ORWELL ASTRONOMICAL SOCIETY IPSWICH

Charity No 271313

MARCH 2003

Society News

1 Next Committee Meeting

The next committee meeting will be held on Saturday 15th February at 19:30 in the clubroom. This is an open meeting and any one who is interested is invited to attend.

2 Events for 2003

Lecture Meeting Friend's Meeting House, Fonnereau Road	Provisional talk by Martin Lunn	No date fixed
Astronomy Workshop	**Hertsprung Russell Star Sequences** Presented by Paddy O'Sullivan	Wednesday 5th March
First Presidential Lecture	Dr. Allan Chapman **The Victorian Amateur Tradition** At Orwell Park School Location in the hall to the right of the School's entrance foyer	Friday 7th March 19:30 start arrive by 19:15
Open Weekend	Very provisional Observatory only open	May be around Easter
Astronomy Workshop	**Comets, Asteroids and Impacts** Presented by Richard Lyzinski	Wednesday 2nd April
BAA Winchester Weekend	King Alfred College Winchester	Friday 25th to Sunday 27th April
Mercury Transit		Wednesday 7th May
Astronomy Workshop	**Radio Propagation** Presented buy Paul Whiting	Wednesday 7th May
Web Society Annual Meeting	Sackler Lecture Theatre Institute of Astronomy Cambridge	Saturday 17th May
BAA Exhibition Meeting	The Cavendish Laboratory Madingley Road Cambridge	Saturday 28th June
Summer Excursion	No destination yet decided	No date yet decided
Summer Barbecue	Ken Goward's garden Tuddenham	Provisional date Saturday 19th July
National Astronomy Week	No programme yet decided	23rd to 30th August
Joint meeting with the SPA	This meeting is still in the planning stage	Saturday in September
Equinox Star Party	Thetford	26th to 28th September
Christmas Meal	Provisional dates 10th or 17th December	No venue decided

3 Membership Subscription for 2003

Subscriptions for 2003 are due from 1st of January. If you have already paid please ignore this request.

The rates for 2003 are:

Junior & Concessionary	£11.00
Adult	£15.00
Family	£17.00

A renewal form was included with the January Newsletter. Return this form with your 2003 subscription, so that the society membership records can kept up to date.
Please make cheques & P.O.'s payable to the: -

ORWELL ASTRONOMICAL SOCIETY (IPSWICH)

Please return all subscriptions **with the renewal form** that was included in January's Newsletter to Martin Cook

4 FAS (Federation of Astronomical Societies) Newsletter

The FAS distributes a quarterly newsletter to all member societies. As we are classified as a large society we receive 30 copies. In recent months these Newsletters have been left at the observatory for interest members to take. This still leaves the majority of members with out access to a copy, unless they visit the observatory on a regular basis.

The FAS are now proposing that Paid Up Societies and their members can have these Newsletters emailed to them in PDF format (an Adobe Acrobat reader will be required to read these).

If this option is taken up we will receive fewer printed copies.
The FAS Newsletter co-ordinator & distributor is Dave Doc Sutton

His email address is doc@tmslws.fsnet.co.uk
If you do email him please mention that you are a member of the Orwell Astronomical Society

Night Sky

All times GMT

Sun

The sun will be rising approximately between	06:50 to 05:40
The sun will be setting approximately between	17:30 to 18:30

Moon

New Moon	1st Quarter	Full Moon	3rd Quarter
3rd	11th	18th	25th

Mercury Mercury will be at superior conjunction on the 22nd

Venus Venus will be rising about an hour before the sun this month. It remains in bright morning twilight sky until superior conjunction in August Magnitude - 4.0

Mars Mars will be rising at about 03:00 by the end of the month. Magnitude 0.5

Jupiter Jupiter will be setting by 04:00 by the end of the month. Magnitude –2.4

Saturn Saturn remains well place to observe this month, in Taurus. It will be setting at about 03:00 by the end of the month. Magnitude 0.0

Uranus Uranus will be rising about 04:40 by months end. Magnitude 5.7
Neptune Neptune will be rising at about 04:00 at the end of the month. Magnitude 7.8

Meteor Showers

There are no prominent meteor showers visible this month

OCCULTATIONS DURING MARCH

The table lists stellar occultations which occur during the month under favourable circumstances. The data relates to Orwell Park Observatory, but will be similar at nearby locations.

D / R	Date & Time (UT)	Lunar Phase	Sun Alt (°)	Star Alt (°)	Star	Mag
D	05 Mar 18:25	0.06+	-8	16	ZC 128	7.0
D	07 Mar 18:49	0.19+	-11	32	ZC 355	7.4
D	08 Mar 18:58	0.27+	-12	40	Hip 14863	7.5
D	08 Mar 19:32	0.27+	-17	36	ZC 466	7.3
D	09 Mar 19:47	0.36+	-19	43	ZC 595	6.8
D	10 Mar 20:54	0.45+	-28	43	ZC 734	6.6
D	10 Mar 22:27	0.46+	-38	29	Hip 22972	7.5
D	12 Mar 00:02	0.56+	-42	24	ZC 893	7.5
D	13 Mar 00:08	0.66+	-41	31	QU Gem	6.8
D	13 Mar 01:17	0.67+	-39	21	ZC 1049	6.8
D	13 Mar 01:39	0.67+	-37	18	Hip 33054	7.4
D	13 Mar 02:29	0.67+	-33	11	37 Gem	5.7
D	13 Mar 20:42	0.75+	-25	62	Hip 37434	7.2
D	14 Mar 01:00	0.76+	-39	31	ZC 1180	7.1
D	14 Mar 01:53	0.76+	-36	23	Hip 38287	7.1
D	16 Mar 19:49	0.96+	-17	38	46 Leo,ES Leo	5.4

James Appleton

Astronomy on a shoestring – The end in sight? – Part Three

Even though I had virtually memorised the instructions and techniques for silvering a mirror, I was well aware that if in the process things went wrong I could either poison or maim myself. I was therefore particularly careful about this phase of production. I had read the rules so many times – and had by now also obtained a copy of the Matthewson book – that I thought I could cope. My greatest care was protecting myself from acid burns or producing a dish of silver fulminate – today's equivalent of Semtex – that could demolish our kitchen at home and me with it.

I was astonished at how well the whole operation went. I noted that the books said that a silvered surface will probably only be much good for a couple of years, but my original silver coating – though very dull the last time I looked – is still intact today – fifty years on. I suspect however, that its efficiency is at rock bottom when it comes to light gathering

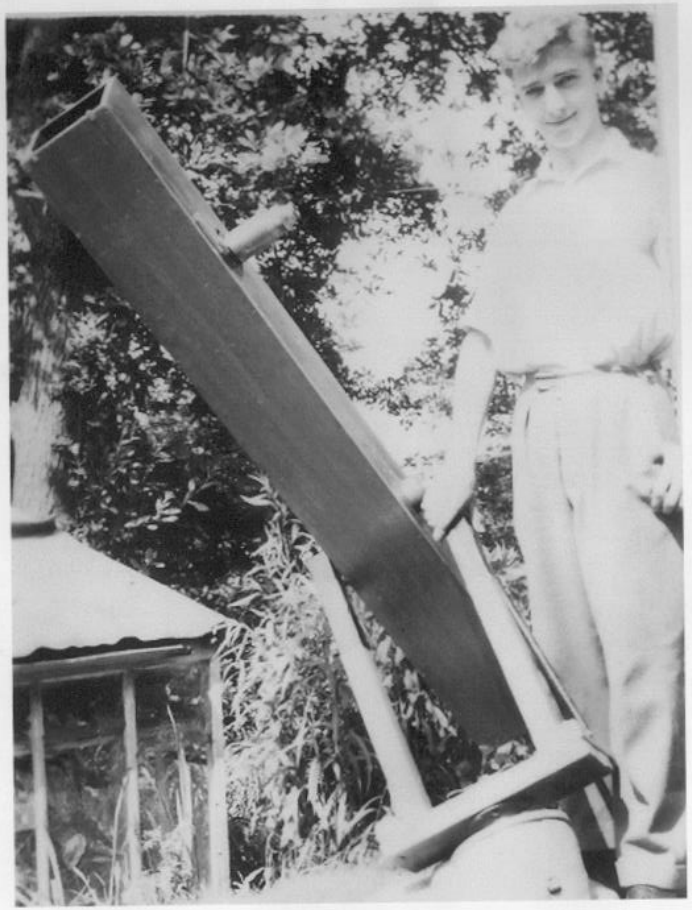
Over the remaining months the equatorial fork mounting took shape and was carefully balanced, using a car stub axle at its centre. The mirror was fixed and a spider made from hacksaw blades that would hold the ex-army right-angled secondary prism. Whilst most things were home-made, I had to resort to buying two eyepieces to supplement my own ex-military optics. It gave me a fine x100, x150 and x300 instrument.

In the years from around 1952 to 1954, when the former Ipswich Society was in its most active phase, a group of us spent many hours cleaning, renovating and decorating the long neglected Orwell Park Observatory. For probably the first time in over a decade, it was brought back into use as a serious piece of astronomical equipment. Part of the decline in the Ipswich Society was brought about, when due to the death of the Secretary and ill health of the Treasurer, the School – under new management – withdrew consent for members to use the telescope. I suspect its condition rapidly and tragically declined until it was again rescued by this Society.

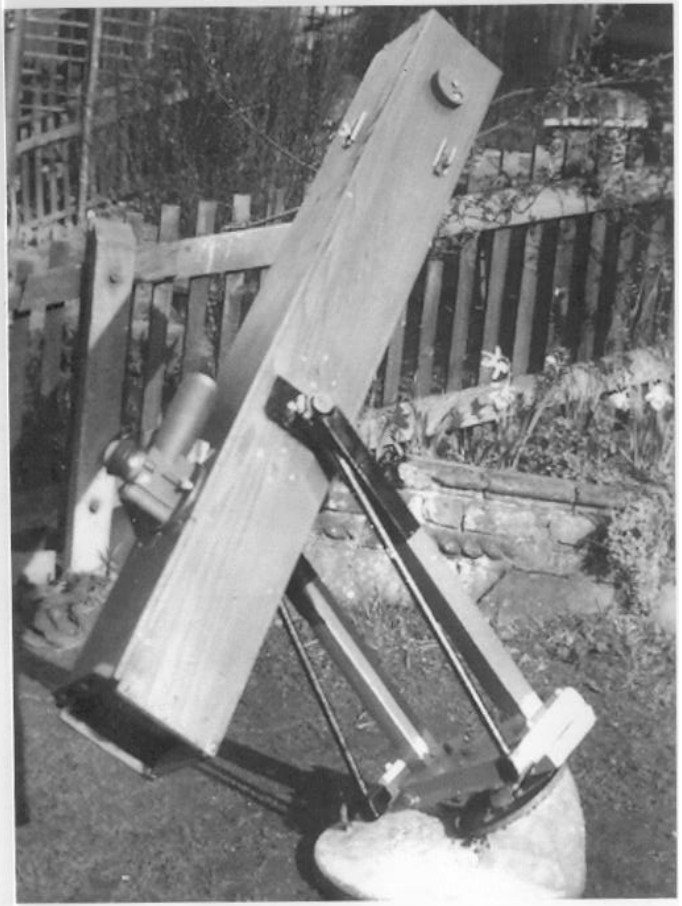
I spent hours in the years that followed the completion of my telescope, scanning the night sky for objects of interest and wonder. It was during my National Service that the old Society was put into serious difficulties as detailed above. Too few active members remained for it to be viable and despite all the work that had gone into the repair and decoration of the observatory at Orwell Park, the Society was finally disbanded in around 1957.

Although I still have all the parts, and in that sense it is still operational, my telescope has not been used for several years due to virtually impossible sky conditions where I live. Perhaps some day I will get it out of mothballs – and maybe give it away.

John Barbrook



Finished 6 inch - 1953



Finished equatorial mount

LUNAR OCCULTATION OBSERVATIONS 1992 - 2002

Introduction

An occultation occurs when an object passes in front of another object so as obstruct the observer's view of the latter. Bodies in the Solar System occult stars and occasionally occult one another (e.g. mutual occultations of Galilean satellites of Jupiter). The most frequent and readily observed type of occultation, termed a lunar occultation, occurs when the Moon passes in front of a star. Occultations by other bodies in the Solar System are much less frequent than lunar occultations, because other bodies present a much smaller angular diameter than the Moon and move more slowly through the sky.

Each day, the Moon travels approximately 13° along its orbit, moving from West to East in the sky. This motion causes the Moon to occult background stars. When the Moon occults a star, the star appears to disappear behind the eastern limb of the Moon and reappear later on the western limb. Because the Moon has no atmosphere, generally disappearance happens suddenly with no preliminary fading and reappearance is equally sudden. Two exceptions to this rule occur in the case of stars with large angular diameter and stars composed of two or more close components.

The Moon's orbital dynamics are such that it is confined to a strip of the sky centred on the ecliptic (the plane of the Earth's orbit around the Sun) with a width of ±6.75°. This strip is referred to as the Zodiacal Band, since it passes through the 12 constellations of the Zodiac. The following extract from a star chart illustrates the limits of the Zodiacal Band as it passes through the constellation Taurus.

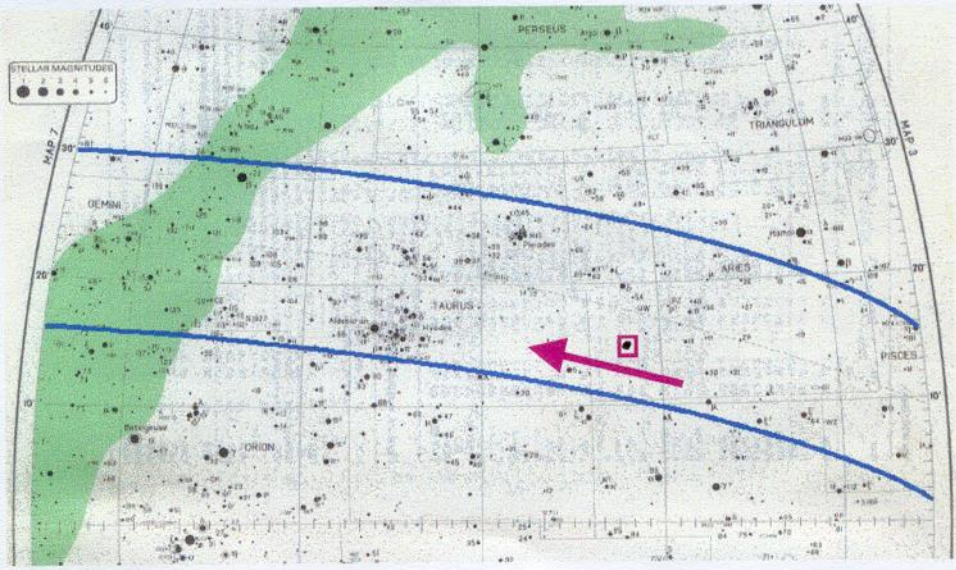


Figure 1. Zodiacal band through Taurus.

Note that the sizes of stars in the map are exaggerated: in reality the stars appear simply as points of light. The Moon is shown to scale inside the small square: note how small it appears in relation to this portion of the Zodiacal band. The arrow (to scale) indicates the extent of the Moon's average daily motion.

There are approximately 850 naked eye stars which the Moon can occult, including the four first magnitude stars: Aldebaran, Spica, Antares and Regulus. (The first magnitude star Pollux lies just outside the band of stars which can be occulted.) Table 1 summarises the stars which are subject to lunar occultations. Note that occultations of most naked eye stars in fact need binoculars or a telescope to be observed: this is to overcome the glare from the Moon.

Magnitude	No of Stars in Zodiacal Band	Visibility of Occultation
1	4 (Aldebaran, Regulus, Spica, Antares)	Naked eye
2	4 (β Tauri, γ Geminorum, δ Scorpii, σ Scorpii)	Naked eye
3	20	Naked eye / binoculars
4	77	Binoculars
5	201	Binoculars / telescope
6	623	Telescope
7	1750	Telescope
8	4,744	Telescope
9 and fainter	~100,000	Telescope

Table 1. Stars subject to lunar occultations.

Timing a lunar occultation event (stellar disappearance or reappearance) establishes a relationship between the following quantities:

- The position of the Moon (determined by its orbital parameters).
- The local topography of the lunar limb.
- The co-ordinates of the star (generally derived from the star's co-ordinates at a standard epoch together with its proper motion vector).
- The observer's location in relation to the Moon (determined by his topographic co-ordinates and the rotation of the earth).
- The observer's personal reaction time (if making the observation visually).

Until recent years, professional astronomers observed lunar occultations in order to improve theories of the lunar orbit, to refine knowledge of the lunar limb and to study the rotation of the Earth. Observations of occultations also sometimes revealed errors in the position or proper motion of stars and the existence of unsuspected double or multiple stars. Nowadays, advances in determination of the lunar orbit, lunar mapping and stellar astrometrics have rendered lunar occultations largely redundant from the point of view of professional astronomers. However, lunar occultations continue to provide an interesting and rewarding spectacle for amateur observers.

Prediction Of Lunar Occultations

Observers need predictions of lunar occultations in order to know when to observe them. The wide availability of powerful computers means that it is possible for any amateur astronomer with suitable software to generate predictions. Organisations such as the BAA and IOTA (International Occultation Timing Association) provide PC packages which are easy to install and use and which generate accurate predictions. The BAA and IOTA websites and the monthly astronomy magazines publish predictions of lunar occultations (see [1], [2] and [3]).

The principal factors determining the circumstances of a lunar occultation of a star are the location of the observer, the position of the star and the position of the Moon. In order to calculate the precise circumstances numerically, it is easiest to work with a projection onto the fundamental plane. This is the plane running through the centre of the Earth perpendicular to the line from the star to the Earth. Standard formulae are available to relate geocentric co-ordinates to projections in the fundamental plane. An occultation corresponds to an overlap of the projections of the Moon and the observer in the fundamental plane.

I use a complex suite of computer software to predict lunar occultations of stars. The software is based loosely on the algorithm *Occult* in [4]. However, numerous enhancements have proved necessary to improve accuracy and to filter out predictions occurring under unfavourable circumstances. The software first performs an approximate search along stars within a narrow band of the ecliptic for potential occultations. It then examines the circumstances of each of the potential occultations in detail (using the approach described above). If a potential occultation does actually occur, and the overall circumstances are favourable for observing, the software applies a correction to the predicted event time based on the local topography of the point on the lunar limb associated with the occultation.

Until about a dozen years ago, it was difficult to generate accurate predictions of lunar occultations. However, in recent years most of the principal causes of inaccuracy in occultation predictions have been effectively eliminated. I adopt the following approach to the main components of the prediction software to ensure maximum accuracy:

- Lunar ephemerides

  NASA JPL (Jet Propulsion Laboratories) distributes lunar ephemerides which enable calculation of the position of the Moon with extreme accuracy (see [5]). For maximum accuracy, I use the ephemeris DE-405 which is the most accurate currently available.

- Star catalogues

  In 1997, ESA (the European Space Agency) published the results of its *Hipparcos* star mapping mission [6] which produced the raw data behind the Hipparcos and Tycho star catalogues. *Hipparcos* provided astrometric data of unprecedented accuracy: stellar positions accurate to sub-milliarcsecond (mas) levels to magnitude 9.0 and to 25mas for fainter stars. I use the Hipparcos and Tycho-2 reductions of the star mapping data. However, proper motion (pm) data for Tycho-2 stars was obtained over a very short timescale and is not particularly accurate, so I use pm data from the ACT catalogue [7] where available for Tycho-2 stars. I use the PPM [8] catalogue to provide coverage in areas of the sky that Hipparcos/Tycho-2 do not cover in depth. Finally I use data from IOTA's XZ94D catalogue for 11 variable stars that are not represented correctly in the other catalogues. Note that stars from the Hipparcos and Tycho-2 catalogues account for over 99.78% of the stars used to predict lunar occultations; the PPM and XZ94D catalogues make up the remainder.

- Lunar limb data

  Deviations in the local lunar limb profile from the average spherical profile can affect a "typical" occultation time by several seconds, and even more for occultation events that are close to grazing. Although IOTA began a project to provide modern, accurate lunar limb profile data based on the results of the Clementine moon mapping mission (1994), the work has not been completed so at present occultation predictions are forced to rely on data generated by C B Watts (1889-1971), an American astronomer, many decades ago. Watt's data is of variable quality and is known to have several significant deficiencies and currently represents the biggest obstacle to producing consistently accurate predictions for all occultation events.

Observation Of Lunar Occultations

The observability of an occultation depends on the following parameters:

- Moon waxing or waning. When the Moon is waxing (phase increasing) the leading limb is unlit. This provides good contrast against the star as the limb approaches and eventually passes in front of it. Conversely, a waning Moon is best for observing the reappearance of the star after an occultation, since the following limb of the Moon is then unlit.

- Age of the Moon. A young Moon is best for observing occultations, since the glare caused by the Moon is correspondingly reduced. When the Moon is very young, earthshine provides faint illumination of the dark portion, enabling the observer to judge the distance between the Moon and star and prepare for the actual moment of occultation.
- Magnitude of the star. In general terms, the brighter the star the easier it is to observe against the Moon's glare as the lunar limb approaches prior to disappearance or recedes following reappearance. Brighter stars therefore generally enable the observer to make a more confident timing.

Observations By OASI Members

During the years 1992 - 2002, I encouraged observation and timing of lunar occultations by members of OASI and requested that observers send me reports of their observations. This activity has now been running for over a decade, so it seems appropriate to draw together the conclusions of the work to date.

Table 2 gives a summary of occultations observed and reported to me during the years 1992 – 2002. Table 2 summarises a total of 241 observations. However, in approximately one quarter of cases circumstances were problematic either in terms of poor weather conditions resulting in low confidence in reported timings, ambiguity in the star, or other confusion over reporting the exact time of the event. Deleting the problematic cases leaves 187 observations for which weather conditions were acceptable, the star was identified unambiguously and the observer had reasonable confidence in the reported timing.

Year	No of Obs	Observers & Observations
1992	4	Unspecified observers at Orwell Park Observatory using the Tomline Refractor.
1993	8	6 observations by unspecified observers at Orwell Park Observatory using the Tomline Refractor. 1 observation by Mike Harlow at Felixstowe using a 10" reflector. 1 observation by Dave Payne at Wickham Market using a 16" reflector.

Year	No of Obs	Observers & Observations
1994	13	1 observation by James Appleton at East Ipswich using a 4.5" reflector. 9 observations by Martin Cook at East Ipswich using a 4.5" reflector. 1 observation by Pete Richards at Orwell Park Observatory using the Tomline Refractor. 2 observations by Alan Smith at Orwell Park Observatory using the Tomline Refractor.
1995	63	3 observation by James Appleton at East Ipswich using a 10" Meade SCT (Schmidt-Cassegrain Telescope). 4 observations by James Appleton at Orwell Park Observatory using the Tomline Refractor. 14 observations by James Appleton at Orwell Park Observatory using the 10" Dobsonian reflector. 15 observations by Martin Cook at East Ipswich using a 10" reflector. 1 observation by Martin Cook at Orwell Park Observatory using the Tomline Refractor. 1 observation by Martin Cook at Orwell Park Observatory using a 4.5" reflector. 3 observations by Martin Cook at Orwell Park Observatory using the 10" Dobsonian reflector. 1 observation by Mike Harlow at Orwell Park Observatory using the Tomline Refractor. 12 observations by Mike Harlow at Felixstowe using a 10" reflector. 1 observation by Dave Payne at Wickham Market using a 16" reflector. 1 observation by Pete Richards at Orwell Park Observatory using the 10" Dobsonian reflector. 5 observations by Ian Swann at Ipswich using a 10" Meade SCT. 1 observation by Ian Swann at Orwell Park Observatory using a 4.5" reflector. 1 observation by Ian Swann at Orwell Park Observatory using the 10" Dobsonian reflector.

Year	No of Obs	Observers & Observations
1996	14	11 observations by James Appleton at East Ipswich using a 10" Meade SCT. 1 observation by Martin Cook at East Ipswich using a 10" reflector. 2 observations by Mike Harlow at Felixstowe using a 10" reflector.
1997	68	1 observation by James Appleton west of Ipswich using 10x50 binoculars. 16 observations by James Appleton at Orwell Park Observatory using the 10" Dobsonian reflector. 41 observations by James Appleton at East Ipswich using a 10" Meade SCT. 2 observations by James Appleton at East Ipswich using 10x50 binoculars. 5 observations by Martin Cook at East Ipswich using a 10" reflector. 1 observation by Martin Cook at Orwell Park Observatory using the Tomline Refractor. 2 observations by Dave Payne at Orwell Park Observatory using the Tomline Refractor.
1998	21	10 observations by James Appleton at East Ipswich using a 10" Meade SCT. 5 observations by James Appleton at Orwell Park Observatory using the 10" Dobsonian reflector. 3 observations by James Appleton at East Ipswich using 10x50 binoculars. 1 observation by Martin Cook at Orwell Park Observatory using the 10" Dobsonian reflector. 2 observations by Mike Harlow at Newbourne using a 12" reflector.
1999	12	7 observations by James Appleton at East Ipswich using a 10" Meade SCT. 2 observations by James Appleton at East Ipswich using 10x50 binoculars. 3 observations by Martin Cook at East Ipswich using a 10" reflector.

Year	No of Obs	Observers & Observations
2000	35	3 observations by James Appleton at Orwell Park Observatory using the Tomline Refractor. 10 observations by James Appleton at East Ipswich using a 10" Meade SCT. 1 observation by James Appleton at East Ipswich using 10x50 binoculars. 21 observations by Martin Cook at East Ipswich using a 10" reflector.
2001	2	2 observations by James Appleton at East Ipswich using a 10" Meade SCT.
2002	1	1 observation by James Appleton at Orwell Park Observatory using the Tomline Refractor.
Total	**241**	

Table 2. Observations by OASI members reported during 1992 - 2002.

Comparison Of Predicted And Measured Occultation Times

All the observations reported to me were timed by the observer at the eyepiece either by clicking a stopwatch button and referring later to an accurate time source, by looking away from the eyepiece to read the time from a clock or by calling out the occurrence of the event to a colleague observing a clock. In each case a personal reaction time is involved (two personal reaction times in the case of an observer calling out the event to a colleague looking at the clock). The reaction time of the observer can be up to about a second for an amateur observer with little practice; a skilled observer can achieve less than ¼ second, but this takes much practice.

The personal reaction times limit the accuracy of the timings reported to me and I have therefore rounded all reported event times to the nearest second prior to further analysis.

To complement the empirical data, I have calculated "predictions" (many of them retrospective) for all reported events using the best available stellar position data from the star catalogues described earlier. Figure 2 is a histogram illustrating the spread of timing residuals (i.e. errors) defined as:

measured occultation time – predicted occultation time (in seconds)

for the 187 observations deemed confident.

Figure 2 shows a form that is roughly normally distributed, as would be expected. The median residual is 1 second, most likely accounted for by the reaction times of the observers.

I have analysed the data at length to look for any relationship between difficulty of the observation (represented by magnitude of the star and/or phase of the Moon) and magnitude of the residual; however all such analyses have proved negative.

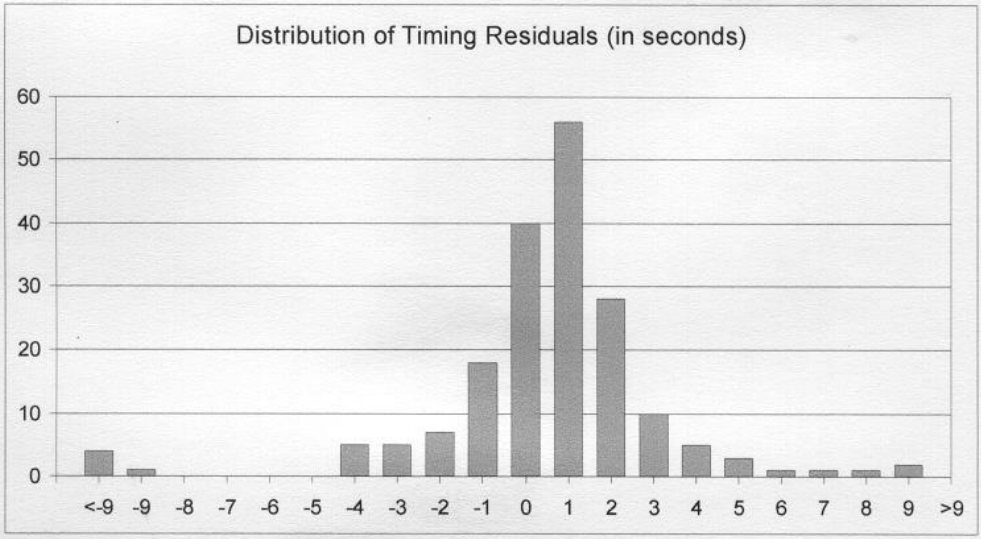


Figure 2. Distribution of timing residuals.

Analysis Of Timings For Individual Observers

If one regards the lunar limb profile as known (or its effect approximately averaged out over multiple observations) then the residuals in occultation timings are associated entirely with the observer's personal reaction time.

Table 3 compares the residuals for all observers who reported more than one occultation during the decade 1992 – 2002. It lists the number of observations by each observer, the observer's mean residual and the observer's standard deviation of residuals. The latter quantity may be thought of as a measure of the consistency of the observer's timings. Top observer according to this table is clearly Martin Cook, who achieved a large number of observations together with a relatively small average personal reaction time (mean 0.5 seconds) and a good consistency of reaction time (low standard deviation).

	Appleton	Cook	Harlow	Payne	Swann	Smith
No observations	92	54	16	4	7	2
Mean (sec)	0.8	0.5	-0.8	1.0	0.3	1.0
Std Dev (sec)	2.9	1.5	8.2	0.7	1.2	0.0

Table 3. Comparison of occultation observers' residuals.

Estimation of ΔT (Delta T)

Universal Time (UT) or Greenwich Civil Time is based upon the rotation of the Earth. UT is required for civil life and in the time of those astronomical phenomena involving local hour angles. However, the Earth's rotation is generally slowing down and moreover is subject to unpredictable irregularities (some associated with movements of masses within the liquid core of the Earth).

Astronomers need a uniform time scale to predict astronomical phenomena such as planetary orbits, lunar occultations, etc. From 1960 to 1983, Ephemeris Time (ET), based on the motion of the planets provided this uniform time scale. In 1984, Dynamic Time (DT), based on atomic clocks, effectively superseded ET; however, DT may be thought of as a continuation of ET.

The quantity ΔT, pronounced "delta T" provides the link between the variable timescale of civil life and the constant timescale of astronomical phenomena. Mathematically, ΔT is defined by $\Delta T = ET - UT$. The exact value of ΔT cannot be predicted in advance and can only be deduced retrospectively from observations.

The BAA and other astronomical organisations produce estimates of ΔT retrospectively based on the movements of the planets. It is possible to analyse the results of occultation timings to estimate ΔT and its change over the years. The method is complex (see [4]) but in essence each timing of an occultation event can be used to estimate a value for ΔT. By plotting individual estimates of ΔT against the date of the observation and calculating a best fitting straight line, it is possible to smooth out the variability of the individual data points and estimate the variation of ΔT over time. Figure 3 illustrates the estimates obtained by this means (excluding three outliers) together with the best fitting straight line. Table 4 illustrates the corresponding estimates of ΔT together with the values adopted by the BAA (based on a straight line fit to values in the BAA handbook over the period 1990 – 2002) – agreement is excellent!

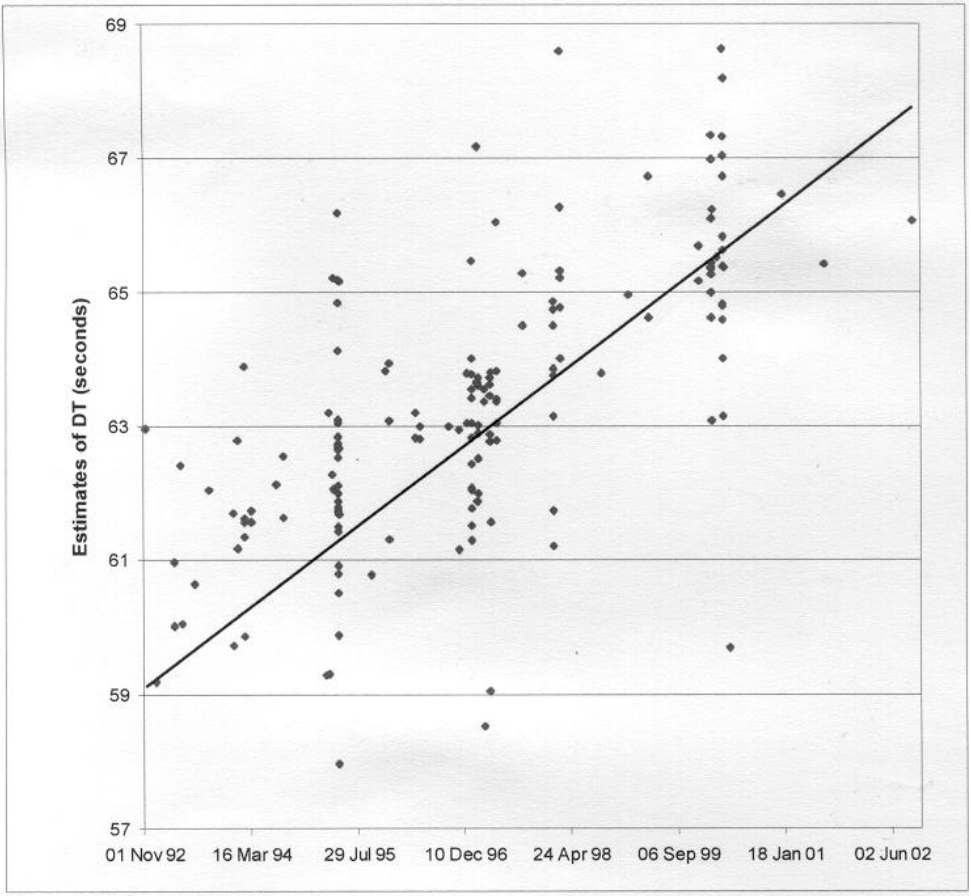


Figure 3. Estimates of ΔT.

Source	Estimate of ΔT (seconds)
OASI	59.3 seconds at the start of 1993 Increasing by 0.88 seconds *per annum* thereafter
BAA	59.0 seconds at the start of 1993 Increasing by 0.88 seconds *per annum* thereafter

Table 4. Estimate of ΔT compared with BAA adopted values.

Outlook For The Decade 2003-2012

The coming decade promises many good opportunities for observing lunar occultations.

The Moon's orbit is defined by a range of periodicities, both short and long term. The short term periodicities mean that the Moon's path through the sky tends to follow a pattern whereby it almost repeats itself every month. However, the longer term periodicities gradually shift the orbit so that no particular pattern of approximate repitition can last more than a few years. This results in so called "occultation seasons", lasting for some years, during which particular stars are repeatedly occulted, or repeated not occulted.

The effect of occultation seasons is most obvious for the brightest stars that can be occulted, particularly the four first magnitude stars Aldebaran, Spica, Antares and Regulus. We are currently in an occultation season when no first magnitude stars are occulted. Of the first magnitude stars, only Regulus is subject to occultations visible from East Anglia during the coming decade, with two occultations in October 2007. The next occultation of a first magnitude star after Regulus does not occur until September 2015 when an extensive series of Aldebaran begins.

Another visually appealing spectacle is that of the Moon occulting the Pleiades. The next occurrences of this phenomena are in September and December 2006.

References

[1] http://www.ast.cam.ac.uk/~baa/

[2] http://www.lunar-occultations.com/iota/iotandx.htm

[3] http://sorry.vse.cz/~ludek/mp/results/

[4] *Astronomy On The Personal Computer*, 2nd edition, O Montenbruck and T Pfleger, Springer-Verlag, 1994.

[5] http://adc.gsfc.nasa.gov/adc/

[6] http://sci.esa.int/hipparcos/

[7] ftp://adc.gsfc.nasa.gov/pub/adc/archives/catalogs/1/1246/ReadMe

[8] http://cdsweb.u-strasbg.fr/cats/I.htx

James Appleton

08 January 2003

Millennium Telescope Update

On Saturday 16th November, the wooden side bearings and secondary cage of the MMT were cut from 18mm HVHC (Hardwood Veneer Hardwood Core) plywood. The timber had already been obtained from Holdens located on Duke St, near Ipswich Docks and delivered to Gary Coleman's house. Gary marked out the dimensions as specified by Paddy O'Sullivan onto the timber and cut the parts to shape using a plunge router in his garage. Here are some photographs from this occasion.

The first stage was checking out the measurements of the parts marked on the timber as per the specified dimensions. This was critical, as once the cutting commenced, it was too late to make any last minute changes. At least 45 minutes was spent on checking the dimensions of each component. A few alterations were made proving this was time well spent.

Figure 1 - Checking the measurements

At this stage, it's worth mentioning a few words about the router and jig. The accompanying photo shows a close-up of the underside of the router. The router used was a plunge router and the cut depth was set around 3mm each time a cut was made requiring multiple passes of the router to cut through the timber completely. This was so as to avoid lots of swarf/sawdust each time and to minimise the effects of overheating. Its cutter, a tungsten carbide tip provided an extremely clean vertical repeatable cut. The router was coupled via a hose to a vacuum cleaner which automatically turned on immediately the router was powered on and off a few seconds after the router was powered off. Gary fabricated a jig or template pre-marked with the centres for each cut for the side bearings and secondary cage (inner and outer). The jig was attached to the plywood sheet via a screw for each cut to ensure a clean circular cut.

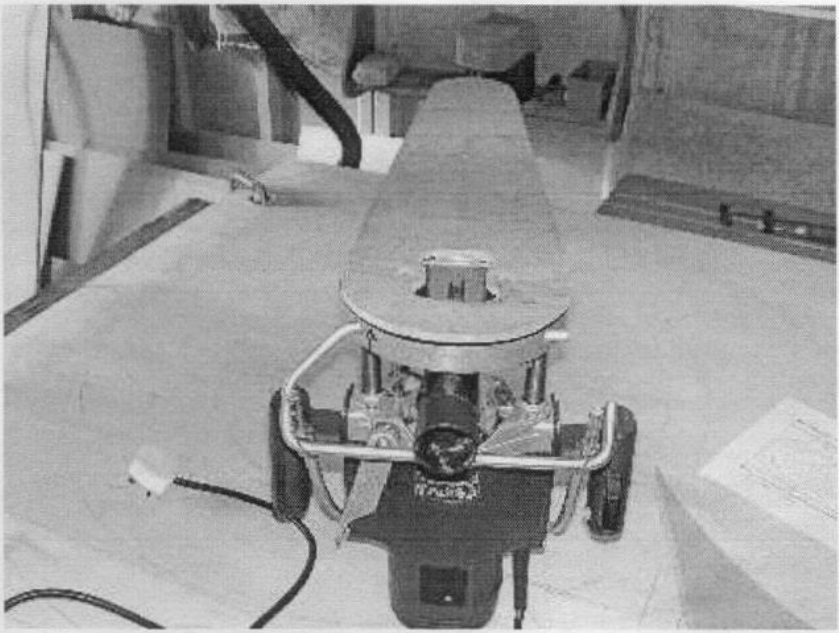


Figure 2 - Closeup of Router and Jig

The next shot on the following page shows Gary repositioning the jig for a differently sized cut.

Figure 3 - Resetting Jig for a different sized cut

Despite the vacuum cleaner, it was still necessary following each cut or router pass to clean the timber of swarf and sawdust. A chisel was also used to remove the "whiskering" at the edges of the cut following each 3mm excursion into the timber. Gary commented this was almost certainly due to its hardness. This is shown in Figure 4 opposite.

Before each cut was made, Gary moved the router around the cut to check there were no loose objects in the way of the cut and Paddy moved the vacuum cleaner hose attached to the router around. Wooden end stops were attached via G-Clams to the ends of the track to prevent the router/jig assembly from exceeding the measured dimensions and causing any further safety-related concerns as a machine tool such as a router can be extremely dangerous. Once this was completed, Gary commenced the routing operation, each incursion into the plywood was around 3mm. This is shown in Figure 5 opposite.

The end result - two "sledge-runner" side bearings and a secondary cage ring!

Neil Morley
February 10th 2002.

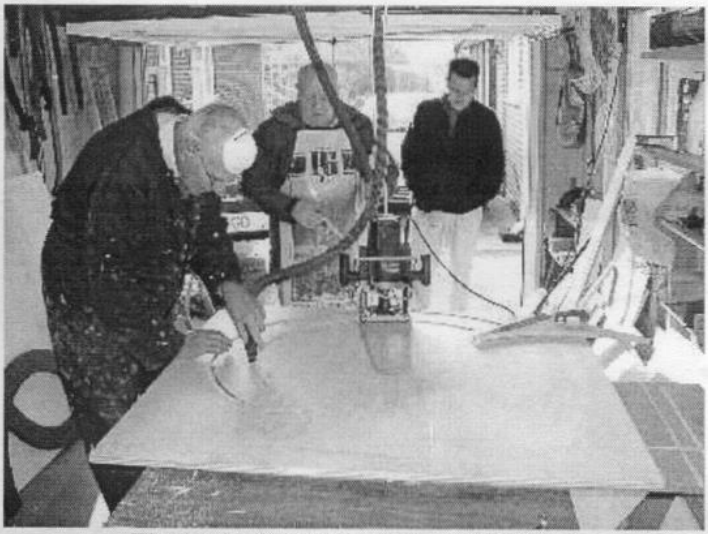


Figure 4 - Cleaning the swarf/sawdust

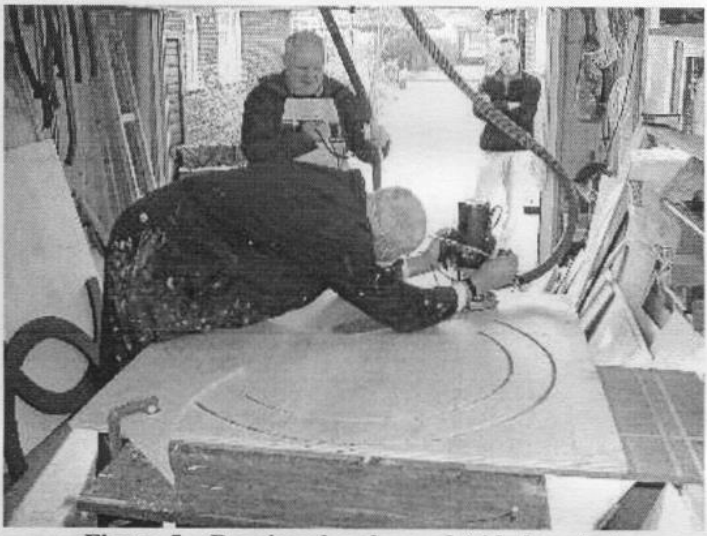


Figure 5 – Routing the plywood (side bearing)

Extra Observing Night

Monday March 24th at 8.0pm the third of the above sessions will take place at the observatory. The constellation of Cancer will be the target, with Simon Clarke giving a lead. Best to come on time, and familiarize yourself, with ideas of what you would like to observe. We may need to work 'in shifts' at the telescopes, as more than two at a time per telescope is crowded. We are at the moment, using the small balcony telescopes. Ted Sampson.

Tomline Telescope Training

You will know that a 'test' is required of members before you can operate the above telescope. Training for this is soon to start again, with a view to increasing the number of 'approved' operators. We have found that only a small number at a time is practical. We already have several members in line for the first phase, but plan to keep going after that, training at a rate of four at a time. Any members, (and that can be anyone) who would like to be an approved operator of this historic Victorian machine, please speak to me (Ted Sampson) personally. We can then have a conversation about timing, expectations, and raise any queries you may have about the telescope, its use, and when training and testing can take place. Meanwhile, get to know the telescope, especially on cloudy nights, and make it known you are keen! Members may find on two Wednesdays per month from 7.45 to 8.15 that the upper dome is 'Closed For Training'. Ted Sampson.

2003 COMMITTEE

		Home Phone	Work Phone
CHAIRMAN & PUBLICITY	K Goward		
SECRETARY & WORK PARTY ORGANISER	R Gooding		
TREASURER	G Coleman		
MECHANICS & MEMBERSHIP	M Cook		
NEWSLETTER CO-ORDINATOR	E Sims		
ASTRONOMY WORKSHOP	T Sampson		
WEB SITE & MEETING MINUTES	J Appleton		
EQUIPMENT CURATOR	P O'Sullivan		
LIBRARIAN	M Whybray		
CO-OPTED MEMBERS			
LECTURE CO-ORDINATOR	P Richards		
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MEMBERSHIP — M. Cook [redacted] Ipswich IP4 5PZ

Observing Programme For March

Dates	Observing Director	Activities
Monday 10th March Monday 24th March	P O' Sullivan T Sampson	Small Telescopes Night Topic Cancer
Tuesday		Nothing Booked
Wednesdays 5th 12th 19th 26th from 8.00	M Cook D Payne	Nebular & Faint Objects
Thursday 6t & 13th Thursday 20th Thursday 27th	9th Ipswich Cubs 18th Holywell Cubs Woodbridge Ladies Club	Group Visit
Friday		Nothing Booked

All members are welcome on any night, but on nights other than Wednesday please check with the appropriate director that the observatory will be open.

Special Events

1. ASTRONOMY WORKSHOP 5th March

The Astronomy Workshop starts at 7.45pm on Wednesday 5th March. The topic is " Hertsprung Russell Star Sequences ". The Presenter is Paddy O'Sullivan.

2.FIRST PRESIDENTIAL LECTURE 7TH MARCH

The first presidential lecture by Dr Allan Chapman is to take place at Orwell Park School in the hall to the right of the entrance foyer on Friday 7th of March at 7.30pm . The subject is "the Victorian Amature Tradition".

3. COMMITTEE MEETING 26th APRIL

The next Committee Meeting is to be held on Saturday the 26th April at 7.30pm in the class room at Orwell Park School. All members are welcome to attend.

Society Contact Details

		Home Phone	Work Phone
Chairman	**D Payne**		
Secretary	**R Gooding**		

Contact details for the full committee are inside the back page.

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