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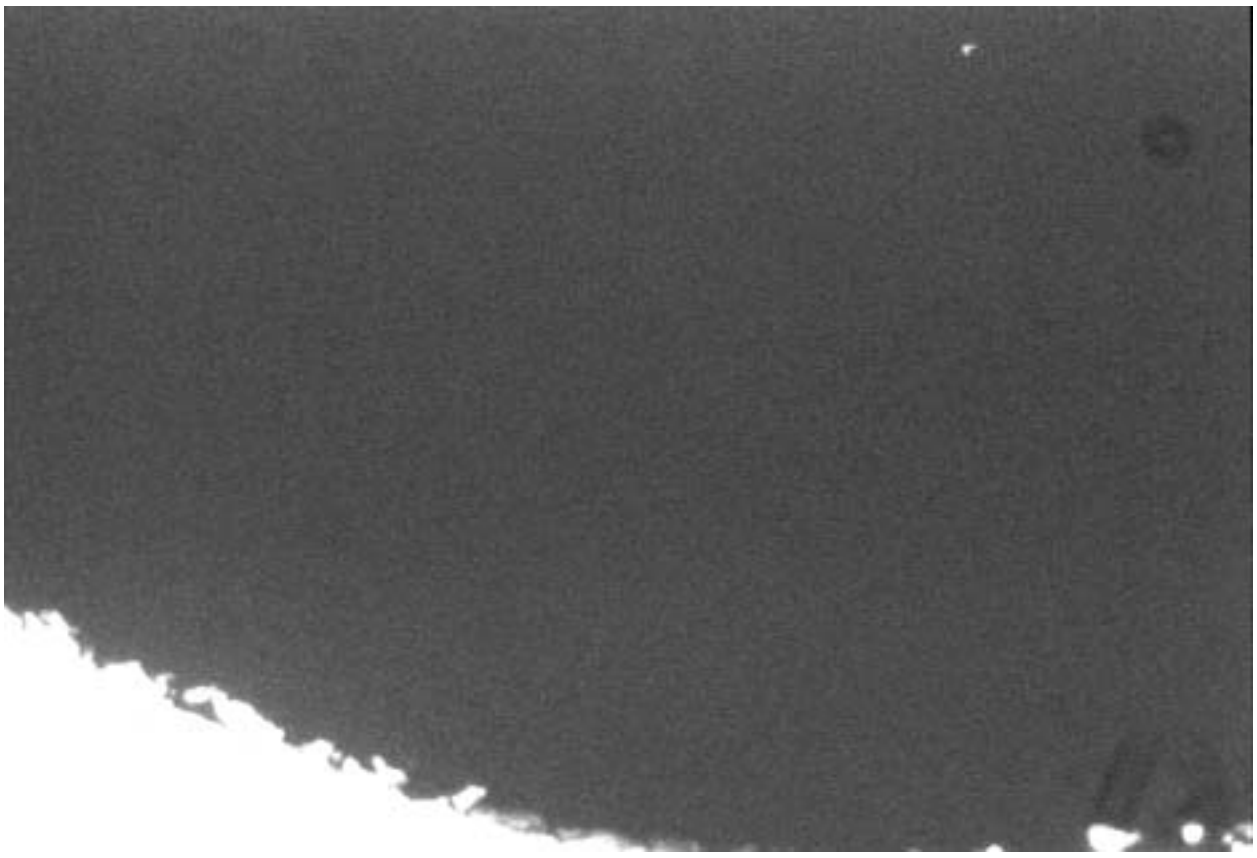

2001 Lunar Leonid Impact

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ON THE COVER: Lunar impact flash recorded by David Palmer at 19 November 2001 00:18:58 UT. The image was captured in evening twilight using a C-5 and a PC-23C camera at Los Alamos, New Mexico. David Dunham in Laurel, Maryland and Tony Cook in Alexandria, Virginia were able to confirm this impact. They both imaged the event with 8-inch telescopes using Watec 902H cameras while the Moon was near an altitude of only three degrees.

What to Send to Whom

Send new and renewal memberships and subscriptions, back issue requests, address changes, email address changes, graze prediction requests, reimbursement requests, special requests, and other IOTA business, but **not observation reports**, to:

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Send Total Occultation and copies of Lunar Grazing Occultation reports to:

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All payments made to IOTA must be in United States funds and drawn on a US bank, or by credit card charge to VISA or MasterCard. If you use VISA or MasterCard, include your account number, expiration date, and signature. (Do not send credit card information through e-mail. It is neither secure nor safe to do so.) Make all payments to **IOTA** and send them to the Secretary & Treasurer at the address on the left. Memberships and subscriptions may be made for one or two years, only.

Occultation Newsletter subscriptions (1 year = 4 issues) are US$20.00 per year for USA, Canada, and Mexico; and US$25.00 per year for all others. Single issues, including back issues, are 1/4 of the subscription price.

Memberships include the *Occultation Newsletter* and annual predictions and supplements. Memberships are US$30.00 per year for USA, Canada, and Mexico; and US$35.00 per year for all others. Observers from Europe and the British Isles should join the European Service (IOTA/ES). See the inside back cover for more information.

IOTA Publications

Although the following are included in membership, nonmembers will be charged for:

Local Circumstances for Appulses of Solar System Objects with Stars predictions US$1.00
Graze Limit and Profile predictions US$1.50 per graze.
Papers explaining the use of the above predictions US$2.50
IOTA Observer's Manual US$5.00

Asteroidal Occultation Supplements will be available for US$2.50 from the following regional coordinators:
South America--Orlando A. Naranjo; Universidad de los Andes; Dept. de Fisica; Mérida, Venezuela
Europe--Roland Boninsegna; Rue de Mariembourg, 33; B-6381 DOURBES; Belgium or IOTA/ES (see back cover)
Southern Africa--M. D. Overbeek; Box 212; Edenvale 1610; Republic of South Africa
Australia and New Zealand--Graham Blow; P.O. Box 2241; Wellington, New Zealand
Japan--Toshiro Hirose; 1-13 Shimomaruko 1-chome; Ota-ku, Tokyo 146, Japan
All other areas-Jan Manek; (see address at left)

ON Publication Information

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STATISTICAL COMPARISON OF VIDEO AND VISUAL OCCULTATION TIMINGS

Cliff Bader

Introduction

In *Occultation Newsletter* for March 1977, I published an article concerning statistical analysis of one's total occultation angular residuals, which at the time were computed by Her Majesty's Nautical Almanac Office at Greenwich Observatory. The intent of the analysis was to assess the consistency and accuracy of the observer's work and to spot any major errors in geographic coordinates or timing equipment. I used it to evaluate a group of my own timings, which were made at the telescope with stopwatch or by the eye-ear method.

With the advent of video cameras suitable for occultation work, and the corresponding potential for more accurate timings, I naturally wanted to revisit the analysis and compare my video and visual ILOC residuals. This could not be done until a statistically useful population of video timings was available, as is now the case. The new analysis revealed some interesting facts and relationships, which are discussed below.

Analysis Approach

The approach used is to compute the mean and standard deviation (SD) for a group of residuals, first changing the sign of the disappearance O-C's in order to make a positive sign indicate an observed time later than the calculated time for both R's and D's. The resultant "angular seconds late" or (with minus sign) "angular seconds early" values do not correspond directly to time, since the rate of approach to the lunar limb depends on the geometry of the event, but are nonetheless useful for comparative purposes. On the average, 0.1 second of arc amounts to something like 0.25 second of time, and this relationship can be used for a group estimate. (The particular value for a given event can be obtained from the RV column in OCCULT photoelectric predictions, which gives the radial velocity of approach of the star to the lunar limb in milliarcseconds per second.)

A final step in the analysis is to consider the timings to be a sample from a hypothetical parent population, and to calculate the confidence limits for the mean and SD of that population. These limits narrow only as the square root of the sample size, so it takes a discouragingly large number of samples to get really narrow confidence intervals. At some point it becomes necessary to draw a line and work with the data at hand, as has been done herein.

New Analysis Description and Results

The new data cover the years 1994-2000 and relate to three timing methods: Video using frame freeze and time insertion, video at normal speed with visual timings refined via multiple playbacks, and non-video visual timings at the telescope. The second method was employed only when the star was too faint, the sky conditions too poor, or the moon too nearly full to permit reliable frame-by-frame analysis. Non-video timings were made when the event was beyond camera reach or, in a few instances, when time constraints (or laziness) precluded setting up the video equipment, and were done with a stopwatch or by eye-ear.

Table I summarizes the results of the present analysis and those reported in the 1977 article. The prime notation for O-C indicates that the ILOC O-C disappearance signs have been changed.

METHOD	NUMBER OF TIMINGS	(O-C)' MEAN ARCSEC (95% CONF LIMITS)	(O-C)' STD DEV ARCSEC (95% CONF LIMS)	MEDIAN STAR MAG	TIMES>1 ARCSEC FROM MEAN
VIDEO/FREEZE	62	-0.32(-0.24/-0.41)	0.34(0.42/0.29)	6.1	0
VIDEO/VISUAL	21	-0.29(-0.15/-0.43)	0.33(0.48/0.25)	6.8	0
VISUAL	49	-0.29(-0.14/-0.44)	0.52(0.65/0.44)	7.8	5
1977 VISUAL	107	0.11(0.22/-0.01)	0.60(0.69/0.53)	--	--

TABLE I. TIMING ANALYSIS RESULTS

The salient feature of the table is the fact that the new results are statistically indistinguishable from each other, with the single exception of the standard deviation for the non-video visual timings. The latter fits better with the SD of the old visual timings, but it is likely that different factors influence the values. These and other aspects of the analysis are discussed below.

Comparison of the Means

The tight grouping of the means for the new timings indicates that there are no recognizable systematic differences related to the method used, as would be the case if my personal equation was consistently and seriously underestimated or overestimated. Since all of the work was done from the same observing site and geographical coordinates (except for a minor GPS-based longitude correction for the year 2000), the difference between the new and 1977 means most likely originates in the astrometrics of the reduction process rather than in observational factors. Both values are within the range of lunar ephemeris corrections regularly reported by ILOC.

Standard Deviation Implications

Since I have reasonable confidence in my coordinates and have taken numerous precautions to eliminate sources of error in the time-inserted video, I am inclined to believe that the standard deviation of the frame-freeze timings is not much larger than that intrinsic to the reduction process. With this assumption, the frame-freeze standard deviation can be used as a baseline for assessing the accuracies of the other two methods.

The video/visual timing residuals are much more closely clustered than the non-video ones, and appear to rival their time-inserted counterparts in this respect. Five of the non-video timings had residuals greater than 1 arcsecond, compared with none for the video timings; this seems to imply that the ability to repeatedly view events allows the detection and rectification of many poor timings, which go unrecognized with only one opportunity.

Other factors might contribute to the difference in SD's. The table shows that the median magnitude for the non-video timings was one magnitude fainter than that for the video/visuals. The cataloged star position data might not be as accurate for the fainter stars, although I would not expect any degradation to be large enough to explain the standard deviation difference. Also, one might suspect that the non-video timings, relegated as they were to the more difficult events, would be inherently more vulnerable to observer error. I also tend to discount this factor, because many of the video/visual events were so close to being lost in pixel noise or background light that ten or more replays with various video adjustments were needed to convince me that the timing was even worth reporting.

It remains to discuss the relationship between the SD's for the new non-video and the 1977 timings. Conflicting factors are probably responsible for their near equivalence. On the one hand, the 1977 timings encompassed the complete magnitude range of the three new groups combined, and would therefore be expected to have more easily visible events and a lower observer SD than the new non-videos. On the other hand, the astrometrics of that period were less accurate than those of today, and therefore resulted in a higher intrinsic SD. Also, my visual acuity and reaction time consistency have undoubtedly deteriorated over the years, but their effect has likely been offset by accumulated practice and experience.

Conclusions

It is plain that the accuracies of astrometry and geodesy have improved to the point where observation-dependent factors dominate in the variance of my residuals for visual timings at the telescope. The case is not so clear for visual timings made from videotapes; the ability to review the events and refine the timings appears to bring the overall variance down to a level commensurate with its intrinsic magnitude.

This is not to say that the visual/video and frame-freeze timings deserve equal weight. Standard deviations for uncorrelated variables add according to the square root of the sum of the squares; thus, observer SD need only be slightly smaller than the intrinsic in order for the latter to dominate and mask it. Furthermore, my present video/visual SD confidence interval is broad enough to accommodate the combined effect of observational and intrinsic 0.3 arcsecond SD's. More data are needed to clarify the situation; unfortunately, the video/visual timings are confined to the limited region between the frame-freeze visibility threshold and that where the camera becomes unusable, and will never be very plentiful.

It would be interesting to see if other observers come up with similar or differing results and to compare numbers. The calculations, which were somewhat

laborious in 1977, are easy on a spreadsheet. The means, their SD and confidence interval, and the medians can be directly calculated with Microsoft Excel functions. The confidence limits for the SD's, as computed above, are based on a chi-square distribution (Excel CHIINV) and involve a bit more work. For n samples, standard deviation s, and 95% confidence, the lower limit is given by the square root of $(n-1)s^2$/CHIINV(.025,n-1), and the upper by the square root of $(n-1)s^2$/CHIINV(.975,n-1). These equations assume normally distributed (O-C)'s, a condition reasonably well met for mine and probably those of other observers.

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6 June 2001

An Unusual Total Occultation or was it a Grazing Occultation?

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Browsing through some old Sky and Telescope magazines I came across a Letter to the Editor from the February 1961 issue. Leo Deming from Terre Haute, Indiana wrote about an unusual occultation he observed with his son on the evening of November 25, 1960 40 years ago! Mr. Deming timed the occultation by the 1st quarter moon of the 6.7 magnitude star ZC 3333 (SAO 146271) with an 8-inch reflector using 98x.

Both Mr. Deming and his son saw the star vanish, re-appear, and vanish again in a time interval of about 0.3 second. He recorded the final disappearance at 1:07:32.0 Universal Time. Deming also reported that since the star was moving near "the extreme northern part of the Moon, its path relative to the limb was very oblique, and hence it may have been covered by a Lunar hill."

Using the information that Leo Deming provided, a multiple event has indeed occurred. Since a disappearance/ reappearance event was witnessed independently by himself and his son (son used a 5-inch refractor at 20x), this indicates that a possible grazing occultation may have occurred. Adding to this theory was the fact that Deming mentioned that the star was moving near to the "extreme northern limb of the Moon." This could mean that the Moon, moving eastward, just barley passed the star at its northern limb, further evidence indicating a grazing occultation. But it could also mean a total occultation in which the star caught the tip of a lunar mountain, or a total occultation of a double star. A double star would have a gradual fading of light or have two distinct disappearances. Several hundred double stars with very close separations (down to 0.03") have been discovered by the occultation technique.

Deming gave his street address in Terre Haute, Indiana at the end of his letter. Using his street address, I was able to get his longitude, latitude coordinates from **www.MapsOnUs.com,** and elevation from **www.topozone.com**. This is critical information for computing Occultation predictions.

Using OCCULT, I computed the occultation event for the night of November 25, 1960. It showed the Moon passing in front of the star at a position angle of 29° and a cusp angle of 51° .

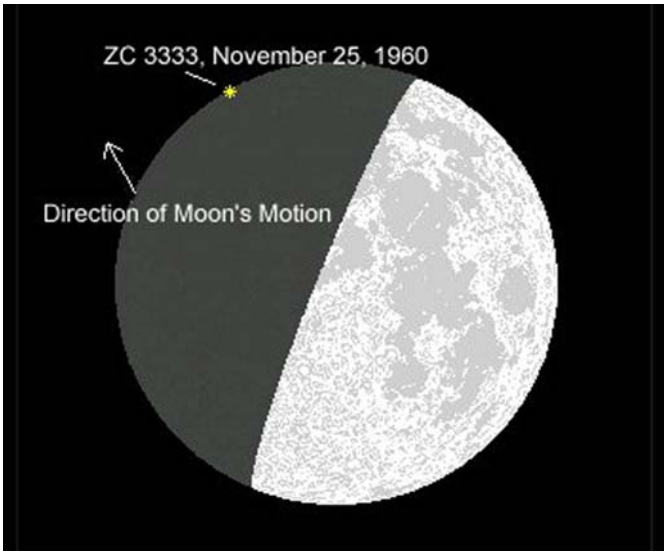

Figure 1. ZC 3333 occulted by the Moon on November 25, 1960 from Terre Haute, Indiana.

Thus there was no grazing occultation. This was clearly a total occultation. See Figure 1. But ZC 3333 is (now) a known double star, with a separation in 1960 as 2.4" and a position angle of 311°. Thus Leo Deming and his son saw one of the components covered up by the Moon, and 0.3 seconds later saw the second component covered. This is an early example of an observation/discovery of a double star by the occultation technique. ZC 3333 is a relatively nearby

star system, 8.8 parsecs from our Sun, and has an orbital period of at least 250 years.
The position angle of the components (magnitude 6.7 and 8.0) of 311° was partially in line with the Moon's easterly motion. OCCULT showed the occultation occurring at 1:07:26 UT, 6 seconds earlier than Deming's observation. LOW (The Lunar Occultation Workbench software) predicted the occultation to occur at 1:07:33 UT, only 1.0 second later than Deming's observation. Errors can be accounted for the inaccuracy in the motion of the Moon over 40 years and/or the exact location that Leo Deming and his son were at when they made the observation. OCCULT's error could be accounted for if the observation was made within a 3 kilometer radius of Leo Deming's house (the Moon's motion is about 0.5 km/sec). Perhaps he and his son went to a school yard nearby their house or open field to make the observation. With the Moon at a altitude of 40° that night, it seems unlikely that there were any obstructions in a typical backyard that would force observers to relocate to see the Moon.

In addition, the sky atlas program MEGASTAR's solar system option computed this observation to within 30 seconds of the sophisticated Occultation software time. Thus it can be concluded that Leo Deming and his son did not see a grazing event, but rather observed the total occultation of a double star, possibly behind a lunar mountain. •

Minutes of the 2000 IOTA Annual Meeting

Richard Nugent,
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The 18th annual meeting of the International Occultation Timing Association was held Saturday and Sunday June 11-12, 2000 at Avila College in Kansas City, Missouri in conjunction with the Astronomical League's 50th anniversary meeting of its Mid States regional convention (Mid-Con). This meeting place was chosen because of its central location along with the opportunity to expand and disseminate knowledge and information about IOTA's activities to members attending Mid-Con.

Sixteen members and attendees were present at the meeting and included:

President David W. Dunham from Maryland,
Secretary-Treasurers Craig and Terri McManus from Kansas, Executive Secretary Richard Nugent from Texas, Dr. Wayne Warren, Jr. and Harry E. Bates from Maryland, Walt "Rob" Robinson and Nick Ruess from Kansas, Clive and Beryl Cadle from Oklahoma,
Bob Sandy, Wayne Clark and Jerry Kennedy from Missouri, Hal Povenmire from Florida, Marilyn Burke from Texas, Danny Falla from California.

At 10:30 AM **President David Dunham** opened the meeting and asked attendees to introduce themselves. Following the introductions, there was a brief discussion about the fact that IOTA members were charged a registration fee for the Mid-Con convention. It was stated that at no other meeting in IOTA history has there been a fee for use of facilities or for registration, although that strictly speaking was not the case. In 1995, IOTA held its meeting in conjunction with the Astronomical League's annual meeting in
San Antonio, and earlier it was held one year in conjunction with the Texas Star Party, both of which had registrations. However the Mid-Con people normally charge for their annual meetings to cover costs of facilities and to attract high profile speakers in constantly changing fields of astronomy. An obvious benefit was the cheap room rates offered at the college dormitory compared to those of local hotels.

GPS, S/A DEVELOPMENTS - Dr. Wayne Warren, Jr. discussed the recent development of the Government turning off the Selective Availability (S/A) function on the Global Positioning Satellites (GPS) system on May 2, 2000. S/A and the GPS system has been in the control of the US Military since the launch of the GPS constellation of satellites and has been kept "on" for Military reasons. S/A was used to scramble GPS signals so that receivers on the ground could only obtain positional accuracy of latitude and longitude coordinates accurate to approximately 100 meters. This accuracy has long been known to be unacceptable for IOTA activities and could only be worked around by the differential corrections procedure (DC or DGPS). And in foreign countries, where accurate coordinates were needed for solar eclipse limit observations, time consuming arrangements had to be made with "friendly" institutions to establish an accurate base station (benchmark) for computing relative coordinates for these one-time events. With DC, 1-2 hours of GPS readings had to be taken in order to collect enough data

points for later computer reduction in order to obtain 2-3 meter accuracy. In addition, only GPS receivers capable of collecting and storing thousands of data points could be used to obtain such accurate coordinates. In this regard, Vice-President Paul Maley had negotiated the loaning of a very sophisticated GPS receiver from Trimble Navigation in California over the past 8 years for use on solar eclipse expeditions. This particular Trimble Navigation GPS receiver has a retail price of over $2,500, so understandably it was not financially feasible to just go out and buy one like a tape recorder or video system. With the S/A now turned off, 5-meter accuracy in one's position can now be obtained in about 10 minutes with virtually any GPS receiver, as long as there is good satellite geometry!!!

Dr. Warren described a Magellan GPS receiver he had just ordered along with a software package from a company called Fugawi that downloads data directly into a computer. The Magellan receiver cost about $250 and the software about $80 at the time of this writing. While this discussion continued, Dr. Frank Miller passed around a Magellan 2000 receiver for attendees to see. Preliminary tests by Dr. Warren with the S/A turned off yielded an astounding 1.5-meter accuracy after a few tests. Dunham says that 10 minutes should be sufficient to obtain excellent positional results. Compared to just 2 or 3 minutes of data collection by the GPS receiver, 10 minutes could average out signal fluctuations caused by the Earth's ionosphere. Along this item, Dr. Warren said he would like to see a program to do interactive GPS measurements. This would allow the user to see ionosphere fluctuations in real time.

Despite all the excitement with the S/A scrambling function now turned off, Bob Sandy mentioned that he still routinely gets accurate positions from the USGS maps. But the problem with the maps is that they are quoted to show 95% of the mapped features to within 40 feet of their true positions, just barely within IOTA's requirement of 15 meters. At best, USGS maps can only provide 40-foot accuracy - and again - it requires extra time to obtain and measure the maps.

Even with the S/A function turned off there is still the problem of obtaining accurate elevations of the observation site. GPS altitudes are still below par and users can use the USGS maps to get the elevations. USGS maps are currently available at **www.topozone.com**, where observers can read off the elevation for their particular observing site.

Dr. Warren had also showed results for a digital raster-graphics map to plot graze data for the graze of 18 μ Geminorum, a spectroscopic binary of sub arcsecond separation, from February 15, 2000 in Largo, Maryland. In this case the position angle and distance can be plotted of the binary for orbital analysis.

Danny Falla then briefly discussed a program he wrote in basic to compute latitude, longitude positions from USGS maps. Following this around 11: 15 AM the attendees broke the meeting to join the Mid-Con meeting where IOTA had a scheduled presentation.

MID-CON Meeting, 11:15 AM Saturday

Joining the Mid-Con meeting, **Walt "Rob" Robinson** talked about IOTA's beginnings when a 14-year-old boy named David Dunham received a 60mm refractor for Christmas in December 1956. This sparked an interest in astronomy, especially positional astronomy and celestial mechanics. On September 18, 1962, Dunham succeeded in predicting his first grazing occultation using a FORTRAN computer program. As IOTA grew in size and scope of observations, predictions and results, it was formally established in 1975 and incorporated in 1983 in Texas as a non-profit corporation. Other highlights in IOTA's history Walt "Rob" Robinson mentioned:

May 1990 - IOTA published in the Astronomical Journal the shape of the asteroid Pallas from 131 chords,

1995 - First email notification of occultation events compared to telephone notification in prior years.

The International Lunar Occultation Center (ILOC) in Japan to date has catalogued some 250,000 total occultations since 1980, and more than 18,000 graze events. These are analyzed by ILOC and the data distributed worldwide to astronomers. Walt introduced IOTA's President Dr. David Dunham to the Mid-Con meeting. Dunham then briefly described some of his work with the Applied Physics Laboratory at the John Hopkins University on the NEAR mission to the asteroid EROS and his role in the computation of orbits.

David Dunham wasted no time and showed the group how IOTA's efforts resulted in the first confirmed meteoritic impacts on the Moon during the Leonid meteor shower last November 18, 1999. The visual sighting of a "flash" on the Moon's dark side was made

by Houston Astronomical Society (HAS) member Brian Cudnik at the HAS observatory in Columbus, Texas. Cudnik was talking to IOTA Executive Secretary Richard Nugent while observing through a Celestron 14 telescope when he saw the flash. Cudnik immediately recorded the time (4:46:20 UT, November 18, 1999) and estimated the magnitude at about +4. (Unfortunately, Nugent had turned off his video system outside the Observatory building just minutes before going in to talk to Cudnik !!). Cudnik contacted Dunham the next day for possible confirmation. Fortunately, Dunham was video recording the Moon's dark side with a 5" telescope in Mt. Airy, MD. Dunham described how he anxiously reviewed his video tape of the Moon and at the exact time that Cudnik had reported - there was indeed a flash visible on the tape. The flash only appeared on two video frames, but it did appear. The flash was also seen by Steve Hendrix in Cameron, Missouri.

Five other impacts were soon identified by Pedro Valdez Sada near Monterey, Mexico and by David Palmer in Greenbelt, Maryland. Dunham confirmed these events also on his videotape. Dunham showed the location of the 6 confirmed impact flashes from that November 18 night on a Moon map. The flash positions have been determined to an accuracy of about 2 degrees. The analysis of these flashes has seemed to rule out artificial satellites, since all low satellites were in the Earth's shadow at the time (events all near local midnight) and none of the geosynchronous satellites were within 3 degrees of the Moon at the time. Dunham proceeded to show a video of the November 18, 1999 impact flashes. Other events showed on video were image intensified occultations of stars in the Praesepe cluster, three asteroidal occultations in Jan. 1991, a graze of 97 Tauri in July 1995 (including events of a newly-discovered companion), and a graze of an 8th-mag. star in May 1995.

Dunham commented that asteroid occultations with the HIPPARCOS and TYCHO catalogs available have made this an exciting new field for amateurs with relatively inexpensive video equipment. Dunham then showed some asteroid profiles:

308 Polyxo - from January 10, 2000, Four (4) chords were obtained including the first successful chord from an F-14 aircraft. This observation was made by Southwest Research Institute astronomers Drs. Dan Durda and Alan Stern. Other chords observed were by Richard Nugent, Joe Hobart, and John Sanford.

Eros - from January 24, 1975

911 Agamemnon - from March 21, 2000, only 2 chords.

216 Kleopatra - from May 5, 2000 issue of SCIENCE, shape profile was obtained from updated radar equipment from the Arecibo Radio Telescope in Puerto Rico. [See the separate article about this asteroid.]

Dunham then showed a few viewgraphs of some upcoming occultations events for this year including the spectacular 752 Sulamitis event in which the m = +2.9 mag star μ Geminorum will be occulted for up to 13 seconds. This is the brightest star being occulted in recent history anywhere over land. (Two years ago April 10, 1998, the 1st magnitude star Regulus was occulted by an asteroid somewhere over the Pacific Ocean north of Hawaii).

Following Dunham's presentation Walt Robinson described all of IOTA's websites that contain useful updated and time critical information on occultations and grazes, along with an archive of articles on nearly all aspects of occultations.

12:00 noon, and the meeting broke for lunch

IOTA Business Meeting

At 1:25 PM IOTA attendees began the business meeting separate from the Mid-Con meeting.

FINANCIAL REPORT, **Craig and Terri McManus** read their report, which showed IOTA to be in good financial shape with $5,633.94 in the checking account as of June 6, 2000. For the period March 31, 1999 through June 9, 2000 there was a small cash flow of $27.22. The cash flow report is shown below:

Cash Flow Report
3/31/99 Through 6/9/00

INCOME

Back issues	15.00
Contribution	7.00
Interest Income	98.03
Member Dues	2840.00
Merchandise	26.00
Subscriptions	355.00
TOTAL INCOME	**$3,341.03**

EXPENSES

Card Cost	49.62
Internet Cost	526.89
Office Supplies	84.64
Postage	719.27
Printing	1324.69
Reimbursements	608.70
TOTAL EXPENSES	**$3,313.81**
OVERALL TOTAL CHANGE	**$27.22**

Craig remarked that IOTA has currently 277 members consisting of 181 full "paper" members, ("paper" members receive paper copies of the Occultation Newsletter as opposed to receiving them online), 20 members online, thus leaving 75 members who receive additional mailings (Asteroid Occultation supplements and updates).

David Dunham motioned the members present to accept the financial report as it was presented and the motion was seconded. The motion carried without any opposition.

IOTA MANUAL STATUS - Wayne Warren is currently working on the IOTA manual. He is currently investigating converting it from GML to a script format such as Microsoft Word. Warren reported there are problems in the conversion of tables and some equations to Word format. However, once the conversion is complete to Word format, the manual can easily be converted to PDF (ADOBE) and other formats. The manual is currently about 120 pages long and several runs will have to be made to work out the bugs. The manual is now currently on a hidden URL on the IOTA web site in a zip file. Craig and Terri McManus have several hard copies of the manual and will send one to anyone who requests it.

PUBLICATION REPORT - In Rex Easton's absence, David Dunham updated the attendees on IOTA's Occultation Newsletter (ON) publication status. ON is far behind schedule. This is especially frustrating for institutional subscribers. Dunham proposed that IOTA members volunteer to assist in the publishing of back issues of ON until caught up. It was decided that Volume 8, No's 2, 3 and 4 be published by the end of 2000 with Volume 9 starting in 2001. Dunham assigned the August issue editorial assistance duties to Richard Nugent, October to Wayne Warren, and December to Craig and Terri McManus.

Craig McManus reminded the attendees of the high cost of publishing and postage for ON. A typical issue costs $585 to print (at discounted rates) and postage runs approximately $525. In addition the Asteroid Supplement costs around $720 for printing only!! Richard Nugent suggested the possibility of getting a discount non profit postage rate, however IOTA doesn't do enough volume to warrant the fees charged by the post office for such rates or to switch to bulk mail rates. Craig McManus mentioned that air printed matter is the preferred way to send issues to other continents.

1999 MINUTES: Richard Nugent gave a brief presentation of the highlights of the minutes for the 1999 IOTA meeting in Denver. The minutes have been in a draft form (unpublished) since June 1999 awaiting Dunham's review since a good part of that meeting was Dunham's own personal history into occultations and grazes from the early 1960's. It was important to have this information proofed by Dunham regarding IOTA's early beginnings so that 21st century readers of ON would have accurate historical information about the earliest occultations, grazes and the start of IOTA as a new important branch of astronomy. The minutes should be ready for the next ON issue (actually, they are in this issue).

David Dunham briefly discussed meetings in which IOTA will have a presence: The European Symposium on Occultation Projects (ESOP) and amateur-professional collaboration in the U.S. Dunham and B. Timerson published an abstract detailing the amateur-professional collaboration IOTA has enjoyed over the years, and presented by Dunham at the American Astronomical Society's meeting in Rochester, NY, on June 5. Amateur and professional observers have used total and grazing lunar occultations to further refine the lunar limb profile. This highly accurate profile has been used to identify Baily's Beads during solar eclipses to measure small variations in the solar diameter. IOTA has also worked closely with professional astronomers on all aspects of asteroid occultations. Once a difficult field because of the larger errors in the predictions, it is now a growing new field due to the highly accurate HIPPARCOS star positions. Some 26 asteroid occultations were observed in 1999 alone in part due to the accurate astrometry work of Ron Stone at the U.S. Naval Observatory in Flagstaff, AZ and by Bill Owen at the Jet Propulsion Lab's Table Mountain Observatory in California.

IOTA PUBLICITY: IOTA had important publicity with the recent derived shape profile of asteroid 216 Kleopatra, acknowledging IOTA's independent discovery of its shape from an observed occultation from January 19, 1991. IOTA was acknowledged in a paper in which the shape profile of Kleopatra was published using the recently upgraded radar equipment with the radio dish at Arecibo in Puerto Rico. [See the separate article about Kleopatra and IOTA's role.] Kleopatra was also observed using the new 10 meter Keck Telescope on November 19, 1999 using adaptive optics, once again confirming the cigar shape of this asteroid. (see Sky and Telescope, April 2000, page 17). IOTA also made headlines in the news and on internet news sites with the video recording and confirmation of meteor impacts on the Moon from the Leonid meteor shower from last November 18, 1999. The confirmed video impact flashes on the Moon's surface from a Leonid meteor made the Astronomy Picture of the Day (APOD) for December 8, 1999 (**www.antwrp.gsfc.nasa.gov/apod/astropix.html**).

IOTA/ES ESOP NEWS: Dunham commented that Europe has many more occultation observers than the United States. Europe observers are closer together distance wise. They seem to have a more dedicated scientific mindset, possibly due to the European sanctification of science in the curriculum of its educational system. Craig McManus has received emails from European observers asking how to access the password protected website for IOTA subscribers. Obviously this site containing ON is for paid IOTA members only. [But note – a similar site for IOTA/ES is being set up at **http://www.iota-es.de**].

Dunham mentioned sad news regarding Hans Bode. His wife, Heliga, recently died and Hans had been suffering from major health problems. Hans is one of the major drivers for IOTA's European Section.

At 2:39 PM Dunham motioned to end the business meeting. It was unopposed.

Craig McManus had brought to the meeting his video system setup to record occultations and grazes. It consists of an ASTROVID low light video camera, GPS unit, HORITA time inserter that inserts GPS times directly into the video (WWV is used as a check), and an image intensifier. An adapter allows the intensifier to be used on SCT telescopes. The system is also capable of recording latitude, longitude and altitude data simultaneously along with the GPS time. The system can detect stars to magnitude +13 using a 10" telescope, and +15 using the 20" Obsession telescope. This impressive performance allows one to see very faint occultation stars, (and galaxies/nebulae) in real time on video monitors that Craig mentioned was extremely useful for star parties. Instead of having one person at a time look through the eyepiece, many people could see a galaxy/nebula on the television monitor.

Craig McManus then showed a video of their first successful asteroid occultation of 911 Agamemnon from March 21, 2000. From their location they recorded a 14-second event.

The capabilities of this system were further shown when Craig and Terri did a Messier Marathon using a 10" f/10 SCT. They were able to observe 105 out of the 110 Messier objects in a single night !!

Dr. Harry Bates reported on his successful observation of the occultation by 102 Miriam of the star ZC 1154 (SAO 97095) on February 15, 2000. His system consisted of an 8" SCT, PC-23C video camera and WWV receiver. After driving to several locations to seek a hole in the clouds, he finally found an opening and the skies cleared up. He recorded an 8.36-second occultation and later digitized the tape and showed a graph. His digitized light curve of the event showed a possible short duration event prior to the occultation. Some speculation as to the nature of the event was discussed by the attendees, but no conclusive explanation could be reached.

Richard Nugent showed his video of the Baily's Beads from the August 11, 1999 solar eclipse. He traveled to Diyarbakir in the southeastern Turkey desert and met Paul Maley's tour including Chuck Herald. Nugent and Herald navigated using a GPS receiver on loan from Trimble Navigation to find a particular rock identified by Paul Maley 6 months prior on a site survey expedition. He found the rock and set up using his highly portable system - 4" Meade 2045D SCT, video camera, Sharp Viewcam camcorder model VL-E650 with built in 3" viewing screen and speaker, and WWV receiver with direct feed into the camcorder. Nugent was stationed just inside the southern umbral eclipse limit under clear deep blue skies. The video clearly showed the dozens of Baily's Beads progressing along the Sun's limb over a period of about 2 minutes. Nugent had experienced about 16 seconds of totality at his location. Prior to the start of 1st contact, the

temperature was measured at 105ºF. After mid-eclipse, the temperature had dropped to around 95ºF with a light breeze. Chuck Herald was stationed about 1 kilometer north but had problems with his filter and could not obtain useful video data. Nugent collected several thousand GPS data points using the Trimble Navigation GPS unit on loan at each site. The data were analyzed later by Paul Maley and accurate coordinates were obtained.

David Dunham showed a graph of the calculated lunar diameter from the graze of ZC646 from the lunar eclipse of November 29, 1993. Paul Maley, Chuck Herald and Richard Nugent observed from Baja, Mexico and several brave observers from Canada fought bitterly cold conditions approaching –28ºC to observe the graze of the same star. The Maley/Nugent/Herald data fit reasonably well with the Watts charts but the Canadian team's data didn't match existing Watts charts well. Thus, an average lunar polar diameter calculation will be difficult, but Dunham will try and publish the results in a future ON.

Bob Sandy presented the results from the spectacular grazing occultation of Aldebaran from April 19, 1999. There were 10 expeditions with 38 observers and 122 events were timed. Additional timings were made of "flashes", or faint fades due to Aldebaran's large angular size (0.033") Sandy showed the video he obtained then Kiowa, Colorado expedition and the graze profiles from Utah and Colorado. The large number of events have added many useful data to the lunar limb profile database.

Sandy also showed the graze profile of ZC 2892 from November 14, 1999 observed by members of the Astronomical Society of Kansas City. The profile showed an unusual slope at Watts angle 176º. This strange slope was confirmed by a Japanese team observing the graze of 44 Capricorni at a different libration angle.

Sandy then showed a video of the occultation of ZC 1276 taken just 4 days before the IOTA meeting (June 6, 2000) from a light polluted trailer park. The video showed 3 total occultations by the crescent moon and a star with apparent magnitude m = +9.7.

Daniel Falla suggested having a "clickable" map on IOTA 's website for new occultation observers. The location sensitive "click" would then display information on a particular occultation. Dunham commented that maps are published in Sky and Telescope for important events with contour lines showing occultation/graze limits. Readers can then interpolate to get data for their particular location. In addition Dunham said detailed times are posted regularly on IOTA's website for most North American cities.

Hal Povenmire described his graze/occultation work and how he decides to reduce submitted grazing occultation events from expeditions he leads. In 37 ½ years in chasing grazes, Povenmire has more than 350 successful grazes, plus many more failed ones. He has 40 grazes with questionable data that have not been reported. Hal has on average attempted about 70 grazes per year. Why is Hal Povenmire so successful? Is it the good weather in Florida? According to Hal, to ensure that a lot of grazes are successful, he has maps extending way out on the graze lines.

Povenmire told the group what the last 37 ½ years have cost him: 23 tape recorders, 16 time signal cubes, 300,000 miles on vehicles, $43,000-$44,000 plus 1 wife. In 1968 Hal had the option of attending his graduation to get a Master's Degree or go to a graze. HE DID THE GRAZE AND GOT 6 EVENTS! Hal told a few of his most memorable stories (too many to list in the minutes) and asked for IOTA member's experiences for a possible future edition of his Graze Observer's Handbook.

At 5:00 PM, the meeting broke to rejoin the Mid-Con talk on asteroid astrometry given by Brian Warner and Richard Davis.
At 6:30 PM a Banquet was held in a nearby hotel. A dinner with a few speeches plus some attractive door prizes rounded out the evening.

Sunday, June 11, 2000

The IOTA meeting continued at 9:45 AM with a group photo. David Dunham then showed the reduced asteroid profile shapes from Saturday's video shown at the Mid-Con meeting.

Plans for some future asteroid events were discussed:

142 Polana - July 1, 2000, Central Florida to Central Texas, (m = 1.7, TYCHO star m= +11.1

481 Emita - July 3, 2000, Virginia to southern California, (m = 2.7, star m = +10.9. The star being occulted is not on the HIPPARCOS or TYCHO system

thus larger path errors can be expected in the predictions.

111 Ate - July 7, 2000, Louisiana, Texas gulf coast, central Mexico, (m = 3.8, TYCHO star m = +9.4

142 Polana - July 11, 2000, Central Florida to central Texas, (m = 3.8, TYCHO star m = +9.1

309 Fraternitas - July 20, 2000, Nebraska to Georgia, (m = 4.7, TYCHO star m = +10.5.

Several predictions for 2001:

238 Hypatia, March 6, 2001, (m = 3.2, HIPPARCOS star being occulted m = +9.5, gibbous moon 20 degrees away.

97 Klotho - May 25, 2001, (m = 6.5, HIPPARCOS star m = +6.5, crescent moon on opposite horizon.

447 Valentine, August 18, 2001. This asteroid is near a stationary poiint in its orbit, and some very fortunate observers in Antarctica will have a 3,270 second occultation !!! [Unfortunately, an update of Valentine's orbit since then shows that this path will miss the Earth's surface.]

9 Metis, September 7, 2001, Northwest US - California to Winnipeg, (m = 4.8, HIPPARCOS star m = +6.07, a possible naked eye event.

TYCHO - 2 CATALOGUE - released on February 8, 2000. This new important catalogue contains positions, proper motions and two color photometry for the 2.5 million brightest stars in the sky. The positions and the magnitudes were obtained with a new reduction of the original observations from the Tycho experiment on the ESA HIPPARCOS satellite and have a stated epoch of 1991.25. The stars have been reduced to the J2000 reference frame define by the HIPPARCOS catalogue. The proper motions in TYCHO-2 are probably the most accurate attainable in modern day astrometry - by direct comparison from the older positions of the Astrographic Catalogue (average epoch 1909) and more than 143 ground based catalogues, all brought to the HIPPARCOS based system.
The average density of stars is about twice that of the ACT catalogue. It is thus more likely that TYCHO-2 catalogue stars would be occulted by asteroids providing high accuracy in predicting ground paths of these highly location-sensitive events.

Wayne Warren mentioned that are problems with double stars in the TYCHO-2 catalogue. Double stars with separations of less than 0.8" have been thrown out since they could not be resolved. Errors in closer doubles are due to the fact that they are treated as "blended".

Bob Sandy asked about the faintest limiting magnitude of HIPPARCOS. Warren said the catalogue is complete to m = +7, accurate to 1 or 2 milliarcseconds (0.001"), and Tycho - 2 catalogue complete to m = +11.5, accurate to 7 milliarcseconds (0.007"). TYCHO-2 proper motions are accurate to 2.5 milliarcseconds/year (0.0025"/yr).

Dunham remarked that both the Tycho and Hipparcos catalogues were produced by the spinning HIPPARCOS satellite. Star positions are highly accurate made relative to each other and are not directly on the system relative to Earth's equator (but have been referenced to it via objects also observed with radio telescopes).

Dunham showed charts from the RASC Observer's Handbook for upcoming grazes from July - December 2000 and preliminary plans were considered for select events passing near the location of the attendees.

It was mentioned that the duties of time insertion of video tapes were recently handed over to **Rick Frankenberger** of San Antonio. This job was previously handled by long time IOTA member Don Stockbauer. In addition, Derald Nye is still doing time insertion of video tapes in the Arizona area. Wayne Warren mentioned that Tom Campbell has a time insertion system that is currently not being used [Tom recently sent it to Wayne].

This prompted a discussion about methods to perform time insertion of video tapes quickly and inexpensively. Video time insertion allows the extraction of data to about 0.03 second at a 30 frame/second recording playback rate. The Stockbauer system uses WWV tones to trigger the time insertion. Dunham showed a new system on a schematic diagram using the GHS clock designed by T. Hayamizu of Japan. At a estimated cost of $200 it uses a flashing light to trigger the time insertion. Suggestions are needed for new techniques to simplify the time insertion process, since it is critical for occultation timings.
Walt "Rob" Robinson updated the attendees on IOTA's websites. Started in 1995, they are averaging 20,000 hits per year with more than 90,000 hits since

start up. Some 30 megabytes of space are currently available. Overall the websites are very successful for disseminating IOTA news and information about grazes, occultations, specific and general purpose articles and techniques.

Richard Nugent shared a tip on attaining fainter stars on video for observers who do not have image intensifiers. He had a short video adapter made at a local machine shop to connect his video camera to the back of his 4" Meade 2045D SCT telescope. The adapter placed the CCD chip about 2 inches closer to the focal plane of the telescope. This has resulted in a decreased f ratio and a larger field of view. With a larger field of view, fewer pixels are used to display a star image thus they are brighter. The limiting magnitude for his 4" telescope system from his light polluted backyard in Houston city limits is m=+8.5.

Nugent brought up an issue suggested by Paul Maley - that adequate coverage be obtained at the northern and southern umbral eclipse limits for the next 4 solar eclipses.

At 11:40 AM the meeting was adjourned and David Dunham showed some videos of additional grazes/occultations. Dunham suggested that he might try to digitize some of the spectacular grazes and asteroid occultations to produce a video tape of high quality that can be used by IOTA members for talks and presentations. •

IN MEMORIAM: ROBERT CLYDE (1910-2000)

Richard Taibi

Bob was active in IOTA soon after David Dunham began to encourage grazing occultation observation. Bob lead many Ohio graze teams during the 1970's and 80's, and this is how I met him in 1977. Bob was a retired optician by then and able to donate his considerable energy and talents to observational projects, his local astronomy club and to mentoring younger amateurs like myself. His enthusiasm for "grazes" was infectious, and many NE Ohio amateurs, like Chris Stephan and I, caught the "bug". Those of us who knew Bob all miss his warm friendship and his wry sense of humor. (For example, he paid his respects to the Naval Observatory, which then was the sponsor of graze calculation computer time, by reversing the syllable order to name his own backyard observatory "El Nav" Observatory.)

Bob's skills as an amateur telescope maker; his contributions to Mahoning Valley Astronomical Society; and his observational contributions to IOTA and AAVSO were recognized when he was awarded the Ohio Turnpike Astronomers' Association's George Deidrich Award. His contributions to those he knew and mentored are incalculable and are remembered, especially whenever we are under the stars. •

Publication status of the Occultation Newsletter

John Graves
Editor

Although this is my first issue as the editor of ON, as a member of IOTA I am acutely aware of the problems we have encountered in publishing Occultation Newsletter on a regular schedule.

As the new editor I am committed to returning us to a regularly quarterly schedule. To accomplish this goal, Occultation Newsletter will be published on a bimonthly basis until midyear 2003. After that, we will return to a normal quarterly schedule. Here is a schedule of the publication dates for the next few issues:

Volume 8, Number 4 - January 2002 - 2nd issue of 2001
Volume 9, Number 1 - March 2002 - 3rd issue of 2001
Volume 9, Number 2 - May 2002 - 4th issue of 2001
Volume 9, Number 3 - July 2002 - 1st issue of 2002

The deadline for submissions to be included in the January 2002 will be December 26, 2001.

Beginning with the March 2002 issue, the deadline for submissions will be the 1st business day of the calendar month preceding the publication date. In the case of the March 2002 issue, the deadline for submissions will be February 1, 2002.

Please send electronic submissions to:
editor@occultations.org

KIWI-Universal Time at a Pushbutton

Arthur Lucas

You're hearing a lot of chatter about advanced timing methods and there's more to come. I would like to alert you to a project I've just finished that seems meretorious. KIWI is a software package put together by Geoff in New Zealand. It uses a GPS unit such as the Garmin 35HVS with a precise 1 pps signal to exactly time an event. If you had a good enough finger you could time to 0.001 second. I do not.

My report along with Geoff's comments are posted on:

www.geocities.com/kiwi_36_nz/kiwi/kiwi.htm

When all shakes out we'll see how this fits in the big picture. At the moment its better than anything for those 12th magnitude, visual only observations. You get instant Universal Time and can press the button as many as (my limit) 5 times per second and still get good data. It also leads you through your personal equation. variation on it, latitude, longitude, and elevation to complete a report before you retire for the evening. •

Watec 902H Camera

David Dunham

The Watec 902H camera is highly recommended for recording lunar meteor impacts. Last night, I used it for the first time to image the 10% sunlit Moon's dark side, recording 4 reappearances of stars. It was fantastic, with incredible detail visible on the Earthlit dark side, and the 9th-mag. stars showing brilliantly, using my 8-inch Schmidt-Cass. and f6.3 focal reducing lens.

The Watec camera will clearly be able to record lunar impacts about 2 magnitudes fainter than the PC-23C, and similar gains are obvious for lunar and asteroidal occultations as well. It has almost the same performance as my image-intensified system at a fraction of the cost; I bought my Watec 902H from Security Products International, Pottstown, PA (phone 610-970-5150) for $340 + $6.63 for shipping, but lower costs may be available elsewhere. The Watec 902H camera is made in Japan and widely used by observers there. Contact information is available at http://www.watec.com but that is for the American division in Las Vegas; you can e-mail them at watec@watec.com to perhaps ask them about dealers selling the camera in other countries (you might also check with security camera and telescope dealers in your country).

With my telescope, it will make it possible to observe grazes of 9th and probably even 10th-mag. stars during the crescent phases, giving more opportunities to observe these events closer to home. It is also HIGHLY recommended for asteroidal occultations, making it possible to videorecord many more of these events than with the PC-23C. Visual observations of asteroidal occultations, especially of fainter stars, suffer greatly from always larger-than-reported reaction times which always complicates the analysis of those events; removing the "personal equation" greatly increases the value of those observations. The larger area as well as the sensitivity helps considerably in finding the target star. Visual observations of asteroidal occultations are not useless, and are encouraged at least to help define the path limits, but video timings are better.

Also useful, if you have a Schmidt-Cass. telescope, for increasing the area of the Moon imaged, is a focal-reducing lens; this also helps for asteroidal occultations (larger field of view) and lunar occultation reappearances. The f6.3 focal reducer is available in the range of $125 to $140 or so from many telescope dealers. Probably even better, for a larger field of view to image virtually all of the Moon's dark side, is the Meade Series 4000 CCD f3.3 focal reducer available for $144.95 from Focus Camera, Inc. in Brooklyn, NY (phone orders 888-221-0828), and probably from some other Meade dealers. I just received mine today, and it fits my C-8 since Meade and Celestron backs are the same. I hope to try it out tonight and will send another message only if I have any problems with it.

The Watec 902H is very small (32mm on a side) and operates essentially the same way as the common Supercircuits PC-23C (but it has just an RCA output rather than BNC video output, so you don't need a BNC-to-RCA adaptor) and is powered the same way, with 12V DC, with the same power cord available from Radio Shack - see details in the video information on the IOTA Web site at

http://www.lunar-occultations.com/iota.

Don't throw away your PC-23C since it's handy as a microphone/mixer to record sound (WWV); the Watec doesn't have a microphone.

Frank Anet writes, and I concur (and add some more information): The standard high sensitivity setting on the WAT-902H is useless, as the noise background is very high, greatly reducing the dynamic range, and the sensitivity is no better than with the low setting.

The cover on the back of the camera needs to be removed (micro-size Phillips screws) to get to the ultra-micro switch to change the sensitivity to low (the camera is extremely small and light weight). On the low setting, the background noise for a dark scene is still greater than necessary (but much reduced from the high setting and certainly acceptable). I permanently set the sensitivity to low. When observing lunar occultations, it behaves in the same way as does the PC23C, so that the gain is reduced automatically if too much of the bright side of the moon is visible (or also if there is a lot of glare from the invisible bright limb). Like the PC23C, it has a switch to control the exposure time (either 1/60 second or automatic). For dark images, these two settings give the same results.

The sensitivity is adjusted from high to low with a microswitch that can be reached only by taking off the back plate of the camera. Frank recommends a No. 00 Phillips screwdriver to remove these small screws; the screwdriver available in the "Radio Shack" kit works, according to one source. But I was able to remove the screws with a No. 0 Phillips screwdriver.

With the back removed, the tiny white sensitivity microswitch (not labeled) is mounted on the right side of the right side card (looking down into the camera with the RCA video output jack up), about a 4th the size of the shutter on/off switch on the left side that is accessible through a hole in the back plate. The sensitivity microswitch comes in the up (high sensitivity) position; just use a small object, or your fingernail, to push it down). Then reattach the back plate (last night, I observed without the back plate on, wanting to know what would happen when I changed from high to low sensitivity, but after seeing the results, the much higher noise with high sensitivity, I'm going to keep it on the low setting).

More about sources for the Watec 902H:

Tony Cook wrote in Aug.: As for prices - I hunted around on the web. The price for the 902HS at the following site is claimed to be $350 but when I phoned up and asked they gave me a price of $320? and the 902H was under $300. (the 902H is recommended; tests show that the 902HS is noisier, but not really more sensitive for detecting stars, than the 902H). http://www.4spi.com/pages/pg1.html
[this is the route I followed, but the "under $300" price doesn't seem to be available now. David]

Frank Anet wrote earlier: I purchased a Watec video camera (WAT-902H) from Rock House Products International, 2 Low Avenue, Suite 205, Middletown, New York 10940, because of its "Ultra Low Light" ability and "Incredible Low Light
Operation", as quoted on the Rock2000.com web site. The price was about $500, but that was several months ago; it is probably cheaper there now.

David Dunham
2001 Nov. 12

2001 Leonid Lunar Impact Flash Confirmed

Compiled from the IOTAoccultations mail list

David Palmer writes:

The bright flash was at 00:18:58 UT Nov 19. It was roughly equatorial, nearer to the central meridian than to the terminator.

David Dunham writes:

I just reviewed my tape, and at the time you give, and location, I also recorded the flash. You were in Los Alamos, NM, recording in twilight, but for me in Laurel, MD, the Moon was only a few deg. above the horizon, shining through some thin cirrus, so the lunar features on the dark side are not as obvious as they were earlier that evening. But the dark edge of the Moon is visible and it will be possible to determine the location from my tape. This should encourage others to review their tapes for flashes as you have done.

Tony Cook writes:

2001 Nov 19 00:18:58UTC (Time code 00:46:20:01-00:46:20:03) - Flash lasting 1/10th sec near center of Moon. Brightness fades with time. Some whispy, hazy cloud drifting past Moon at this time, but can still see some parts of Earthshine. Moon slightly above 3 deg above the horizon at this time. •

IOTA's Mission

The International Occultation Timing Association, Inc. was established to encourage and facilitate the observation of occultations and eclipses. It provides predictions for grazing occultations of stars by the Moon and predictions for occultations of stars by asteroids and planets, information on observing equipment and techniques, and reports to the members of observations made.

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IOTA European Service (IOTA/ES)

Observers from Europe and the British Isles should join IOTA/ES, sending a Eurocheck for DM 40,00 to the account IOTA/ES; Bartoldknaust Strasse 8; D-30459 Hannover, Germany; Postgiro Hannover 555 829-303; bank code number (Bankleitzahl) 250 100 30. German members should give IOTA/ES an "authorization for collection" or "Einzugs-Ermaechtigung" to their bank account. Please contact the Secretary for a blank form. Full membership in IOTA/ES includes one supplement for European observers (total and grazing occultations) and minor planet occultation data, including last-minute predictions; when available. The addresses for IOTA/ES are:

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IOTA on the World Wide Web

(IOTA maintains the following web sites for your information and rapid notification of events.)

IOTA Member Site
http://www.occultations.org

This site contains information about the organization known as IOTA and provides information about joining IOTA and IOTA/ES, topics related to the *Occultation Newsletter*, and information about the membership--including the membership directory.

IOTA Lunar Occultations, Eclipses, and Asteroidal and Planetary Occultations Site
http://www.lunar-occultations.com

This site contains information on lunar occultations, eclipses, and asteroidal and planetary occultations and the latest information on upcoming events. It also includes information explaining what occultations are and how to report them.

IOTA's Telephone Network

The Occultation Information Line at 301-474-4945 is maintained by David and Joan Dunham. Messages may also be left at that number. When updates become available for asteroidal occultations in the central USA, the information can also be obtained from 708-259-2376 (Chicago, IL).