Advertisements

Do you have anything for sale, or do you want anything (preferably, but not necessarily astronomical)? Advertise here - no charge.

Subscriptions due

Your subscription is now due, as follows:-

Single or double	£5.00
Students and OAPs	£3.00

Please send the above amount to the Astronomy Section Honorary Treasurer:

Peter Langford, 3 Cameron Place, Upper St Jacques, St Peter Port.

Your subscription includes a free copy of the 1995 Astrocalendar, giving full details monthly of the stars, planets, meteor showers, etc. It also includes the bi-monthly newsletters Sagittarius, free use of the Section's telescopes, loan of magazines, books etc.

Don't forget that you must also be a paid-up member of La Société Guernesiaise.

Sponsors wanted

Sponsors are wanted for the next five issues of Sagittarius. The normal sponsorship amount is £25.00, which covers the cost of copying and distribution.

We could also do with a sponsor for the leaflet about membership of the Astronomy Section, at, say £50 to £75. Please let us have your ideas.

Astronomy Section Officers

Section Secretary:	Geoff Falla	724101
Honorary Treasurer:	Peter Langford	720649
Light Pollution Officer:	Ken Staples	54759

The next newsletter will be published early in March. The deadline for publication materials is 15th February.

La Société Guernesiaise, Candie Gardens, St. Peter Port, Guernsey
Observatory: Rue du Lorier, St. Peter's, Telephone 64252

Editor: David Le Conte, Belle Etoile, Rue du Hamel, Castel Guernsey GY5 7QJ Telephone 64847

Opinions expressed in Sagittarius are those of the authors, and are not necessarily endorsed by the Astronomy Section or La Société Guernesiaise.

Sagittarius

The Newsletter of the Astronomy Section of La Société Guernesiaise

January/February 1995

Forthcoming events

Darken our Lightness
by Ken Staples
Tuesday, 24th January
8.00 pm at the Observatory

Annual Business Meeting
Tuesday, 31st January
8.00 pm at the Observatory

Chasing Solar Eclipses
by Michael Maunder
Tuesday, 14th February
8.00 pm at the Frossard Lecture Theatre, Candie Gardens

In this issue:

Landmarks in Space Research by Geoff Falla

The Ulysses Mission by Daniel Cave

The Liberation Monument - Part 2 by David Le Conte

CCD News

Inside

Major articles in **bold**

Centre insert

January/February star chart

Darken our Lightness

Ken Staples will be talking about **light pollution at 8.00 pm on Tuesday, the 24th January at the Observatory**. Ken, an active Astronomy Section member, is Guernsey's Light Pollution Officer, having been appointed to this position by the British Astronomical Association's Campaign for Dark Skies (CfDS).

Since his appointment last year, Ken has been pursuing a goal of reducing the adverse effects of increasing outdoor lighting, and has approached States Committees, architects and lighting providers. He will be telling us about the national and local campaigns.

His talk will be illustrated with slides and posters from the UK CfDS.

Chasing Solar Eclipses

At 8.00 pm on Tuesday, the 14th February, Michael Maunder will be talking about his experiences on many trips abroad in search of total and annular **solar eclipses**. Note that this will not be at the Observatory, but **in the Frossard Lecture Theatre at the Candie Headquarters of La Société Guernesiaise**. It is part of the Société's programme of winter lectures.

Michael is an internationally renowned photographer of solar eclipses, and a Council Member of the British Astronomical Association. He spoke to us several years ago, and has been a member of the Section ever since. His remarkable pictures, often taken with relatively simple equipment, have been published in many journals. You will recall his recent one where he "caught" the eclipse in his hand.

No doubt he will again enthral us with his collection of pictures and anecdotes.

Annual Business Meeting

The Section's Annual Business Meeting will be held **at 8.00 pm on Tuesday, the 31st January at the Observatory**. The agenda will include: the election of officers, Treasurer's report and budget, the solar mirrors, workshop area, Liberation Day plans, and the 1999 total solar eclipse. All members are urged to attend.

Orion - the Surfer

On the 15th November 1994 Steven Jefferys told us all about the constellation Orion, from its Babylonian origin (the "light of heaven") to modern day stellar physics. He pointed out that there are about 1000 stars in the constellation, but he concentrated on seven of them (Betelgeuse, Rigel, Bellatrix, Saiph, Alnilam, Alnitak and Mintaka), and two nebulae (M42 and the Horsehead, which itself consists of two objects - an emission nebula and a dark nebula).

Steven then used this as a jumping off point for a discussion about the evolution of stars, and the Hertsprung-Russell diagram. Orion and its neighbouring constellations are good subjects for this purpose, as they contain excellent examples of stars in various stages of evolution.

Steven's talk was amply illustrated with colour slides and other pictures, including recent images of proto-planetary discs in the Orion Nebula, taken by the Hubble Space Telescope. He concluded by pointing out that such areas of star formation occur in the Milky Way Galaxy's spiral arms, which are waves of pressure, and that therefore Orion the Hunter should perhaps be more properly called Orion the Surfer!

Quiz and Supper Evening

On the 13th December ten members and guests gathered for the annual Quiz and Christmas supper. The questions this year were set by Secretary Geoff Falla, who posed some interesting teasers. First prize was won by Roger Chandler. A thoroughly enjoyable evening was enhanced by excellent food and wine.

Educational activities

DoE successes

Congratulations to Zoë Byrom and Jane Porter, who completed their Duke of Edinburgh Gold Award in Astronomy, under the guidance of David Le Conte and other members of the Section. This involved a whole year of monthly visits to the Observatory.

Brownies at Observatory

On the 7th November 26 members of the 10th Guernsey St Martin's Brownies, together with three leaders, visited us. The cloudy sky miraculously cleared and they were able to have excellent views of the Moon, Saturn, and Albireo.

Talk to La Houguette School

On the 6th December David Le Conte gave a talk and demonstrations about the Moon to about 50 children at La Houguette School.

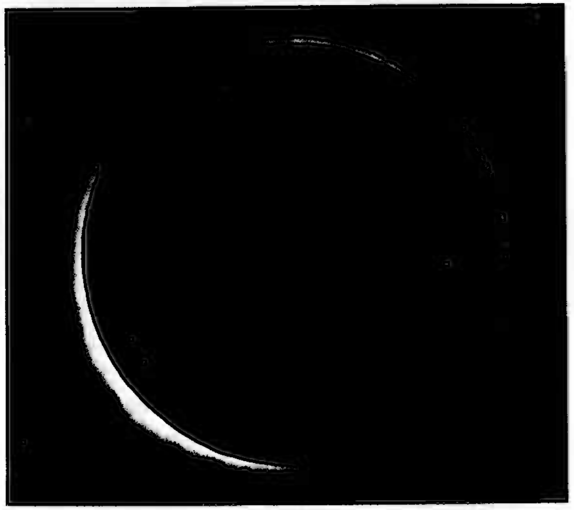
CCD - first light

Twinkle, twinkle little star,
Light that comes from very far.
Now we have the means to see
With our brand new CCD.

Geoff Falla's rhyme celebrates the first CCD results, which appear on page 17. ¤

Total solar eclipse

Section member Dr Stephen Sweet went to Chile to observe the total solar eclipse of 1994 November 03. His trip was in a party led by Patrick Moore, and observations were made from a site at an altitude of 14,600 feet, 120 km from Arica in northern Chile. His photograph below shows a small corona because of low solar activity.



10-inch Meade

Member John Ferguson has kindly lent us his LX200 10-inch Meade telescope for several weeks. It is a fully computerised instrument, with a large database of objects. The telescope moves itself directly to a selected object, and makes observing a dream. Come and try it.

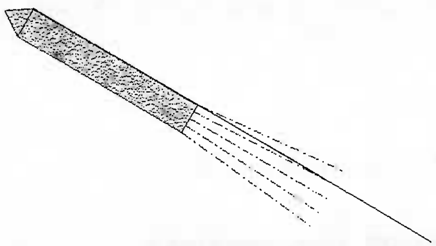
1995 Programme

Your 1995 Programme of events is included with this newsletter. Once again we have put together a varied and interesting programme of meetings, with a wide range of subjects, from the technical to the far-out. There is something for everyone here. ¤

Landmarks in space research - by Geoff Falla

Today the regular launch of manned or automatic spacecraft and satellites is very much taken for granted. Large liquid fuelled rockets are used, whereas in the earlier stages of rocket development solid fuel propellants were in general use. The Second World War saw a period of major research and development, with German engineers pressed into service in pursuit of the war effort. The skills developed during this time were later used by the United States and the Soviet Union to continue research and development of more powerful rockets, leading eventually to the launch of spacecraft into orbit and to the planets.

The origins of rocket development can be traced back many centuries. The smallest solid fuelled rocket can be seen as the simple firework, invented by the Chinese and in use as far back as the 9th century using gunpowder as a propellant. These were later developed into a weapon used for defensive purposes and known as "fire arrows".



In 1687 Sir Isaac Newton included the principle of rocket flight in his Third Law of Motion - that for every action there is an equal and opposite reaction.

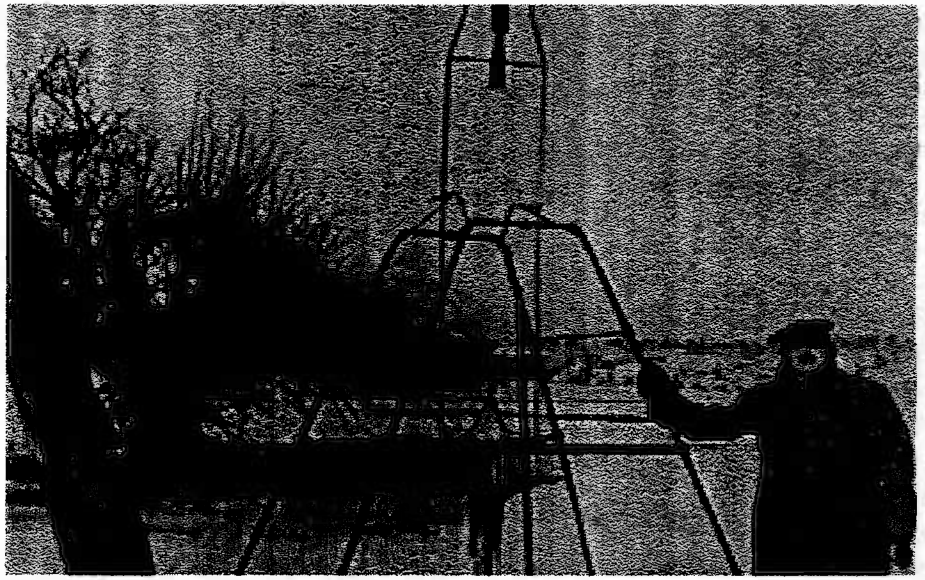
Towards the end of the 18th century iron-cased rockets with a range of over one mile were in use in India, while in 1804 WilliamWilliam Congreve developed solid fuel rockets in England, where they were manufactured at Woolwich Arsenal.

The author Jules Verne wrote a prophetic novel in the year 1865, which was entitled *"De La Terre á La Lune"* - From the Earth to the Moon. The novel described a lunar journey, and the author correctly chose Florida as the launch site.

In 1883 the Soviet scientist Konstantin Tsiolkovsky set out the principles of rocket flight in space, and recommended the use of liquid hydrogen and liquid oxygen as the ideal propellants, which are in use in today's rockets. In 1895 he went on to propose the feasibility of an artificial Earth satellite which would orbit outside the atmosphere at an altitude of around two hundred miles, very similar to the orbits of present day satellites. This remarkable man also proposed the gyroscopic stabilisation of rockets, that airlocks could be used to enable the crew to leave the spacecraft, and the concept of space stations assembled from parts.

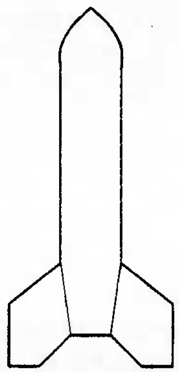
The American Pioneer Robert Goddard began a study of liquid propellant rockets in 1909, and on the 16th March 1926 achieved the world's first flight of a liquid fuel rocket at Auburn, Massachusetts. Like the first aircraft flight by the Wright brothers, rocket flight had humble beginnings, with Goddard's test rocket travelling a distance of about 50 metres. Five years later german scientists also achieved a flight using a liquid fuelled rocket. The Soviet Union followed in 1933.

The Second World War saw the rapid »»



Robert Goddard with one of his early rockets.

development of rockets as weapons. As part of Germany's offensive against Britain more than four thousand V2 rockets were launched between September 1944 and March 1945, many directed against



V2 rocket

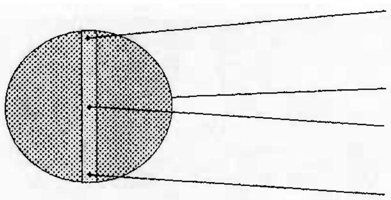
London. After the war German rocket engineers were recruited by the United States and by the Soviet Union to continue research and development of the V2 rocket.

In 1952 the US launched an "Aerobee" Sounding rocket to a height of 60 miles. The rocket nosecone carried monkeys and mice, which were returned safely to Earth by parachute.

A project to launch the first Earth satellite was announced in July 1955. Named Project Orbiter, with plans to use a military rocket for the launch, this was a United States Office of Naval Research project. In September 1955 a rival project "Vanguard" was announced to orbit a satellite using a civilian launcher. Both projects were aimed at a satellite launch as a contribution to International Geophysical Year, 1957.

In September 1956 the three-stage military rocket of Project Orbiter was successfully launched from Cape Canaveral, on a sub-orbital test flight of 3000 miles. However, this project was cancelled in favour of the civilian project Vanguard. »»

The Soviet Union became the first nation to launch an artificial satellite, surprising the world with the launch of "Sputnik I" on the 4th October 1957. The satellite carried a simple radio transmitter beacon to announce its presence in orbit, and was followed a month later by the much larger "Sputnik 2".



Sputnik I

The United States' attempt to launch a satellite was a few weeks later, on 6th December, but ended in failure when the Vanguard rocket exploded on the launch pad. It was to be some years before the lead grasped by the Soviet Union was successfully met by the United States. The Space Race had begun. ¤

Geoff Falla

Famous lives - 6 - Sir Isaac Newton (1642 - 1727) by David Williams

I have listed ten great astronomers in my series, whose work has had a profound effect upon, not only astronomy, but scientific thought in general. However, without a shadow of a doubt one man stands pre-eminent above all others as one of the greatest scientists of history: Sir Isaac Newton, physicist, mathematician and astronomer. He once wrote to another distinguished scientist, Robert Hooke: "*If I have seen further it is by standing on the shoulders of giants.*" (5 February 1675)

Newton was born on December 25, 1642, using the old-style calendar (which transfers to January 4, 1643 new style) in the village of Woolsthorpe in Lincolnshire. [As you may remember, this is the same year in which Galileo died.]

One thing is clear about Newton: he had a very complex character; highly strung, he suffered at least two nervous breakdowns during his lifetime. He was very possessive, highly nervous and afraid of criticism, prone to violent temper, and found it difficult to make or sustain friendships.

After attending Grammar School, he went up to Trinity College, Cambridge, taking his degree in 1665. During his four years at the University he immersed himself in his studies, and especially the new scientific concepts which had been promulgated by such thinkers as Galileo, Descarte, and the chemist Boyle. Here Newton was to build the framework for his undertaking of the universe as a complex, interwoven web, constructed of invisible particles. Here he was to reject the age-old orthodoxy of Aristotle, and embrace the works of the new natural philosopher/ scientists.

It was during this time, c1664, that he made the following jotting: "*Amicus Plato amicus Aristoteles magis amica veritas*" -

> *Plato is my friend,*
> *Aristotle is my friend,*
> *but my best friend is truth.*

»»

The middle years of the 1660 decade saw Newton confined to his home because of the plague, but he did not rest. During this time he undertook the work that was to result in calculus; he also discovered the binomial theorem. By 1669 he published his work, later refined it and re-published it. As a result he was, by the age of 27 the leading mathematician in Europe! - a fellow of Trinity College, and Lucasian Professor of Mathematics! [a post to be held some 300 or so years later by Stephen Hawking].

Newton's discoveries with optics took place during 1665 and 1666. It was during this time that he demonstrated the spectrum of visible light by refracting a beam of light through a prism. It was because of this, and his belief that chromatic aberration could not be corrected, that resulted in his construction of the first reflecting telescope. If a lens was not good enough, then use a mirror. This design is still in use today, and is named after him.

It is his work on gravity for which he is chiefly remembered, and his great work, the *Principia*, or *"Philophiae Naturalis Principia Mathematica"*. It is interesting to note that this work also provided the basis for the whole of modern day scientific work. It was this work which contained his theory of universal gravitation and his three laws of motion. It would, I believe, be foolhardy to attempt to explain in this brief history of his life how he came to formulate such epoch-making ideas. I have read and re-read his work, but I must admit I find it difficult to précis it, and so I offer you my apologies.

Suffice it to say that when his work was published in 1686 it was greeted as a masterpiece by all except Robert Hooke, who accused Newton of plagiarism - but records do not support Hooke's complaint. The work elevated Newton to international standing as the foremost scientist of his day. His influence upon, not only English science, but more importantly continental science, was immeasurable, and the consequences formidable.

Honours were showered upon the great man: he was made President of the Royal Society in 1703, knighted in 1705, and in 1699 he had been made a foreign associate (one of only eight) of the French Academy of Sciences.

It is difficult to explain adequately the profound effect Newton's work had upon the scientists of the day, and the way it was to influence scientific thought until Einstein early in this century.

For his part, he summed his life up in the following way:-

> *"I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the sea-shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me."*

The great revealer of truth died in London on March 31, 1727. ¤

David Williams

References:

The Penguin Dictionary of Astronomy

Pioneers in Astronomy

Oxford Dictionary of Quotations

The Ulysses Mission - by Daniel Cave

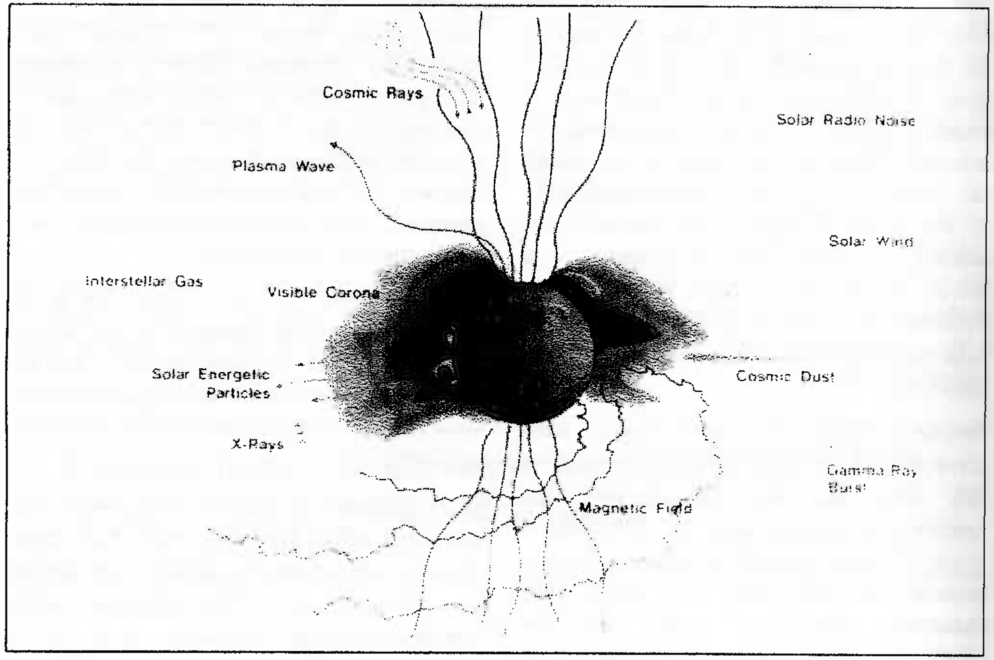


Figure 1. Subjects for Ulysses' investigations

As the Earth orbits the Sun each year we get the same views of our local star. We are able to study the equatorial regions of the Sun well, but many questions regarding solar processes remain. The polar regions of the Sun hold many of the answers to these questions.

Areas Of Study

Investigations of the solar environment may help clarify many of the currently unclear processes -

- Properties of the Solar magnetic field and the way it switches every 11 years are poorly understood.
- The coronal heating mechanism is still uncertain.
- It is not known if the magnetic field is strong enough to hold back the solar corona.
- Solar cosmic rays also need further study from other regions of space.

The Mission

A mission to study the polar regions of the Sun had been considered for many years. The mission that became Ulysses arose from studies conducted by NASA and ESA in the 1970s. Initially known as the "Out Of Ecliptic" (OOE) mission, the joint ESA/NASA project was to consist of two spacecraft. One was to be built by ESA, the other by NASA.

By the end of the decade the mission name had been changed to the International Solar Polar Mission (ISPM) and the launch date had been set for 1983. Subsequent problems meant that by 1981, after numerous configuration changes, the craft being built by NASA was cancelled Further problems with the development »»

of the probe and the Space Shuttle lead to launch slips of a few years and then in 1986 the Challenger accident dramatically delayed launch.

Seven years later than initially planned, and now bearing yet another name, Ulysses was carried into space by the Space Shuttle Discovery on the 6 October 1990. Using a Payload Assist Module (PAM-S) and an Inertial Upper Stage (IUS) to launch it towards Jupiter, Ulysses became the fastest ever manmade object, travelling at 15.25 kms-1.

For a spacecraft designed to study the Sun, Ulysses' trajectory may seem to be rather unusual. It began by taking the craft not towards, but away from the Sun and out to Jupiter. This was to enable the spacecraft to use the gravitational field of Jupiter to rotate its orbit way out of the ecliptic and place it in a path that would carry it over the poles of the Sun. No launch vehicle can provide enough energy to send a probe directly over the poles of the Sun from Earth.

This technique also had the advantage of allowing Ulysses to obtain new data on the Jovian magnetosphere during the manoeuvre.

The Spacecraft

The spacecraft itself weighs 370 kg and consists of 9 instruments to fulfil its scientific objectives (two additional experiments make use of the craft's radio system and do not have dedicated instruments). Communications between the Earth and Ulysses are maintained through its high gain antenna. The antenna permanently points towards Earth where its signals are received by NASA's Deep Space Network. Continuous real-time telemetry is feasible, but when this is not possible, onboard tape recorders ensure that no data is lost. The probe's Radioisotope Thermoelectric Generator (RTG) provides the 250 Watts needed to power all the electrical systems. A 5.5 metre boom is used to provide the electromagnetically clean environment needed by some of the instruments.

The nine scientific instruments are outlined below.

The "Solar Wind Observation Over the Poles of the Sun" experiment (SWOOPS) detects and analyses the particles in the solar wind. The experiment is used to determine how the solar wind changes with solar latitude and distance.

The "Solar Wind Ion Composition Spectrometer" (SWICS) measures the composition and temperatures of the ions present in the solar wind from hydrogen to iron as they strike the instrument. Locating the sources of the solar wind is possible and information on the processes in the solar corona where the particles were initially accelerated is found.

The "Heliosphere Instrument for Spectral, Composition, and Anisotropy at Low Energies" (HI-SCALE) is designed to look at dynamic solar phenomena such as solar flares. Analysis of the composition of low energy nuclei from the Sun give an indication as to the solar composition.

The "Cosmic Ray and Solar Particle Investigation" (COSPIN) looks for particles that enter the solar system from interstellar space. The primary objective of this experiment is to understand how charged particles from beyond the solar system move in interplanetary space. Determining the origin of the particles and how they move in interstellar space is also an objective of the experiment. »»

The "Unified Radio and Plasma Wave" experiment (URAP) is designed to determine the direction and polarisation of radio sources from the Sun and to study details of plasma waves in the solar wind. Information on plasma wave sources, the propagation medium and solar wind interaction are also being investigated.

The Solar Flare X-ray and Cosmic Gamma-Ray Burst Experiment detects both solar X-rays and cosmic gamma-ray bursts. This experiment is designed to work alone or in conjunction with other spacecraft in the ecliptic plane, such as Galileo. The solar flare portion of the experiment measures the direction of solar flare X-rays and determines how the X-ray producing electrons were moving in the solar flare. The gamma-ray burst experiment attempts to locate the direction of the cosmic gamma-ray source. If a burst is detected by another spacecraft the small differences in arrival times of the event is used to pinpoint the source.

The "Cosmic Dust Experiment" measures the concentration of dust in interplanetary space. Some of these dust particles are thought to be left over from the formation of the solar system. Other particles may be from comets, asteroids or from interstellar space. The dust experiment measures the speed, charge and travel direction of the particle. The particle number density at various latitudes is also measured by this experiment.

The solar magnetic field is virtually impossible to measure from low solar latitudes and, so, two magnetometers will provide vital information on the field as they are carried through the polar regions of the Sun. One is a high sensitivity device for use on the weaker fields and the other has a lower sensitivity and was used to record details of the intense Jovian magnetosphere.

The "Energetic Particle Composition Experiment" consists of two sensors. One looks for medium energy ions present in the solar wind. This is to gain information on a phenomenon known as coronal storage, where particles are trapped by the solar corona. The other part of the experiment, the gas sensor, searches for neutral interstellar hydrogen. There was a small window shortly after Ulysses was launched (70 to 100 days) when this experiment could be conducted.

Two of Ulysses' experiments do not require dedicated instrumentation to be performed. These are the "Coronal Sounding Experiment" and the "Gravity Wave Experiment".

The Coronal Sounding Experiment uses the probe's communication equipment to study the electron density in the solar corona. The experiment can only be conducted when the Earth and Ulysses are on opposite sides of the Sun, a situation that occurs twice during the mission. The radio signal from the probe is observed when the signals pass the Sun. The electrons in the signal path slightly affect the frequency of the received signal. The frequency will scintillate as the coronal electron density changes.

Gravity waves that were predicted by Einstein's theory of general relativity have yet to be detected. The hope is that these ripples in space-time can be found by observing the radio signals received from Ulysses when it is at opposition. They will cause a very small Doppler shift in the observed radio transmission. »»

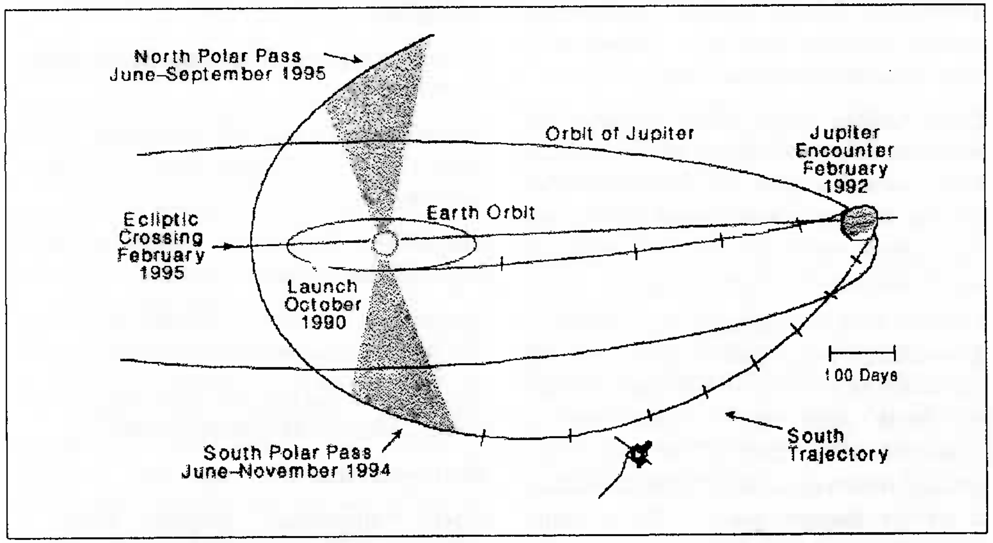


Figure 2. The spacecraft's trajectory took it out to Jupiter before the gravitational field of the planet was used to send the craft over the poles of the Sun.

The Discoveries

The 1992 Jupiter flyby allowed Ulysses to gather data on the planet's magnetic field from higher latitudes than had been reached by previous craft. The encounter lead to the discovery that the solar wind exerts a much stronger influence on the planet's magnetic field than was previously thought. There were three key observations which led to this conclusion.

Firstly it was found that the high latitude magnetic field lines did not return to Jupiter across its equator; they just lead out into interplanetary space. The second surprise came as Ulysses was leaving the Jovian system. It was found that the field lines were not rotating with the planet, but were being swept towards the tail of Jupiter's magnetosphere. This effect was attributed to the drag caused by the solar wind. Finally there was the discovery of a thick layer of solar wind particles mixed with Jovian particles just inside the boundary of the magnetosphere. This is interpreted as being due to the solar wind stripping away field lines from the magnetosphere.

The best chance of detecting gravitational waves occurred when Ulysses was its furthest from Earth, at Jupiter. There was, however, no detection of the phenomenon.

As Ulysses headed towards the south polar region it passed through an electrical current sheet. The passage through this sheet was coincident with a doubling of the solar wind speed to $800\ kms^{-1}$. The sheet also signalled the change in magnetic field direction. Above the sheet the field lines are directed outwards, away from the Sun. Below the sheet the field lines are inward facing. Other than around this sheet it has been found that the solar magnetic field is remarkably uniform.

Ulysses also detected shock waves propagating through the solar wind. It is thought that these waves provide the »» massive acceleration needed to create the rapidly moving hydrogen, helium and other ions that have been observed.

Other unique observations include the detection of neutral helium atoms arriving from interstellar space, the measurement of micron sized interstellar dust grains and the highest resolution measurements of cosmic ray nuclei compositions.

Ulysses is now captured by the Sun's gravitational field. After Ulysses has left the south pole, its orbit will carry it over the north polar region from June to September 1995. Here it will again make detailed observations of its environment as it travels through space. The exciting possibility of an extended mission has also been proposed.

Ulysses' orbital path will carry it far from the Sun after 1995, but the probe will return to the south, then north polar regions in 2000 and 2001 respectively. This second pair of encounters, unlike the first, occur near the maximum of the sunspot cycle. Data obtained at this time may give vital clues as to the cause of the variable solar activity.

Information Sources

The following sources were found to be helpful when writing this essay -

Internet

Images and fact sheets regarding the mission were acquired from NASA Spacelink - anonymous ftp site: *spacelink.msfc.nasa.gov*

Mission status reports (September 1992 - October 1994) and press releases were obtained from the Public Information Office of the Jet Propulsion Laboratory - anonymous ftp site: *jplinfo.jpl.nasa.gov*

Spaceflight

Details of the launch and Jupiter encounter were found in -

Spaceflight, Volume 32, November 1990, page 363-4, "Ulysses Begins a New Odyssey"

Spaceflight, Volume 32, December 1990, page 388-90, "Ulysses Launched"

Spaceflight, Volume 34, March 1992, page 75, "Ulysses Survives Jupiter Flyby"

Spaceflight, Volume 34, May 1992, page 166-7, "Ulysses Swings by Jupiter"

Picture Credits

Cover illustration adapted from a Micrographx Designer 4.0 tutorial.

Figure 1, ESA diagram obtained from NASA Spacelink

Figure 2, ESA diagram obtained from NASA Spacelink ¤

Daniel Cave

The Enterprise

Have you ever wondered what happened to the Enterprise? (The Space Shuttle that is, not the starship!)

Well, after it had completed the design tests for which it was constructed, it made a series of appearances at air shows around the United States, Canada and Europe before being put into storage. It is now awaiting the construction of a museum annex to the Air and Space Museum where it will be placed on show along with other historic aircraft. ¤

Daniel Cave

The Liberation Monument - Part 2 - by David Le Conte

The shape of the top of the obelisk

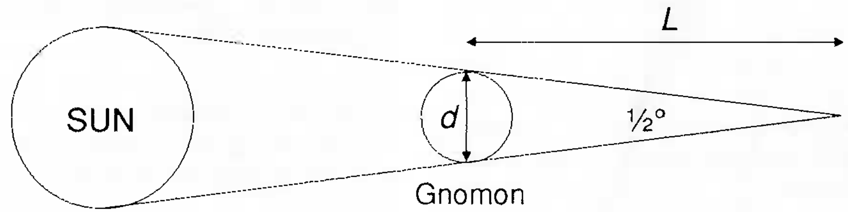
In the last issue, I described the calculation of the various accuracies required for the Liberation Monument, the prediction calculations, the plots of the path of the tip of the shadow of the obelisk, and the experiments carried out to determine the accuracy of the predictions.

During the conduct of the experiments the effect of the appearance of the shadow, ie its umbra and penumbra, on the observations was noted. Dr. Peter J Andrews of the Royal Greenwich Observatory pointed out that the design of the gnomon or obelisk is important insofar as it affects the appearance of the shadow and therefore the accuracy of the device. In order for a shadow to have an umbral core the apparent width of the gnomon must exceed ½°, which is the apparent angular width of the Sun.

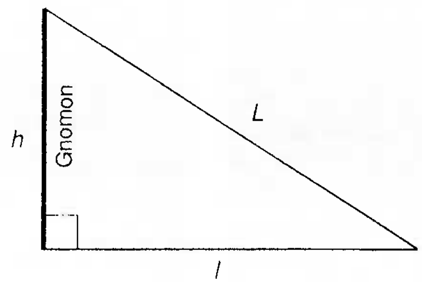
As we are interested in the tip of the shadow, rather than the entire shadow, the width of just the tip of the obelisk is the deciding factor in the appearance of an umbra. The required dimension d is dependent upon the slanting shadow length L, and therefore varies with the altitude (and therefore the azimuth) of the Sun. It is given by the formula:

$$d = 0.00873\,L$$

(since 0°.5 = 0.00873 radians). L is given by: $L = (h^2 + l^2)^{1/2}$. See the figures below. »»

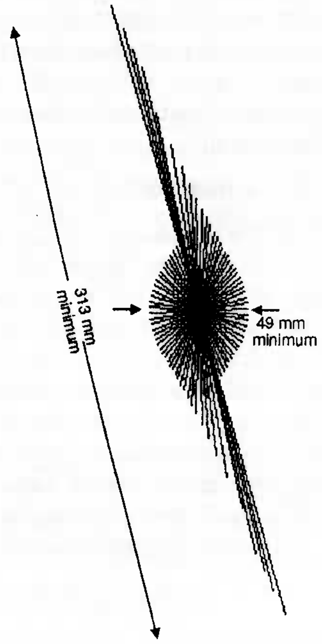


Calculation of minimum width of gnomon to cast an umbra



Calculation of slanting length L of shadow

The required width of the obelisk was calculated for a number of times throughout the day. A schematic representation of the top of the obelisk, based on the azimuths and calculated minimum widths necessary to cast an umbra, is shown below. It is not the shape of the top of the obelisk, but a mathematical plot from which a possible shape can be derived.



Schema of top of obelisk

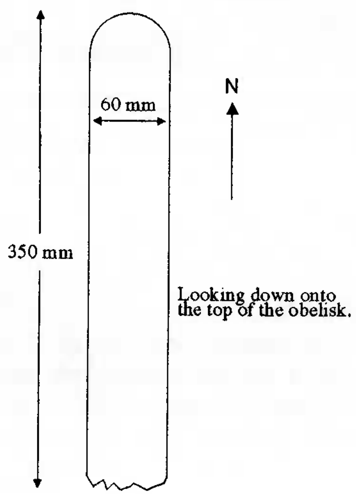
The calculations show that, in order to cast an umbral shadow, the width of the top of the obelisk must be at least 313 mm at 0540 UT, 199 mm at 0600 UT, and 49mm at 1200 UT. The tip of the shadow at these times will be a point at the predicted position. In practice, a width of about 350 mm (250 mm if an umbral shadow is needed only from 0600 UT) in the north-south plane, and about 60 mm in the east-west plane, should be sufficient.

A possible shape is shown in the figure below. However, the chosen shape should be determined by experimentation and artistic considerations. The top need not be flat, but:-

(a) the edges defining the shadow must lie in the same horizontal plane; and

(b) any projection above that plane must not protrude between the Sun and the edge which defines the shadow at that time.

It may be desirable to take into account the effect of the shape of the top of the obelisk on the apparent shadow length. As the top will not be a point, the length of the shadow will properly be measured from the edge which casts the shadow. This will have the effect of increasing slightly the distance of the shadow tip from the point on the obelisk from which the calculations were done; essentially a shadow "lengthening" effect.



Possible shape of top of obelisk

Time of the surrender of the German forces

It is proposed that the seating will be marked at the position of the time corresponding to the signing of the surrender. As the signing took place very early in the morning, the exact time of the event is critical in order to use the correct shadow length and therefore position on the seating.

In his official history of the occupation years, Charles Cruickshank records that:

"*Southern Command were told that the surrender instrument would be signed at dawn, and they were asked to put Operation 'Omelet' in hand forthwith. The surrender was duly signed by Heine* [Generalmajor Heine, German commander of Guernsey] *on the quarterdeck of the Bulldog at 7.14 a.m. on 9 May.*"

The Archives Service of the States of Guernsey Heritage Committee has advised the author that a copy of the surrender document in the possession of the Bailiff of Guernsey shows 0715 as the time of signing, and they have expressed the view that the time reported by Cruickshank could be a misprint. In their view, following a comparison of handwriting, the time was written in by Brigadier Snow, Commander, British Forces, Channel Islands, who signed the surrender instrument with Generalmajor Heine. A copy of the surrender document in the Guernsey Occupation Museum similarly shows 0715 as the time of signing.

The Archives Service says that six copies in English were signed, and two in German. With so many copies to be signed by two men, the signing could well have taken more than one minute, and different times put on different copies. However, as the two copies known to the author in Guernsey both show 0715, that is the time selected to commemorate the signing of the surrender on the seating of the Liberation Monument.

It has been agreed that the times shown on the monument should relate to current British Summer Time, ie the local time in use on May 09 in the year, 1995, in which the monument is to be erected. It is recognised that the local time in common use may change in the future (for example if Guernsey moves to Central European Time), and that the time zone in use in 1945 was also different from that used today. However, it is felt that, as the monument is intended to commemorate the 50th Anniversary of the Liberation, it is quite appropriate for 1995 standard local time to be used.

Consideration was briefly given to using the time in use in 1945. However, this would create a further problem, at least insofar as marking the time of the surrender. The signing was to have taken place at dawn. Sunrise on 1945 May 09 took place at 0435 UT. It is understood that the British were using Double Summer Time (ie two hours ahead of GMT or UT), and the Germans were an hour ahead of that time, to coordinate with the time in Germany. One of the first orders given by the Commandant of the German Forces in Guernsey, after occupying the Island on the 30 June 1940, was that:-

> "*All clocks and watches are to be advanced one hour as from midnight of the 2nd/3rd July, 1940, to accord with German time.*"

(The Star newspaper, Guernsey, Wednesday, July 3, 1940.)

The question (more of academic interest rather than of practical application) may therefore be asked: *what was the time of surrender in UT?* It would appear reasonable to presume that the recorded time was based on the time in use by the British Forces, and it is assumed that this was Double Summer Time. "0715" would therefore have been 0515 UT, some 40 minutes after sunrise. At that time the shadows would have been very long. The shadow of a gnomon 5.55 metres high on 1995 May 09 at 0515 UT would be over 60 metres long, too long for the scale of the proposed monument.

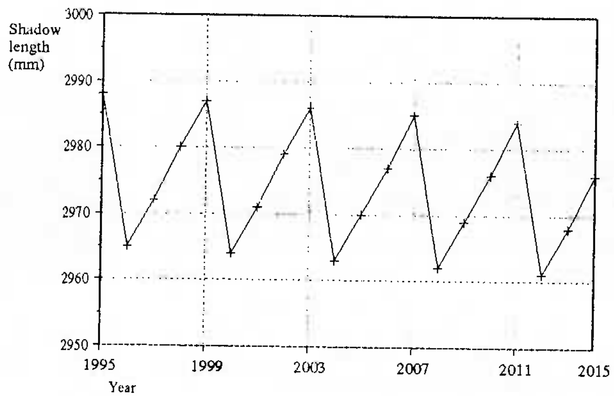
Therefore, the selection of one hour later, 0615 UT, when the shadow will be just 18½ metres long, and BST in 1995 as the standard time to be used for the monument, seems a sensible decision.

It might be possible to change the time markings if Guernsey changes to Central European Time (ie GMT + 2 hours). However, it would not then be possible to mark 0715 as the time of the surrender, as the earliest time shown by the shadow would be 0740.

The shadow in future years

20 years

Calculations have been made of the shadow length and azimuth for future years. There will be slight variations because of the small changes in the position of the Sun. These variations are cyclical because of the effects of leap years. For example, the adjacent figure shows the effect on shadow length over the next 20 years.



Shadow length at 1200 UT, May 09, 1995 - 2015

The shadow length at 1200 UT on May 09 will decrease by 23 mm in 1996 (a leap year), but will revert to approximately its 1995 value over the following three years. There is thus a 4-year cycle, coinciding with leap years. Over the same period, the shadow azimuth at 1200 UT on May 09 will vary by only 0°.02.

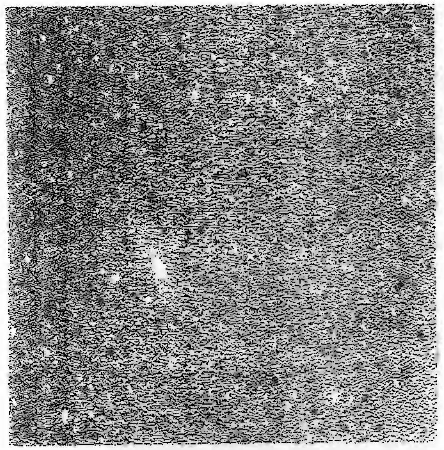
Next time we will look at the changes in shadow length and azimuth over periods of 500 years and 4000 years! And we will learn something about the Gregorian calendar. As a taster, however, note that each century a leap year is skipped, but every fourth century year is a leap year. Years divisible by 100 are not leap years in the Gregorian calendar, unless they are also divisible by 400. Thus, the year 2000 is a leap year, but 2100 is not.

Over such a long period weathering of the monument can be expected to affect its accuracy, although that will depend upon the relative weathering of the obelisk compared with the seating (the one depending primarily on climatic erosion and the other on use). ¤

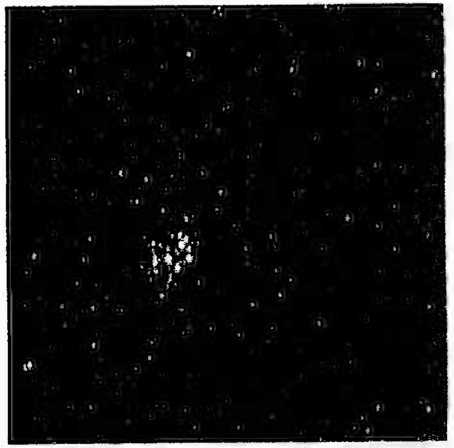
David Le Conte

CCD News

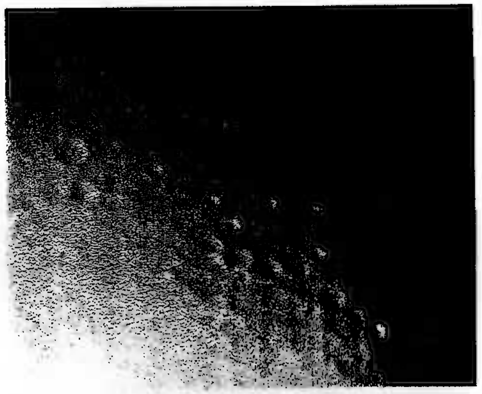
The bad weather in November hindered progress with the CCD imaging system, but December saw a marked change, with several clear nights, and several good images were obtained, primarily by Daniel Cave, using his portable computer. Some examples are show below.



Andromeda Galaxy, 28mm lens. Unprocessed.



Pleiades cluster. 28mm lens. Unprocessed.



Moon. 14-inch, prime focus. With unsharp mask.

Orion Nebula. 14-inch. With unsharp mask.

Potted portrait - Geoff Falla

I was born in Guernsey in 1939, and evacuated with the family to England during the Occupation, living in Plymouth, Tavistock and Bristol, before returning to the Island in 1945. Educated at St Martin's School and Elizabeth College.

I joined the Civil Service in 1959, and worked in the Horticultural Department before transferring to the Cadastre Department at the States Office, now at Nelson Place, Smith Street, where records of property ownership and tax on rateable value assessments are maintained for properties in Guernsey and Alderney.

I was a founder member of the Astronomy Section in 1972. In 1984 I completed an *Astronomy Guide*, a monthly observing guide with a selection of stars and nebulae for the amateur telescope. Apart from astronomy, I have an interest in the general area of unexplained phenomena, which are seen as representing, in many cases, the boundaries and limits of present-day knowledge. I have been a member of the British UFO Research Association (BUFORA) for more than 25 years, with published work. Recently I accepted an invitation to become a member of the Planetary Society, a California-based organisation actively involved in space research.

My hobbies include gardening, walking, and the study of chosen subjects as time permits. ¤

Geoff Falla

Geoff has, of course, been Secretary of the Astronomy Section since 1993.

Letter from Ipswich

I do not intend to compete with Alistair Cooke's weekly Letter from America, but I thought members might be interested to hear about life in East Anglia.

I joined the local Astronomical Society, known as the Ipswich, Orwell Society, in September, and, taking advantage of their generous offer, paid a reduced combined sub that incorporated next year as well!

The Society meets every Wednesday throughout the year, but the various sections also meet on other nights during the week. Meetings are held at the observatory, which houses a splendid 10-inch (250 mm) refractor. Committee meetings are held monthly at the observatory, and are open to members. I have attended one, and found it uninteresting - not surprising really, as I did not know anyone there, and it was really a straight-forward business meeting.

During October the Society held its annual Open Weekend, and this year it coincided with a visit by Helen Sharman to Orwell Park School, where she gave a Public Lecture. I should have mentioned that the observatory is part of a rival school called Orwell Park, but enough of them. Sadly, I was unable to attend due to illness.

Recently, I took a group of 10 and 11 year-olds from my school on an evening visit to the observatory, where they were given a tour by two experienced members, followed by an observing session. We were very lucky as the skies cleared and gave us excellent views of Saturn and the Andromeda Galaxy. Later, we went outside to carry out some constellation spotting, where we were joined by their parents.

I hope to play a more active part in the life of the Society after Christmas, as this term I have been attending a word processing course on Wednesday evenings.

My copies of *Sagittarius* keep me in touch with you all, and I always look forward to reading the various articles. As I am writing this at the end of November, and you will not read it until January, may I wish you all a Very Happy and Clear Night Skies New Year. ¤

David Williams

Microcosm

From time to time we will be including some of the poetry of K V Bailey, who lives in Alderney. His writing includes poems with a space theme, such as the following, entitled *Microcosm*.

How high must an astronaut be
Before he dwindles Alderney
First to a speck, then to a trace
Of foam between the Swinge and Race?

Would great glass set on Ganymede
Pick out as snow the birds that breed
Feathered and warm, by ledge and crack
Over the face of Les Etacs?

Could starship passing Pluto guess,
Screening Earth's watery wilderness,
Gauging its oceans, creeks and bays,
That, centred in the tidal maze.

Where Eurasia's battered front
Meets and headlong bears the brunt
Of storm and wind, an island lies
Unsuspected from the skies?

It is itself a tiny world
Alone. Against the wave-crests hurled
Upon its rocks it shields its own,
Its wastes, its pastures, and its sown.

Its tethered silky cows, its goats,
Its town, its safely harboured boats,
Its life - a microcosmic state
Where great is little, little great.

If gods or avatars there be
Probing the interstellar sea,
If creatures are surveying us
From Crux or Sagittarius,

They may ignore the superpowers,
May set their gaze on gulls and flowers
And deem the by ways of St. Anne
More universal emblems than

The Kremlin's terraced river view
Or Pennsylvania Avenue.
The message of the island's scars
May then be carried to the stars,

But carried also signs that tell
Of gorse and granite, wing and shell,
That register the interplay
Of land and water, cliff and spray,

So that this isle - its scudding ships,
Its daisied grasslands, tidal rips,
Burhou, the Casquets, image-wise
May signal Earth to alien eyes.

Kenneth Bailey admits to having an "amateurish" attachment to astronomy. He was for many years a member of the BAA, and attended its meetings regularly when he worked for the BBC in London. He has written elementary books for children on the subject. He says that he and his wife are hooked on the solar eclipse and have travelled the world in pursuit of them. He also writes on science fiction for journals, magazines and academic symposia. ¤