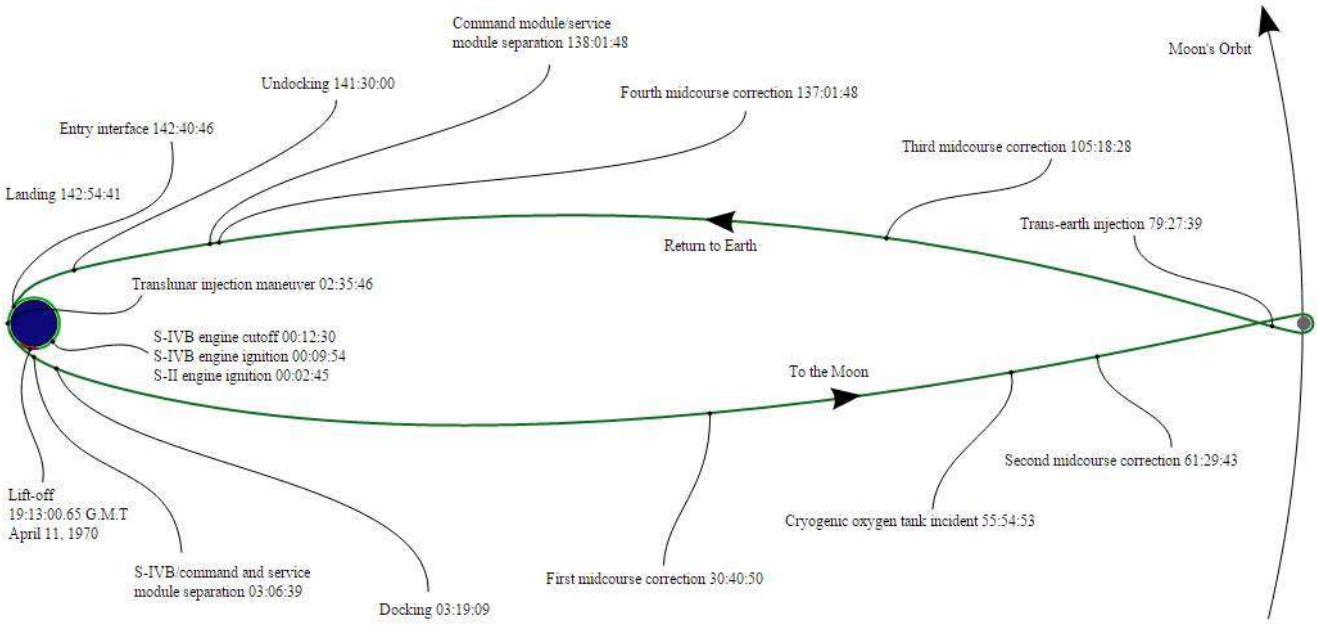
Fifty-six hours into the flight, a standard practice of stirring of the oxygen tanks to even the mass distribution took place. Shortly afterwards, oxygen tank number two exploded prompting the famous call from Swigert; “Houston, we have a problem”. Not only was oxygen needed for breathing but was also used to react with hydrogen to provide drinking water and generate electrical power. So, this loss was very serious.

Crew of Apollo 13: Jim Lovell – Commander, Jack Swigert – Command Module pilot, Fred Haise – Lunar Module pilot



Arrangement of the various modules inside the spacecraft en-route to the Moon

So thorough were NASA's preparations that they already had set-procedures for events that might occur.
Ground Controllers immediately told the crew to power up the Lunar Module and use it as a Lifesaving raft, and it was also decided that the mission had to continue round the Moon and then return to Earth.



Engineers on the ground instructed the crew how to make a device that would "scrub" the carbon-dioxide in the command module to enable them to breath. The astronauts also had to conserve water, with heavy restrictions on its use.

On returning towards Earth, having passed round the Moon and giving the crew a tantalising view of its surface, the crew returned to the Command Module for landing and they then released the Lunar Module. They continued to return safely to Earth, although they were severely dehydrated.

On investigation, it was found that the oxygen tank had suffered internal damage before it was installed on the spacecraft when, during routine purging it had been connected for a short time to a 64-volt supply instead of the 24-volt supply it was meant to be using, resulting in unknown damage to the wiring within the tank. During the mission, there was an electrical short inside the tank and the resulting high temperature caused it to explode.

Finally, Barry described the events that lead to the loss of Shuttle Challenger in 1986.

Either side of the main liquid oxygen tank were two 150-foot-long solid fuel boosters which would burn for 127 seconds. They were assembled and filled on site. At the junction were two "O" rings that went right around the tanks, each about the thickness of a pencil and were there to retain hot gasses during the burn.

Barry said that Marshall Space Centre had written about concerns that if an "O" ring failed, the second ring would not be able to cope fully. For some reason, this memo never reached the manufacturers of the solid fuel boosters. Even so, modifications were carried out, to prevent the possible rotation of the "O" rings during the burn.

Crew of Shuttle Challenger. Front row (Left to right): Mike Smith – pilot, Dick Scobee – Commander, Ron McNair – Mission Specialist.
Back row (Left to right): Ellison Onizuka – Mission Specialist, Christa McAuliffe – Payload Specialist, Greg Jarvis – Payload Specialist, Judith Resnik – Mission Specialist

On the morning of the launch the site was covered with ice in the low temperatures; not good for the “O” rings, but permission to “Go” was given.

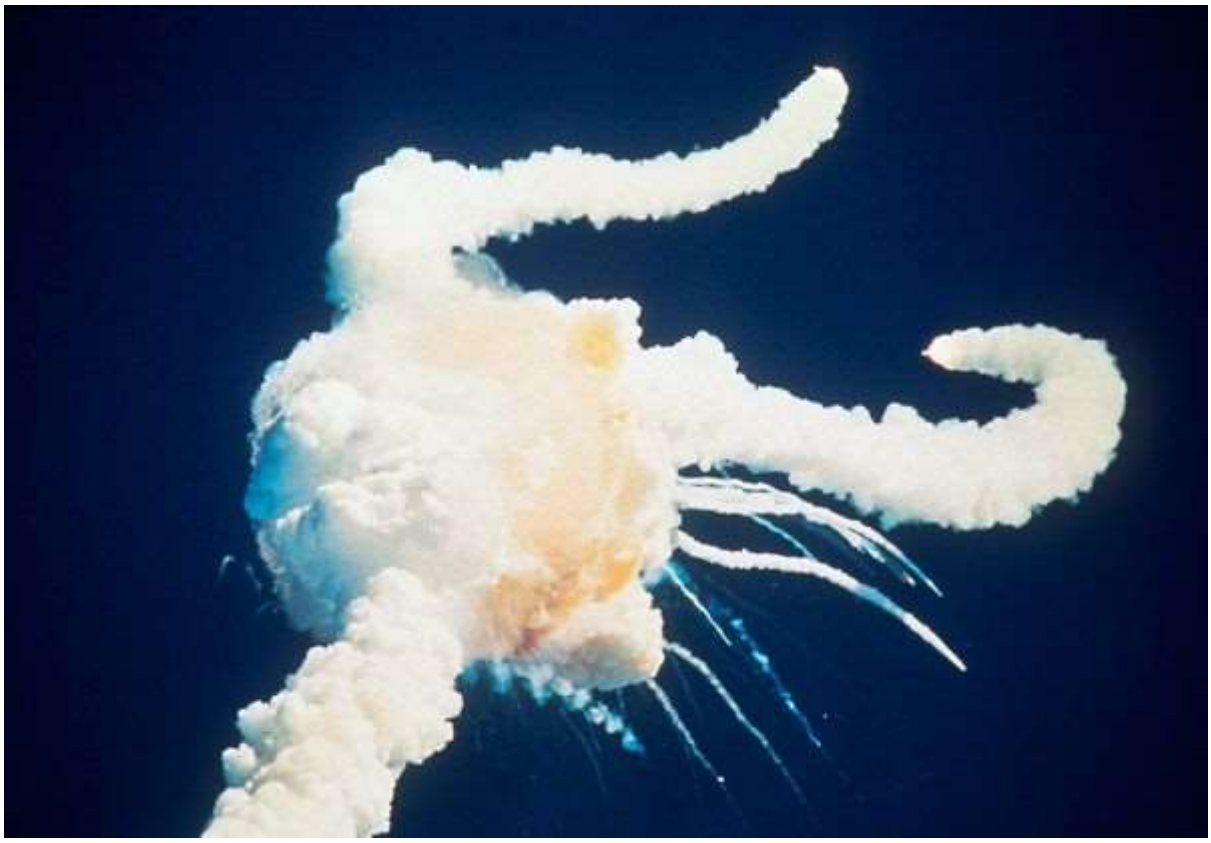
Later it was discovered that a picture of the craft whilst still on the launch pad showed a dark cloud of smoke on the right hand solid fuel booster.

Ice on the morning of the launch

Subsequently, a puff of dark smoke was found in a photograph taken at the launch

Just after launch the “O” rings began to fail causing a loss of thrust on that booster. The nozzles of the main engine tried to compensate. It was still thought that everything was good to go, but the spacecraft was being forced off its trajectory and began to fly sideways, then break up through aerodynamic forces.

The booster struck the main tank causing the liquid hydrogen and liquid oxygen tanks to rupture. The fuels mixed creating a fire ball.



Igniting of the escaping liquid hydrogen and liquid oxygen fuels resulted in a fire ball. The two solid fuel boosters careered off, uncontrolled

Much of the wreckage fell into the sea near Cape Canaveral and was recovered, from which considerable information was been gained.

One final comment Barry made was that following the grounding of the Shuttle Programme, a considerable amount of ammonium chlorate, used as rocket fuel, had been manufactured and had to be kept on site at a company in Nevada. This later caught fire, and the resulting explosion caused the destruction of the facility but also destroyed a local marshmallow factory.

Snippets from the World of Science
John Wayte

Time lapse images of the 2015 partial eclipse in the UK

Following the recent solar eclipse seen in America, John showed the effect seen in his garden when we had a 30% solar eclipse on the 20th of March 2015. He set his camera on fixed aperture and photographed the result. Although at the time, no one really saw any great effect, his camera revealed quite a darkening in his garden when taking an image every minute. This change is only really appreciated with time lapse.

The total solar eclipse of August 2017

John now turned to the recent total solar eclipse across the central states of the USA on August the 23rd 2017. One image showed a view from NASA's Earth Polychromatic Camera, 4 million miles away and another showed an image taken from the International Space Station.

Whole Earth view of the eclipse - NASA

Image of the eclipse taken from the ISS - NASA

End of the Cassini mission

John showed a video clip of the last moments of Cassini, following its very successful mission to the planet Saturn. A number of videos of the end of Cassini's mission can be found by visiting JPL/NASA web site and searching for Cassini Grand Finale.

Enceladus

Finally, John talked about one of the strangest things discovered during the Cassini mission.

Enceladus is a tiny white moon inside the E ring of Saturn's rings system. The moon is less than 500 km in diameter and when Cassini came close, the Magnetometer Team noticed something unusual about its magnetic field which appeared to be deflected off to the side. On closer observations, it was found that parts of the moon were hot and there were unexpected jets rising from the surface close to the South Pole. This was found to be water, and this began to suggest that conditions for life might actually exist beneath the moon's surface.

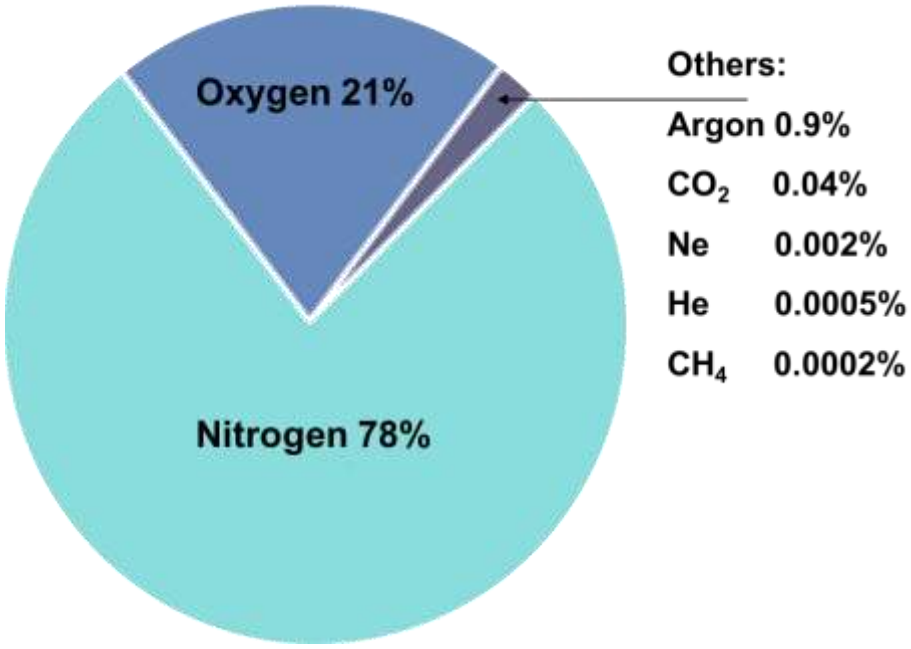
It is thought that this might become one of the most intriguing places to send a future mission.

We were shown a video about this discovery and a number of clips can be found by visiting the JPL NASA site and searching for Enceladus.

Continuing the GCSE astronomy course material
Brian Mills FRAS

This evening, Brian continued his GCSE Astronomy course material by first of all reviewing his last talk on the subject and to be found in the July newsletter.

Then he continued with the planet Earth's atmosphere.



The main gases found in the Earth's atmosphere

He explained that most of the gases in the atmosphere came from the cooling Earth. Also as the planet cooled, water condensed to create the seas, although Brian said that there is some debate about how much also came from comets.

Once photosynthesis began when green plants began to appear, the proportions of CO^2 went down and the proportion of oxygen began to increase.

The atmosphere absorbs x-rays, gamma rays and most ultraviolet. It also regulates the temperature resulting in an overall average of about 15^o Centigrade. Most meteors burn up in the atmosphere, but the atmosphere also contains molecules of oxygen and

nitrogen that scatter sunlight. Because blue light has shorter wavelengths than red light it is not scattered as much which results in our seeing a blue sky.

Brian demonstrated the effect of the atmosphere on the visible sky very well using the free Stellarium software programme. In the programme, it is possible to 'switch off' the atmosphere, which reveals the starry sky in our daylight.

The atmosphere directly affects optical astronomy through turbulence and also the suspended particles tend to reduce the visibility of objects in space due to domestic light reflecting off it. This was exhibited with a photograph of the night sky taken in north America with ground-based light shining upwards. This was compared with the same sky during a major power outage when the Milky Way became visible.

Until recently, most domestic street lighting in the UK was predominantly sodium or mercury, which gained its efficiency by radiating in very narrow wavelength bands. Brian said that astronomy pollution filters would take out just these wavelengths leaving a visible night sky. But much more recently, economic LEDs are being used more and more for street lighting and they have a broad spectrum, so their light cannot be filtered out in the same way.

The next section of the course Brian briefly dealt with was Celestial Observation covering features such as the Moon, the planets, the stars, nebulae, clusters and galaxies and of course the Sun. He also mentioned transient features such as meteors, comets, supernovae and Aurora.

He said that there are 88 constellations but it was Ptolemy who first identified 48, brought together in his book, "The Almagest". The reason he only identified 48 was that he viewed the sky from Alexandria with a limited view of the constellations.

We were told that the boundary lines of the constellations had been drawn in a messy way but this was all changed by the International Astronomical Union in the 1920s when it was decided to redraw the boundaries so that they follow the lines of Right Ascension and Declination.

Brian said that many of the 88 constellations hardly represent the recognisable shape their name suggests. This is different with the asterisms such as the Plough, the "W" of Cassiopeia, the Square of Pegasus and the Summer Triangle.

OCTOBER MEETING

18th October - David Pulley asks the question "So, How Do We Know They Are Planets?"

Meetings will take place at Uplands College, Lower High Street, Wadhurst and are held in classrooms IL5 and IL6 which are in the blue walled classroom block at the far end of the drive from the main gate and up by the tennis courts. Signs will direct you. There is car parking near the block. The postcode is TN5 6AZ.

Meetings begin at 1930 prompt although members are invited to arrive anytime after 1900 as this is a good time to exchange ideas and discuss problems and also help set things up before the meeting starts.

Anyone is welcome but non-members are asked if they wouldn't mind contributing £3 towards costs.

FUTURE MEETINGS

15th November – Jan Drozd regales us with stories about "Astronomical Blunders in Science Fiction"

13th December – (This is the second Wednesday in the month) Brian Mills FRAS tells the story of "The Great Telescope at Birr Castle"

SKY NOTES FOR OCTOBER 2017

Planets

Mercury is a morning object at the start of the month although it is too close to the Sun to be observed. It reaches superior conjunction on October 8th and then moves east of the Sun to become an evening object. Even by the end of the month Mercury will be poorly placed as seen from the UK partly because it lies just below the ecliptic but more importantly because it lies 20° below the celestial equator. The planet reaches greatest eastern elongation on the 28th November, but even then it will be only 5½° in altitude at sunset and will set just under an hour after the Sun.

Venus, on the other hand, is a morning object that lies 8° north of the celestial equator at the start of the month. At sunrise it is more than 20° above the eastern horizon although this diminishes because the planet is moving slowly back towards the Sun in preparation for a solar conjunction in early January 2018. It is a brilliant magnitude -3.9 object that can be used to locate the much fainter Mars (mag. +1.8) on the morning of 5th October. On that day the two bodies will pass just 0.2° apart as shown in fig 1.

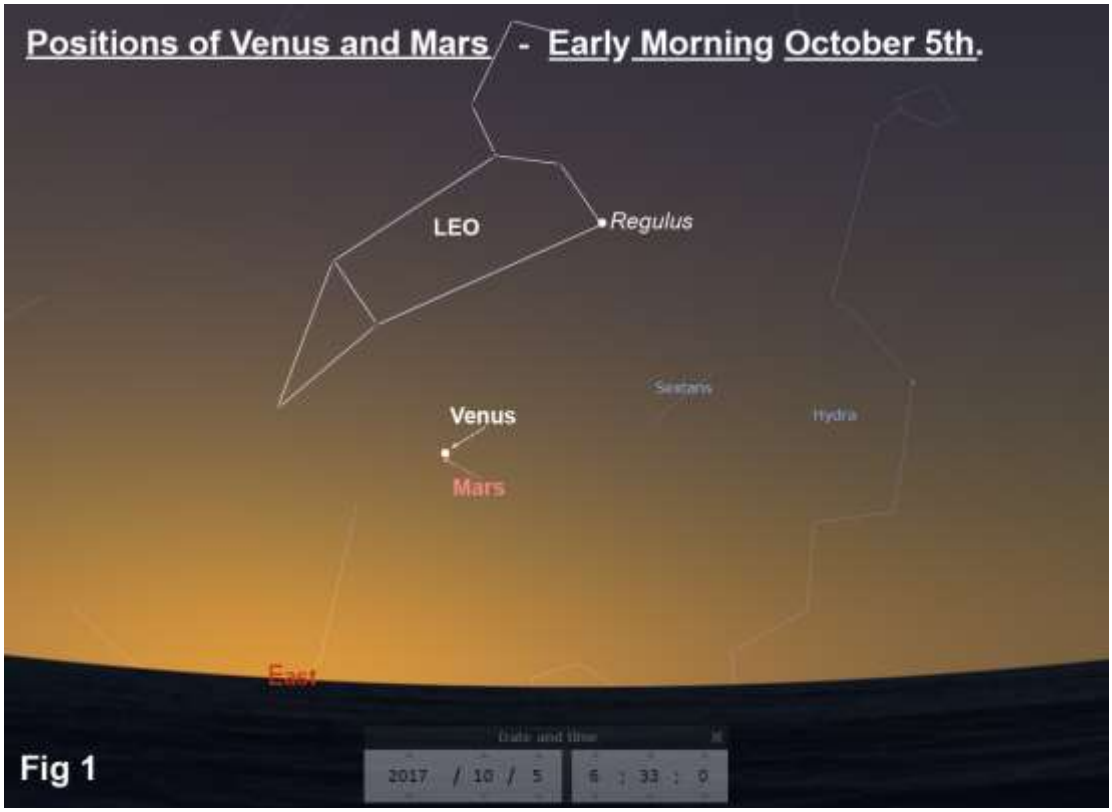


Fig 1

Mars is a morning object in the southern part of Leo for the first part of October, after which it moves across the border into neighbouring Virgo on the 12th. At the start of the month the red planet rises jut over two hours before the Sun and is at an altitude of 14° at the beginning of civil twilight (Sun at -6°). Mars continues to move westwards so that by the end of the month it rises three hours ahead of the Sun. Its magnitude remains stable at +1.8 and, as mentioned above, can be more easily located on the 5th with the aid of Venus.

Jupiter is now too close to the Sun for observation as it approaches solar conjunction on the 26th. It should become visible in the morning skies in mid November although it will be late March 2018 before it is an evening object again.
Saturn is an evening object in southern Ophiuchus setting at 21.45 BST at the beginning of the month, though by the end this has become 19.00 GMT as the planet moves back towards the Sun to reach conjunction in late December. On 16th October the planets north pole achieves maximum tilt as seen from the Earth meaning that we have reached the point where the ring system is displayed to greatest effect. From then on we see the rings more obliquely until, in March 2025, we experience a ring plane crossing when the rings will be edge on to us once more. The position of Saturn at the beginning of October is shown in fig 2.

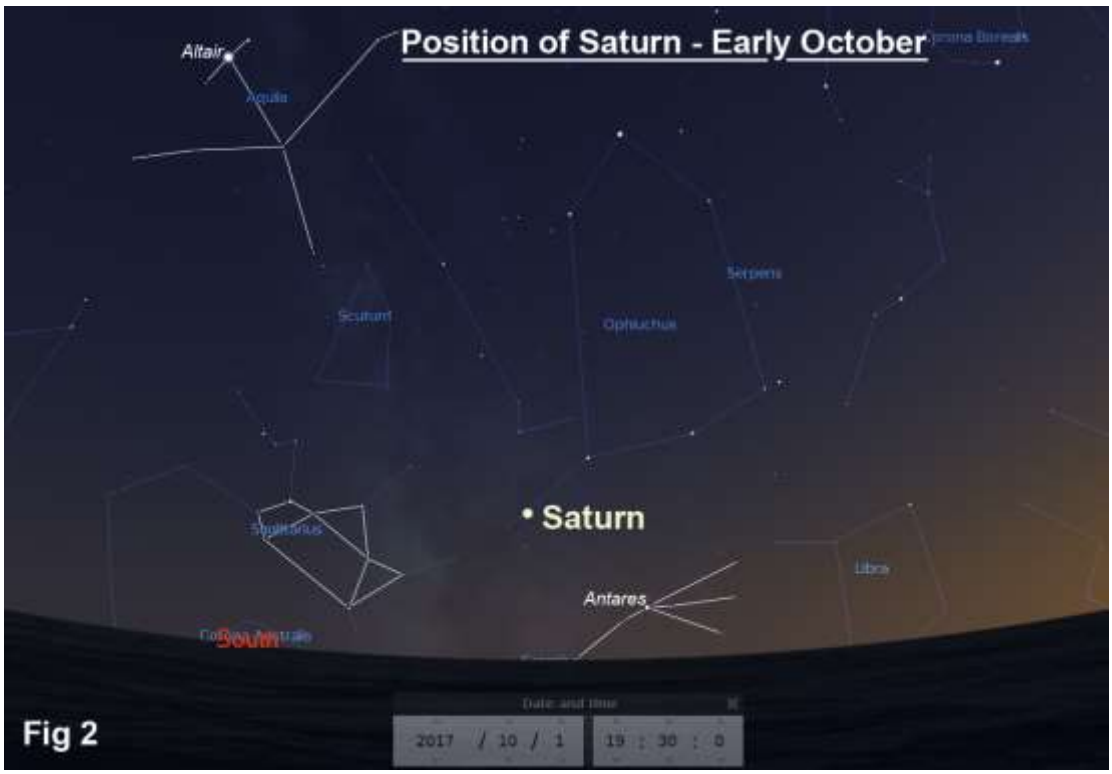


Fig 2

Neptune is not normally covered by these notes due to its faintness but on October 5th a comparatively rare event takes place when the planets largest moon, Triton, occults a magnitude 12.5 star. Obviously this requires a large instrument fitted with specialist video equipment and a method of time insertion. It is anticipated that the occultation could last for around two minutes. If anyone is interested, please contact me for more information. SOFIA, the airborne observatory on board an adapted Boeing 747 will be flown into the shadow path just off the US coast in an attempt to measure Triton's atmosphere.

Lunar Occultations

In the table below I've listed events for stars down to magnitude 7.0 that mostly occur before midnight although there are many others that are either of fainter stars or occur at more unsociable hours. DD = **d**isappearance at the **d**ark limb. RD = **r**eappearance at the **d**ark limb. The column headed "mm" (millimetres) shows the minimum aperture telescope required for each event. **Times are in BST unless otherwise stated.**

Oct.	Time	Star	Mag	Ph	Alt °	% illum.	mm
3rd	23.11	ZC 3421	4.9	DD	31	96	40
18th	14.07	ZC 1821	2.8	RD	30 (Sun +26°)	2	250
28th	19.59	ZC 3091	6.7	DD	22	58	70
30th	20.42 **GMT**	ZC 3355	6.7	DD	29	77	80

Phases of the Moon for October

Full	Last ¼	New	First ¼
5th	12th	19th	27th

ISS

Below are details for passes of the International Space Station (ISS) that are brighter than magnitude -2.0. The details of other passes, including those visible between midnight and dawn, can be found at www.heavens-above.com. Please remember that the times and directions shown below are for when the ISS is at it's ***maximum*** elevation, so you should go out and look at least five minutes beforehand.

Times are in BST.

Oct	Time	Mag.	Alt°	Az.		Oct	Time	Mag.	Alt°	Az.
1st	19:56:40	-3.8	70°	SSE		7th	19:32:54	-3.8	83°	N
2nd	20:40:50	-3.8	76°	NW		8th	20:17:06	-3.7	60°	SSW
3rd	19:48:46	-3.9	88°	N		9th	19:24:52	-3.8	79°	SSW
4th	20:33:03	-3.9	80°	NNW		10th	20:08:56	-2.8	37°	SSW
5th	19:40:52	-3.8	78°	N		11th	19:16:44	-3.2	53°	SSW
6th	20:25:10	-4.0	85°	S		12th	19:08:27	-2.2	32°	SSW

Iridium Flares

The flares that I've listed are magnitude -2.0 or brighter although there are a lot more that are fainter or occur after midnight. If you wish to see a complete list, or obtain timings for somewhere other than Wadhurst, go to www.heavens-above.com . When one of these events is due, it is sometimes possible to see the satellite before and after the "flare" although, of course, it will be much fainter then. **Times are in BST unless otherwise stated.**

Oct	Time	Mag	Alt°	Az.°		Oct	Time	Mag.	Alt°	Az.°
1st	21.00	-5.0	16°	4° (N)		21st	18.56	-5.7	54°	20° (NNE)
15th	19.32	-2.9	45°	13° (NNE)		23rd	18.43	-3.3	57°	23° (NNE)
17th	19.20	-2.7	48°	14° (NNE)		24th	20.45	-2.9	10°	8° (N)
17th	21.03	-2.4	10°	7° (N)		25th	18.31	-2.3	60°	26° (NNE)
18th	19.14	-7.8	49°	17° (NNE)		28th	20.16	-7.0	24°	14° (NNE)
19th	19.08	-3.9	51°	18° (NNE)		31st	19.00 **GMT**	-5.4	30°	17° (NNE)

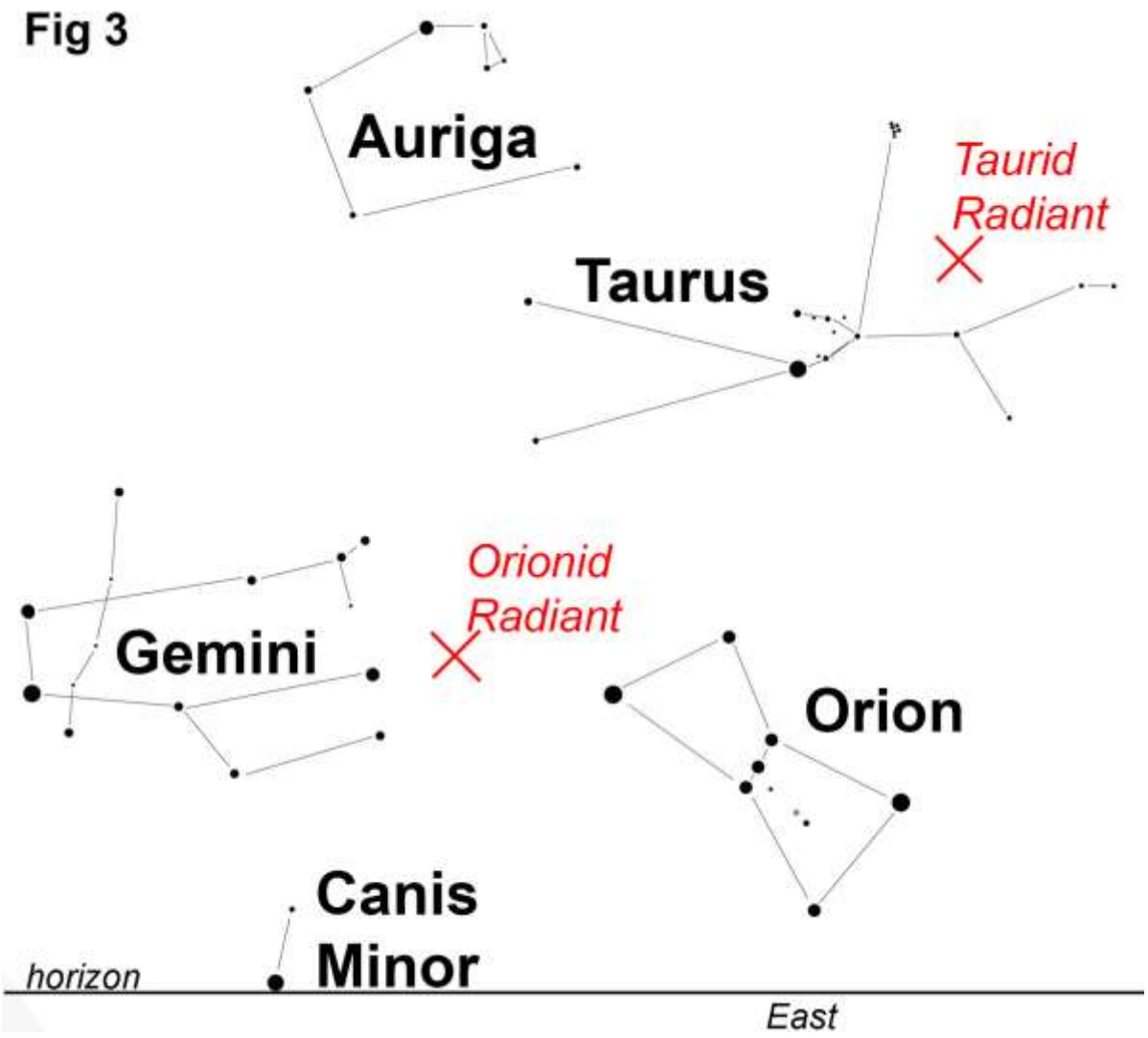
Meteors

The Orionids are active from October 16th to 30th with a long flat maximum occurring between the 21st and 23rd when the zenithal hourly rate (ZHR) is expected to be around 25. Fortunately on those nights a slim crescent Moon will set soon after the Sun so will not interfere in any way this year.

The only disadvantage is that the radiant (the point that meteors appear to radiate from) doesn't rise until 22.00 so some events are bound to be hidden below the horizon.

The Taurids begin on October 20th and last until November 30th although there are really two separate showers with two independent radiants. The first shower reaches its maximum on November 5th whilst the second has a peak on November 12th. The ZHR's for both showers are predicted to be around 10. The Moon will seriously interfere with the first maximum but will not rise until 01.30 GMT for the second. Fig 3 shows the positions of the radiants for both the Taurids and Orionids.

Fig 3



The Night Sky in October (Written for 22.00hrs BST mid month)

In the east the winter constellations are making their presence felt, with Aldebaran and Capella both more than 15° in altitude whilst below them Orion and Gemini are just rising. The area roughly north of them contains a number of open clusters, the brightest of which is M35 at magnitude 5.1. The hunter and twins hint at what is to come, in a few months time, when they command the skies towards the south. Above them all is Perseus with the lovely double cluster consisting of NGC 884 and NGC 869, riding high at more than 55°.

Turning to the south we find the constellations of Pegasus, Aquarius and Piscis Austrinis lined up on the meridian. If you draw a line through the two most westerly (right hand) stars in the Square of Pegasus and continue it southwards it will pass close to the bright star Fomalhaut in the constellation of the southern fish which lies just 10° above the southern horizon. Immediately below the square lies Pisces, which for some years now has been home to the planet Uranus.

The west is dominated by the Summer Triangle, with Deneb still 70° in altitude and the rest of the swan pointing headfirst towards the horizon. The other two members of the Triangle lie further south, although even Altair is still 35° high. Arcturus, one of the pointers to Hercules, has been lost although the other pointer, Alphecca, the brightest star in Corona Borealis, is still visible. Also disappearing is the large area of sky given over to Ophiuchus and the two separate parts of Serpens.

To the north, the Plough has reached its lowest point and will once again soon begin to climb away from the horizon. Diametrically opposite the bear's tail, on the other side of the pole, we find Queen Cassiopeia who is moving closer to the zenith. Gathered around the familiar "W" shape are a number of open clusters ranging in brightness from magnitude 6.5 to 7.5. Below Cassiopeia lies Cepheus, home to IC 1396, part of which is known as the "Elephant Trunk Nebula" that is thought to be at least 20 light years in length.

Advance warning for November

November 13th - Early morning conjunction of Jupiter and Venus.
November 17th - Leonid meteor shower maximum.

Brian Mills

BOOK OF THE MONTH FROM THE WAS LIBRARY

Full Moon by Michael Light

Recently, NASA allowed 900 hundred master negatives from the Apollo Missions to be taken off site for electronic scanning so as to release the sharpest images ever seen. From these, Michael Light has built up a photographic journey to the Moon beginning with the launch, followed by a walk in space, an orbit of the Moon, a lunar landing and lunar exploration. This is followed by the return to Earth, with an orbit of our planet and finally, splashdown.

There are a number of photographs not previously seen and Full Moon also contains five enormous folded panoramic views of the lunar landscape in incredible detail.

At the end of the book is an accompanying essay written by Andrew Chaikin, author of the best-selling "A Man on the Moon". He says the one picture of the Earth taken from the lunar surface marks a turning point in human evolution.

Full Moon was published in 1999 and this book has recently been donated to the Society.

SPACEPLACE - NASA

This article is provided by NASA Space Place.
With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology.
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(This article was received just before the 15th of September – Ed)

Cassini Says Goodbye
By Teagan Wall

On September 15th, the Cassini spacecraft will have its final mission. It will dive into the planet Saturn, gathering information and sending it back to Earth for as long as possible. As it dives, it will burn up in the atmosphere, much like a meteor. Cassini's original mission was supposed to last four years, but it has now been orbiting Saturn for more than 13 years!

The spacecraft has seen and discovered so many things in that time. In 2010, Cassini saw a massive storm in Saturn's northern hemisphere. During this storm, scientists learned that Saturn's atmosphere has water vapour, which rose to the surface. Cassini also looked at the giant storm at Saturn's north pole. This storm is shaped like a hexagon. NASA used pictures and other data from Cassini to learn how the storm got its six-sided shape.

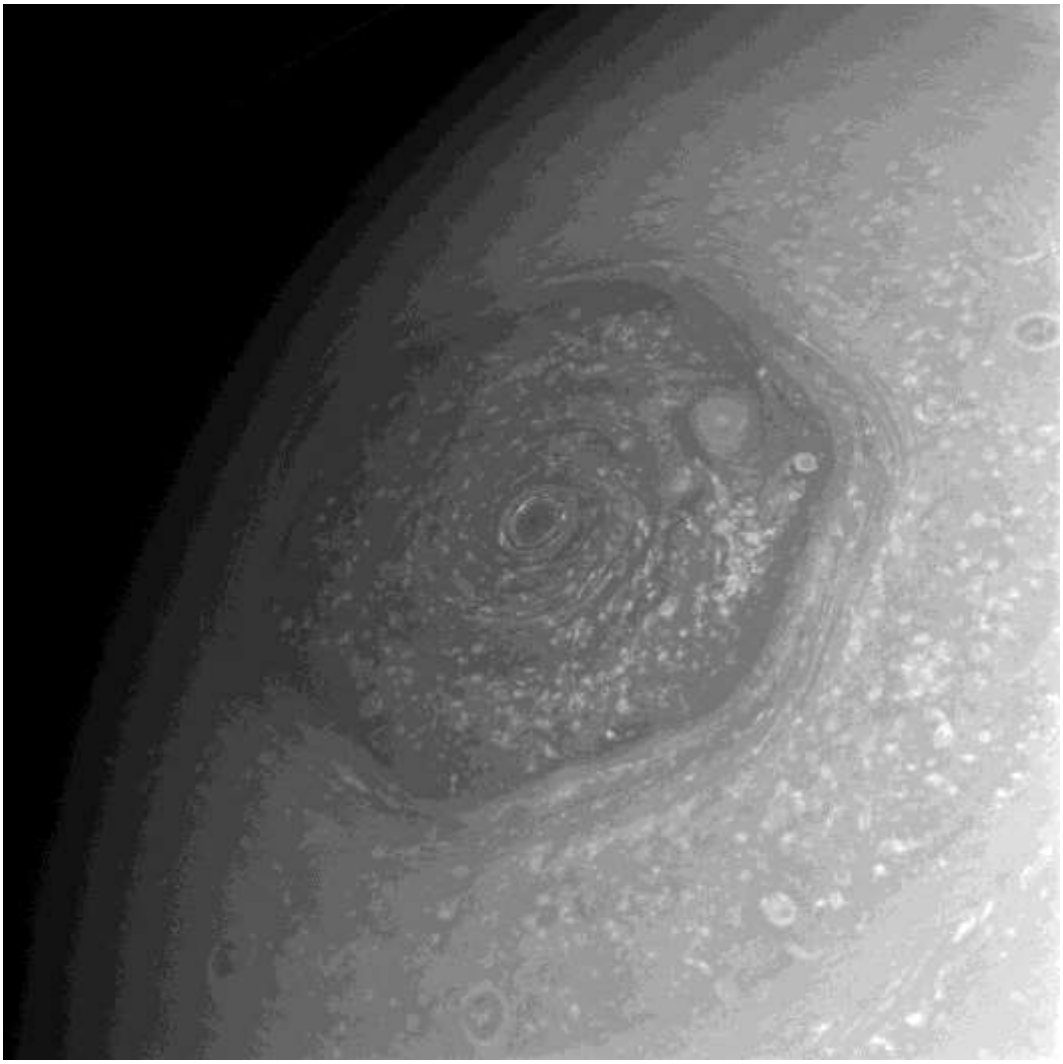
Cassini also looked at some of Saturn's moons, such as Titan and Enceladus. Titan is Saturn's largest moon. Cassini carried a lander to Titan. The lander, called Huygens, parachuted from Cassini down to the surface of the moon. It turns out, Titan is quite an exciting place! It has seas, rivers, lakes and rain. This means that in some ways, Titan's landscape looks a bit like Earth. However, its seas and rivers aren't made of water—they're made of a chemical called methane.

Cassini also helped us learn that Saturn's moon Enceladus is covered in ice. Underneath the ice is a giant liquid ocean that covers the whole moon. Tall geysers from this ocean spray out of cracks in the ice and into space, like a giant sneeze. Cassini flew through one of these geysers. We learned that the ocean is made of very salty water, along with some of the chemicals that living things need.

If there is life on Enceladus, NASA scientists don't want life from Earth getting mixed in. Tiny living things may have hitched a ride on Cassini when it left Earth. If these germs are still alive, and they land on Enceladus, they could grow and spread. We want to protect Enceladus, so that if we find life, we can be sure it didn't come from Earth. This idea is called planetary protection.

Scientists worry that when Cassini runs out of fuel, it could crash into Titan or Enceladus. So years ago, they came up with a plan to prevent that from happening. Cassini will complete its exploration by diving into Saturn—on purpose. The spacecraft will burn up and become part of the planet it explored. During its final plunge, Cassini will tell us more about Saturn's atmosphere, and protect the moons at the same time. What an exciting way to say goodbye!

To learn more about Saturn, check out NASA Space Place: https://spaceplace.nasa.gov/all-about-saturn



Caption: This image of the hexagonal storm on Saturn's north pole was taken by Cassini in 2013. Image credit: NASA/JPL-Caltech/Space Science Institute

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SAGAS website:
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Any material for inclusion in the November 2017 Newsletter should be with the Editor by October 28th 2017