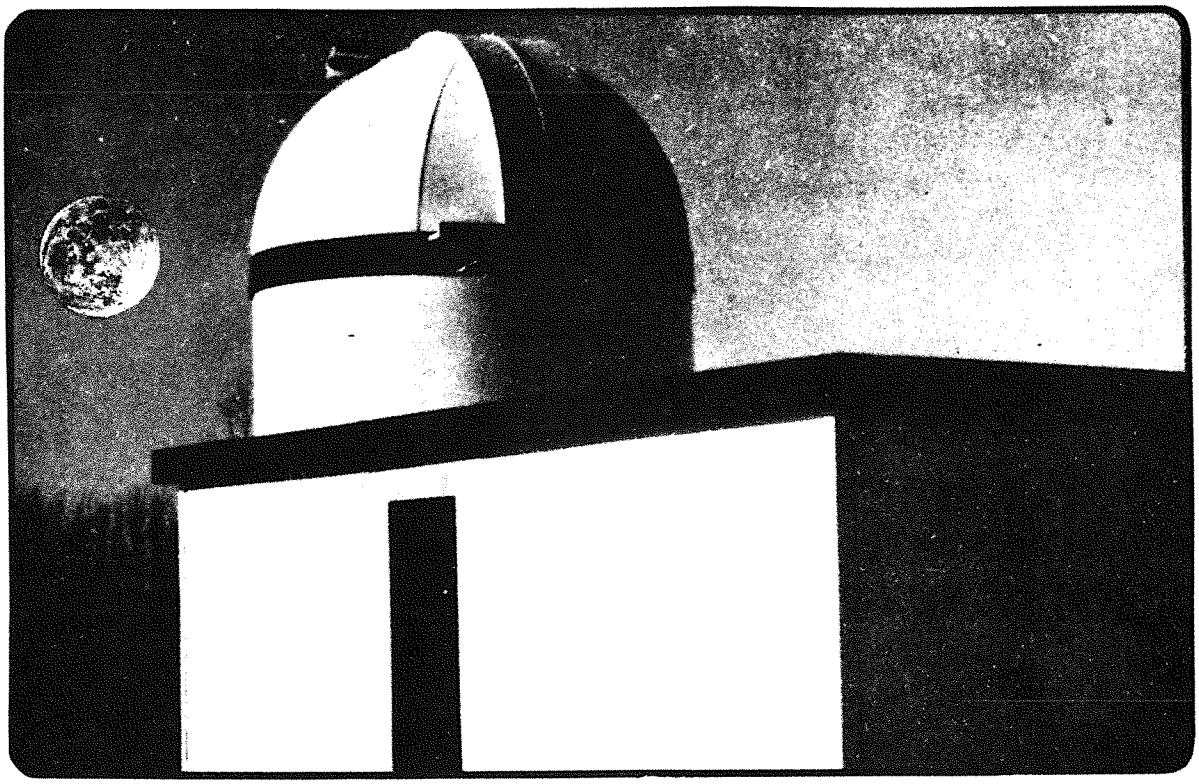

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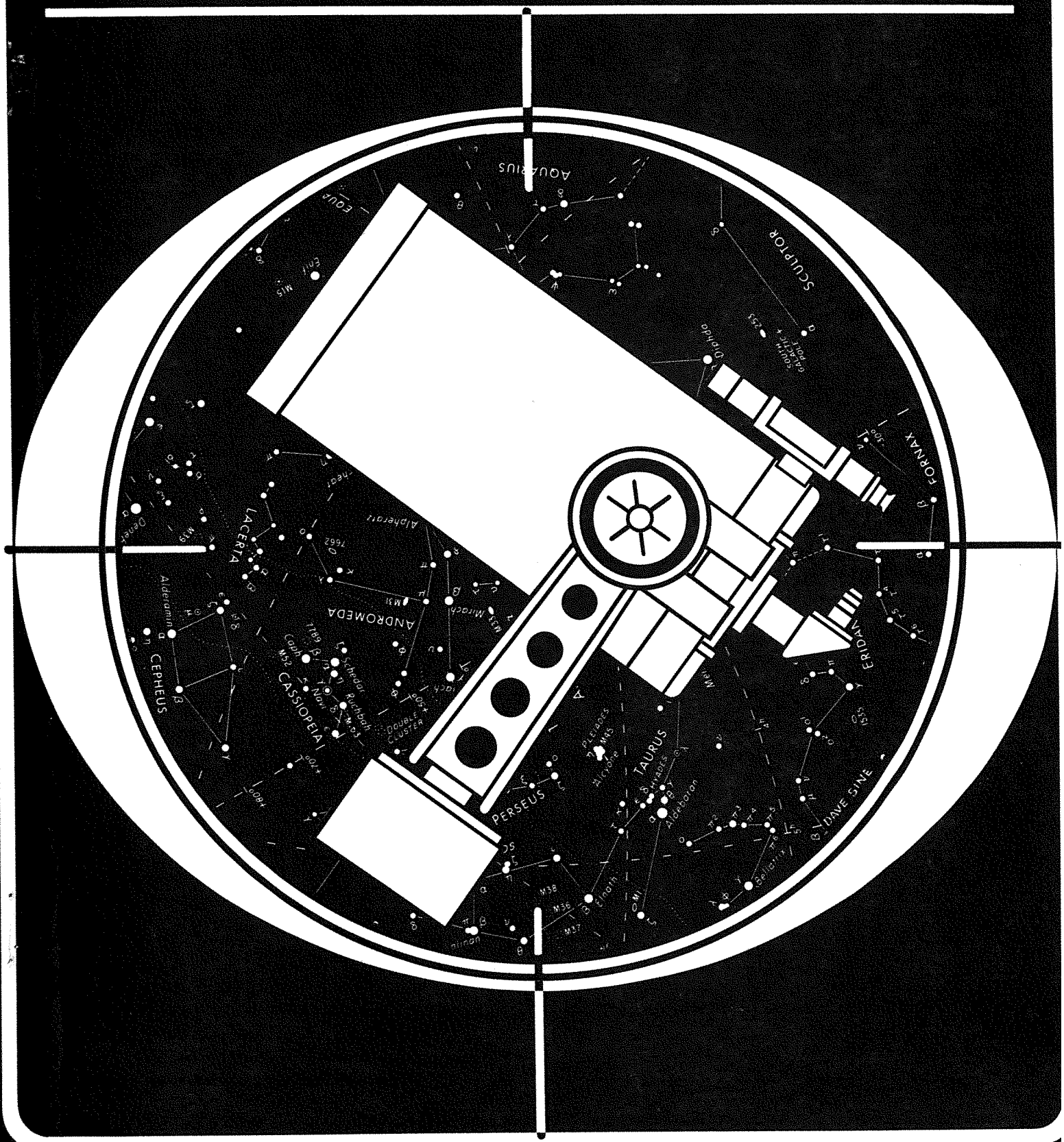

Vol.2 No.4 W I N N I C E N T R I C S 1982
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EDITOR'S NOTES.

The Winnicentrics' Committee wishes all our Centre members and friends a happy, healthy and safe summer. We're looking forward to another successful year for 'Winnicentrics', so please, keep writing your articles and help us get off to a good start in September! I will be in the city for most of July and August so feel free to get in touch with me if you have an article prepared, or perhaps you would like to work on 'Winnicentrics' next year.

Brenda Belkin (Editor)

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SEPT. & OCT. MEETINGS.

SEPTEMBER 10, FRIDAY 8:30pm.

ROOM 217, LOCKHART HALL, UNIVERSITY OF WINNIPEG.

PROGRAM: Mr Bill Krosney will be giving the main talk. (Topic to be decided) Mr Len Gamache and Mr Guy Westcott will show slides and relate tales about their trip to Arizona and tours of the observatories.

OCTOBER 15, FRIDAY 8:30pm. ****PLEASE NOTE THAT THIS IS THE 3rd**** ****FRIDAY IN OCTOBER.****

ROOM 217, LOCKHART HALL, UNIVERSITY OF WINNIPEG.

PROGRAM: THE ANNUAL GENERAL MEETING OF THE WINNIPEG CENTRE OF THE R.A.S.C. The agenda will include a short business meeting, in which all election ballots postmarked prior to October 8th, 1982, will be opened and counted. The results of the election will be declared, this will be followed by a film by the Saskatoon Centre on how they observed the eclipse in 1979. Another film will also be obtained for screening on this night.

PLEASE NOTE THAT MEMBERSHIP FEES ARE ALSO DUE AS OF THE OCTOBER MEETING. THIS IS EXTREMELY IMPORTANT AS THE CENTRE WISHES TO REPLACE THE DOORS TO THE OBSERVATORY AND CANNOT DO SO UNTIL THE DUES ARE FORTHCOMING. THIS IS HOPED TO BE COMPLETED BEFORE THE FIRST SNOW FALL OF THE YEAR. DUES MAY BE PAID TO THE TREASURER AT THE MEETING OR SENT IN TO THE CENTRE ADDRESS.

THANK YOU.

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WINNIPEG CALENDAR 1982.

JULY 1st/2nd/3rd. - Public lectures and star gazing at Riding Mountain National Park. All welcome free.

JULY 5th/6th. - Eclipse of the moon. Glenlea complex will be open for observing this eclipse. For more information phone the Observatory Director: Mr A. Lawless Ph 269 - 4845 Assistant Director: Mr G. Westcott Ph 269 - 1499

AUGUST 28th. - Public Star Party at the Glenlea Observatory.

CENTRE SCENE.

On May 1st, Winnipeg Centre members Len Gamache, Andrew Lawless, Wayne Jaworski, Jean-Paul De Cruyenaere, Tom Cairns, Del Stevens, Dave Sine, Mario Therrien, Guy Westcott, Michael Foster (representing M.A.C.), and myself, hosted a very successful Astronomy Day in Winnipeg at the Manitoba Planetarium. Approximately 115 people browsed through our display which was set up in the History Gallery of the Planetarium. Among the "Sine Language", "Kenya Eclipse", "Ceres", "Message from Arecibo", "Blow Up", and the "Winnipeg Centre" displays were books from the Centre's library, reprints from "Winnicentrics", newsletters from across Canada, astronomer aids, star charts, magazines, 5 slide shows complete with sound, and of course, the telescope display. Included in the latter were Andrew's and Wayne's C8's, Guy's Dobsonian--with the new-fangled "pizza pie-plate" mirror, the Centre's refractor, Dave's Celestron binoculars, Manfred Hirschfeld's Dynamax 8 and Len's clock-driven camera tripod. Star charts, information about the Winnipeg Centre, M.A.C. and the G.A. were made available to the public as well.

A star party was held in the evening in Lyndale Park following the display at the Planetarium. The sky remained hazy throughout the evening, but Mars, Jupiter, Saturn and the Moon put on a good show for the 85 people who attended the party. Set-up time began at 7:30 p.m. as Guy Westcott, Andrew Lawless and Wayne Jaworski set up the C8's and Dynamax 8. Everyone was quite impressed with the quality of the Centre's refractor which was set up as well. Dave Sine brought his Dynamax 6 and his Celestron binoculars as did new Centre member Dave Trimble, who brought his 3" Tasco. Mr. Hill drove in from McGregor, Manitoba for the party and brought his home-built 6" and 8" reflectors. Len Gamache set up his Celestron 750 telephoto lens while I took slides to record the events. Pack-up time was at 11:15 p.m. after which Centre members enjoyed donuts and conversation.

Special thanks to Guy Westcott for rewriting the summary of Centre history and objectives of the Winnipeg Centre, to Kathy Roos Pavlik at the Planetarium for her help in arranging for chairs, tables and other equipment required for the display, to members and friends who attended the display and star party, and especially to the members mentioned above who gave their time to make Astronomy Day 1982 very successful. I hope that next year's Astronomy Day events will be as successful as this year's!

SASKATOON BERRY PIE....

The annual meeting of the Royal Astronomical Society of Canada was held on the May long weekend in Saskatoon, and I was finally able to attend a convention. I read a short paper on Lunar Transient Phenomena and listened with earnest attention to the others, which included reports on variable stars, supernovae and photoelectric photometry. I had the good fortune to meet Alan Blackwell, the director of MORP (Meteorite Observation and Recovery Program), and chat with him about the project.

I had gone down to Saskatoon with Guy Westcott and Len Gamache, who, incidentally, won some awards along with Dave Sine for his photography and Dave's cartoons. We visited a total of four observatories, including a meteorological station. It seems they launch pibald balloons twice a day (causing some UFO reports) and cause cloud ceilings at night by shining a spotlight upwards, (causing UFO reports). At the formal banquet in Saskatoon, I sampled Saskatoon berry pie, a local delicacy.

A big hello and thanks to Joan, John and friends in Saskatoon, plus a special thanks to Gordon Patterson and his wife, for putting up with us.

C. Rutkowski.

COMING UP.....There will be a public Star Party hosted by the Winnipeg Centre on Saturday, August 28th,1982. Commencing at about 8:00pm. at the Glenlea Observatory site. Coffee and refreshments will be there of course! Bring all telescopes, family and friends. For directions to Glenlea Observatory or more information phone Brenda Belkin at 334 - 4027 or Dave Sine at 261 - 0431.

SATURDAY, OCTOBER 30th. 1982.
THE SECOND ANNUAL R.A.S.C. WINNIPEG CENTRE HALLOWEEN PARTY.
WE HAVE GIVEN YOU PLENTY OF NOTICE THIS YEAR, SO PICK A GOOD COSTUME, COME AND HAVE FUN. NO EXCUSES ABOUT NOT KNOWING THIS YEAR.

THANKS DAVE!
Many thanks to Dave Sine for the donation of a five gallon water cooler (electric) to the Centre. The cooler has been overhauled and will be installed at the Observatory in the near future. A boon on those hot summer evenings.

Condensed minutes of the May and June 1982 General Meetings.
MAY 14th. 1982. Rm 217 Lockhart Hall, University of Winnipeg
Attendance: 15 members 7 guests.

The meeting was called to order by the First Vice-President, Mr Westcott at 8:32pm. Members, new members and Guests were welcomed to the meeting. Mr Westcott announced that in the light of Mr Bailey's resignation from the position of President, that as laid down in our bylaws he would preside over the meetings as First Vice-President until the next elections were held in October 1982. He thanked both Brenda Belkin and Dave Sine for their efforts in making Winnicentrics such an excellent publication, with special thanks going to Mrs G Runge for taking on the large project of typing the majority of the magazine. The G.A. at Saskatoon was mentioned and it was hoped to have a reasonable showing from the Winnipeg Centre there. Some of the photographs for a display on aurora (taken by Len Gamache) were passed around. It was noted that some work has been done on the observatory about two weeks previous. The floor no longer interferes with the pier. Thanks were expressed to members for making Astronomy Day and the Star Night a success. Slides of the events were presented by Dave and Brenda along with some astrophotography. The guest speaker was then presented by Chris Rutkowski. Mr Roland Schultz who gave an excellent lecture on the structure of the galaxy and a large scale view of the universe. He discussed the effect galaxies have upon each other as they pass. After the talk many questions were asked, running late into the evening. Meeting was adjourned at 10:46 by a motion from the floor.
JUNE 11th. 1982 Attendance 15 members and 3 guests.
Meeting was called to order at 8:40pm. New members and guests were welcomed to the last meeting of the summer. Mr Westcott mentioned that nomination forms for council and executive positions were available at this meeting and that members should take a more active part in the running of their centre. The displays from the Saskatoon G.A. were on display as were the three awards won by Len Gamache and Dave Sine. Chris Rutkowski did a quick report on the Book Stores in Saskatoon and commented about his paper at the G.A. Speakers are still required for our meetings later this year. At this point Mr Westcott called upon Mr Gamache for his evening presentation on astrophotography. After the talk a coffee break was called for, this was followed by a slide show featuring the Centre's participation in the Saskatoon G.A. Guy,Len and Chris filled in the comentary. Andrew Lawless then spoke shortly about the Long Base Line telescope and how plans were going on the development..The meeting was adjourned at 10:55 by a motion from the floor.

ooOoo

4. BUMP & GRIND.

by Mario C. Therrien.

At last, we get down to the task of grinding and polishing your primary mirror. Assemble all required items in a part of your house, basement, garage, or wherever, that contains running water and you don't mind getting "untidy" or dirty. Next you will have to secure your tool in such a way that it is rigidly held in place yet can be moved and removed periodically. May I suggest a fairly simple "workpost". Find yourself an old trashcan, complete with lid (make sure it's empty and clean or it will start to smell before you finish your mirror). Saw off the lid handle, and bolt an 8" x 8" x 1" piece of wood atop the lid. Then, using 6&1/8" lengths of 2 x 2 planks, form a square in the centre of your 8 x 8 block and nail your 2 x 2 planks firmly onto the block. Now, fill your trashcan with water or sand (after choosing a proper site to place it), replace the lid/block arrangement atop the trashcan. And, voila! a workpost.

To start the grinding of your mirror, place your tool in the "square" of your workpost. You will notice that the tool moves freely within the square. To keep the tool rigidly in place, place some felt or rubber strips between the wood square and the tool. Now that the tool is secured, sprinkle on some #40 silicon carbide abrasive, so that the surface of the tool appears uniformly peppered. Use your fingers lightly to spread the abrasive evenly, if necessary. Next, using a pump sprayer filled with tap water, spray the abrasive surface lightly until the abrasive appears wet, but not runny or puddled. This may take a few tries to achieve the desired effect. Once your abrasive is wet, place the bubble and scratch-free surface of your mirror blank directly atop the tool. Placing both hands in the centre of the mirror blank, apply your body weight atop and move the mirror away from you, until the leading edge of your mirror blank is 1" over the edge of the tool. You will, no doubt, hear a hideous "crunching" sound. If you find it offensive, or your wife threatens divorce, then I urge you not to continue, but buy a mirror. This sound is quite normal, and will be repeated many times throughout the grinding process. Returning to that grinding... now, move the mirror blank towards you until the leading edge is about 1" from the edge of the tool. This is illustrated in figure 1, and is called the centre stroke.

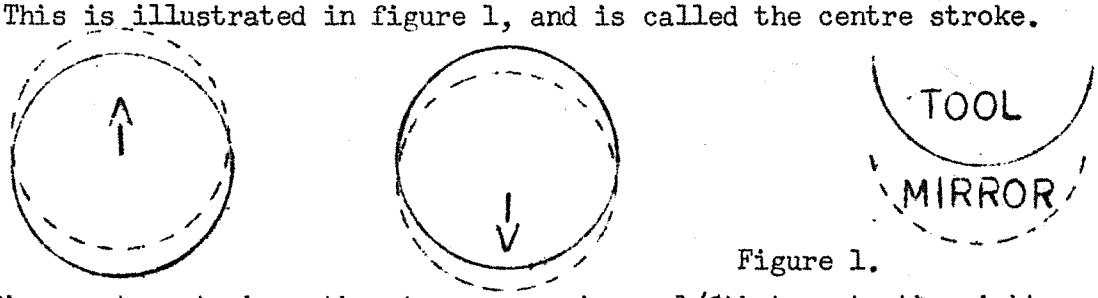


Figure 1.

Make five centre strokes, then turn your mirror 1/8th turn to the right, and move yourself 1/8th of the way to the left of your workpost. Repeat five centre strokes, repeat the turns until you have worked your way around the workpost once. This will be your basic grinding routine. During your routine, it is important to make certain of two things:
(1) If your abrasive appears muddy, it is! Replace it at once.
(2) Never allow your abrasive to go dry. Use your spray pump liberally, you should always clean off your abrasive when you have finished grinding for the evening. Keep a note of where you got up to so you wont have to work it out before you start again.

The grinding process has now commenced in earnest. Your mirror blank is no longer "blank".... you will see a multitude of scratches on its surface. The mirror is now "primed" for further grinding. Carefully clean the mirror and tool surfaces with running water, and begin again. However, this time, place your mirror off-centre another inch as shown in figure 2, and repeat your centre strokes. Continue doing this for at least 10 complete turns around the workpost, or approximately 400 individual centre strokes.

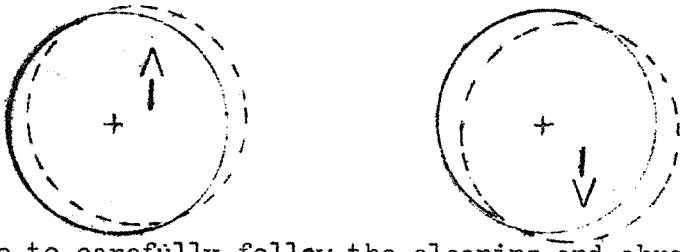


Figure 2.

Be sure to carefully follow the cleaning and abrasive replacement procedures outlined earlier. As you are grinding away, you will notice that the edge of your tool is turning down, and that your mirror is forming a hollow in the centre. EGAD, it works! If the hollow in your mirror is not centred, shorten the off-centreing distance between mirror and tool to about $\frac{1}{2}$", and continue as before. You will know that you have finished this part of the grinding when the entire surface of the mirror is frosted and the depression in the centre of your mirror is 6 millimetres deep, or more.

Now that the mirror is properly "hollowed out", you can proceed to the fine grinding.

The next step in grinding requires a different stroke known simply as the "V" stroke. Figure 3 illustrates the motion of the mirror atop the tool. Tracing the V back and forth once constitutes a single stroke, and as with the centre stroke, the mirror should not hang more than $\frac{1}{2}$ inch from the edge of the tool.

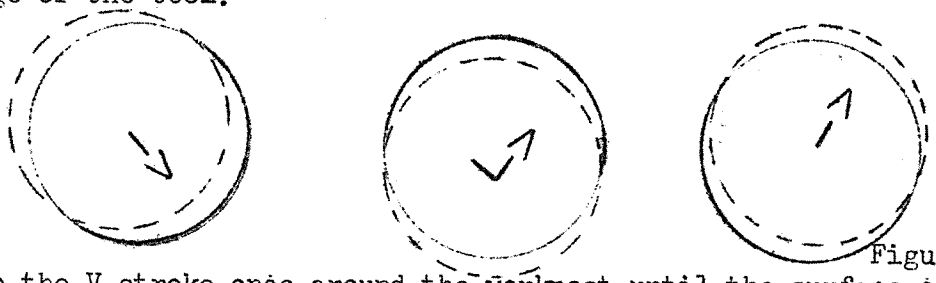


Figure 3.

Use the V stroke once around the workpost until the surface of your mirror is uniformly pitted. Use a hand lens to make certain of this. If there appears to be some deep pits, continue grinding until the pitted surface is uniform in appearance. When you obtain a uniform surface with a #40 abrasive, switch to #80 and continue grinding until once again the pits are uniform on the mirror surface. They will appear about twice as fine as they did in the previous case. You are now at the stage where a rough spherical hollow is emerging. This now leads you to the fine grinding steps using aluminum oxide abrasives.

In this stage of the grinding, you will use a third stroke, the "W" stroke. This is illustrated in figure 4 on the next page. Rather than tracing a V across the tool with your mirror, you will be tracing a W. This allows for a truely spherical mirror capable of being shaped into a parabaloid. Starting with #120 aluminum oxide, proceed as you have already done with the V stroke, only using the W stroke. The following differences, however, should be noted:

(1) Since the #120 to #2000 aluminum oxides are much finer, it would be advisable to make a mixture of abrasive and water, in small amounts say $\frac{1}{4}$ to $\frac{1}{2}$ a cup.

This mixture should have the consistency of pea soup or chowder. Using a separate paintbrush for each abrasive, paint the mixture onto the tool each time you are grinding.
(2) It is very important at this stage not to let the abrasive get very dry.
(3) Move slowly and avoid jerky motion. Strong elbow grease is recommended for this stage.
(4) Never let the abrasive get too muddy. replace it with fresh promptly.
(5) Always thoroughly clean the tool and the mirror when going from one number abrasive to another.

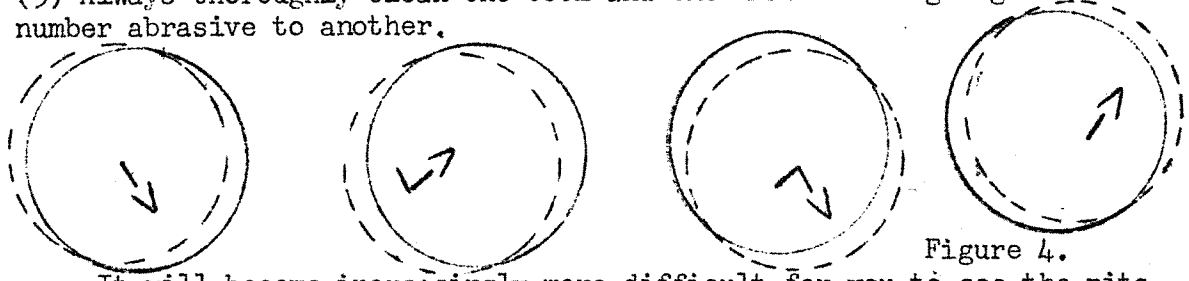


Figure 4.

It will become increasingly more difficult for you to see the pits on the mirror surface as you use finer grades of abrasive. When you check for uniformity of the pits, it would be wise for you to check the mirror in a darkened room, using only a hand-held flashlight as a source of light. Illuminate the mirror from the side for the best results. Laying the mirror on black felt or cardboard is also very useful and helpful for examination.

How much time is spent grinding with each number abrasive depends on how effectively your mirror is being ground. Usually anywhere between 50 and 200 strokes at each stage are required with each abrasive before being able to move on to the next highest number abrasive. The higher the number of the abrasive the more work will be required to grind to a uniform pitting. By the time you get to number 2000, your mirror should be completely transparent when wet, and will form an image of a light source some 36 inches away, if sunlight is excluded. When you've reached this point, your work is $\frac{3}{4}$ over. Cover your mirror and keep it in a safe place it would break your heart if you dropped it now. Keep it away from Dust, dirt and any source of potential scratches. Now gather your courage for the last step, polishing, figuring and mounting your mirror.

ooOoo

NASA NEWS

by Guy Westcott.

HEAOs' Mission Ends.... The trio of satellites designed to study X-rays and cosmic rays and other high energy sources, has now completed its mission and gone into flaming oblivion. HEAO-1 re-entered the atmosphere back in 1979. HEAO-3 suffered a similar fate last December, and now HEAO-2 completed the cycle when it plunged into the atmosphere early this year. HEAO-1 found a superhot halo of gas surrounding the Northern Cross stars. This superbubble is about 6,000 lys from the Earth and the discovery prompted a new theory of star formation. HEAO-2 obtained the first X-ray photographs of supernova remnants, pulsars and star clusters. Carrying the largest X-ray telescope ever built it conducted a detailed observation of over 300 bright X-ray sources and discovered thousands of new ones. It showed almost every type of star in the Galaxy to have an X-ray emitting atmosphere. HEAO-3 was designed to further our knowledge about cosmic-ray particles and gamma ray photons. It measured the relative abundance of elements in the Galaxy. Significant differences between the amounts of certain nuclei in the galaxy and the same elements in the solar system were found by the observatory.

HERE TODAY, GONE TO MAUI!

by Len Gamache.

On the 31st of March I found myself staring up at Mars. It was a clear warm evening and I realized that the planet was almost straight up. The warmth was produced by the gentle trade winds and Mars' elevation was natural when observing from Kaanapali beach on the island of Maui. Never having been farther south than Grand Forks North Dakota, it was shocking to see a resplendent star below Sirius just above the island of Kahoolawe. After checking a star chart, I ascertained that it was Alpha Carinae. Canopus, the second brightest star in the sky was very impressive even at 18° above the horizon. At about 4:00 in the morning, jet lag allowed me to experience the moon and Venus rising peacefully over the mountainous Puu Kukui. Scorpio astonished me. I could see it. All of it!

During my visit I was able to brush up on some astronomical history. The early Hawaiian astronomers (called poe kilo-kilo) watched the movements of the planets, moon and sun, very carefully. They used this knowledge in their daily lives. It was their duty to keep track of time, especially in the sense of growing crops, leaving on ocean voyages and, of course, picking the right time for battle. As it is with many cultures, the astronomers were also expected to gaze earnestly into the night sky and predict the future. Makina, the moon, played an important part in the Hawaiian calendar. The poe kilo-kilo watched for the Pleiades to rise shortly after sunset. Now the next new moon would begin the new year. They realized that the lunar months did not fit evenly into one year. Although it isn't known how the Hawaiians solved this problem, natives on the atoll of Manihiki added a thirteenth month when it was necessary. The ancient Greek Metonic Cycle worked exactly that way. It consisted of 12 years of 12 months and 7 years of 13 months, repeating every 19 years. The Hawaiians had a different name for the moon each day of the lunar month. One day before full, it was called nua (an egg) as opposed to akua (very round) when full. Many astronomical objects have charming Hawaiian names and the milky way (mua moo) is no exception. Each of the planets had 2 names. One for the eastern sky and one for the west. Venus was called hoku-loa in the east and na-holo-holo in the west. Many red objects such as Mars and Antares were known as hoku-ula while Arcturus was hoku-lea. Because Mars is a wanderer, it also had a proper name, holo-holo-pinae. Jupiter because of its brilliance, was known as ika-ika and Saturn, makulu. The Hawaiians had terms for the zenith, horizon, constellations and many individual stars. Unfortunately, most of the data was lost. These people were able to navigate by using the sun, stars, trade winds and currents. It's curious to note that they did not worship La, the sun, but valued its warmth and means for telling directions and time. A popular legend describes the deceleration of the sun by the demigod Maui to lengthen the day. This is definitely something we could use in January.

All in all, it was a wonderful trip. On the return flight I was anxious to see stars from 30,000 feet, but they never turned off the aisle lights. One could barely see the brightest stars. It made me envious of the polynesian mariners carefully guiding their double canoes through an ocean of stars.

ALOHA NUI

TIDBIT.

If the sun was located at the corner of Portage Avenue and Main Street, Jupiter would be at the North Perimeter and Pluto would be located in Gimli, Manitoba!

Q. How much is the moon worth?
A. A dollar, since it has four quarters!

8. DATA PROBE

Q. How are comets named?

by Brenda Belkin.

A. Comets usually bear its discoverer's surname. Often, two or more observers discover a comet simultaneously. The names of the first three observers to report their discovery properly are affixed to the new comet (e.g., Comet Honda-Mrkos-Padjusakova). In addition to this name, the comet is assigned a letter of the alphabet (a,b,c, etc.) that coincides with its order of discovery in a particular year. For example, Comet Kohoutek, 1973f, was the sixth comet discovered in 1973 and was discovered by Lubos Kohoutek. Eventually, the comet is given a longer lasting name, specifying with roman numerals, the year and the order in which the comet passes perihelion. Comet Kohoutek, 1973f is now referred to as 1973 VII, which indicates that it was the seventh comet to pass perihelion in 1973.

Q. How do we estimate the age of lunar features?

A. This is a very good question. According to A Complete Manual of Amateur Astronomy by P.C. Sherrod (available in the Centre's library), there are seven guidelines for making these estimations:

1. Crater size. The larger a crater is, the older it is because the meteoric material has been greatly reduced since the bombardment of 4 billion years ago.
2. Crater depth. Craters that appear to be deep and rounded on the floor are generally young craters. Those in which there appears to be a lot of dust, and thus having a smooth floor, are thought to be very old.
3. Crater walls. Note the degree of rim erosion on the crater wall caused by the solar wind. Crater walls become worn as they age.
4. Secondary cratering. Notice a smaller crater within a larger one; this is secondary cratering. Because cratering is more rare now, it is assumed that a crater in which many smaller craters are found must have accumulated these craters slowly over a long period of time and hence they must be quite old.
5. The albedo of craters. Remembering that albedo is the amount of reflectivity of a surface feature, older craters containing more hard lava and dust have a lower albedo. Older craters are gray, new ones are bright.
6. Rays from craters. Craters from which rays originate are relatively new.
7. Rills. It is believed that tiny craters with rills are very new because the total amount of erosion we see is small compared to that of other features.

Q. Why in some photographs do stars exhibit spikes?

A. This spike effect is mainly due to the type of telescope that the photograph was taken through. All photographs taken through a telescope that has a secondary mirror held by a spider bracket will exhibit this effect. The stars will have a different number of spikes from telescope to telescope as this depends on the number of support legs that the particular spider in that telescope has. I think the effect is quite asthetic as the stars do look like stars.

Our sun is not just your average star

Terence Dickinson

Most science books tell us that our sun is an average star like most of the other 300 billion stars in the Milky Way Galaxy. Although this statement continues to be repeated, it simply is not true.

The average star is smaller, cooler and much dimmer than the sun.

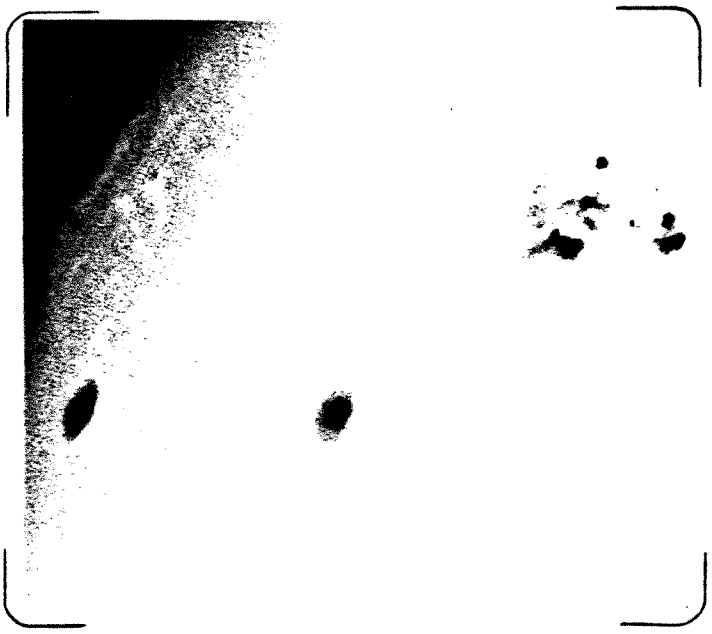
Of the 68 stars nearest to us, all but three are fainter than the sun. The sun actually ranks in the top five per cent of the galaxy's stars in terms of brightness.

The fact that the sun is a single star also makes it unusual. In an examination of stars similar to the sun, Helmut Abt and Saul Levy of Kitt Peak National Observatory near Tucson found that at least two-thirds of those surveyed probably have companion stars in orbit around them.

More recent work by Abt and Levy has revealed two classes of companion stars. If the secondary star orbits close to the primary sun, the pair are likely to have similar masses. If the companion has a large orbit that requires more than about 30 years for one circuit, then there seems to be no special relationship. The second sun in a wide binary system can have just a few per cent of the mass of the main star.

Since many of these two-mass companions are at the threshold of detectability, Abt and Levy say there are probably many more out there than we have seen so far. These observations have renewed speculation that the sun could have a low-mass stellar attendant.

Because some of the observed double stars have their two components separated by 100 billion miles or more, some astronomers have speculated that the sun's companion could be a faint dwarf star, far enough away to go unnoticed.



Photograph by Damien Lemay, Dynamax 8.

Two researchers at the University of Amsterdam, H.F. Henrichs and R.F.Staller, examined this question and found that if the hypothetical companion was about eight per cent of the sun's mass, it could not remain undetected.

Both its brightness and its gravitational effect on the planets would have been noticed by now even if it were a light-year away (six trillion miles). However, they examined the possibility of an object only 2 per cent as massive as the sun existing on the fringe of the solar system. These objects are known as dark dwarfs. Dark dwarfs are not true stars since they are below the mass threshold to produce thermonuclear reactions at their cores.

No dark dwarf is known for certain, but theory strongly suggests they are abundant. Energy from radioactive decay and contractional pressures would give these Jupiter-sized objects a dull red glow.

At a distance of 100 billion miles (about three times farther than Pluto), a dark dwarf would be visible in amateur astronomers' telescopes due to its own radiation and reflection of sunlight. The two Dutch astronomers are convinced it would never have gone undetected this long. Even Jupiter at that distance would probably show up on survey photographs.

continued on page 10.

However, it is conceivable that a dark dwarf, with an orbit that keeps it about two trillion miles from the sun, could go unnoticed.

At that distance, about eight per cent of the way to the nearest star, it would be well within the sun's gravitational grip, but from Earth such an object would be indistinguishable from millions of 18th-magnitude stars.

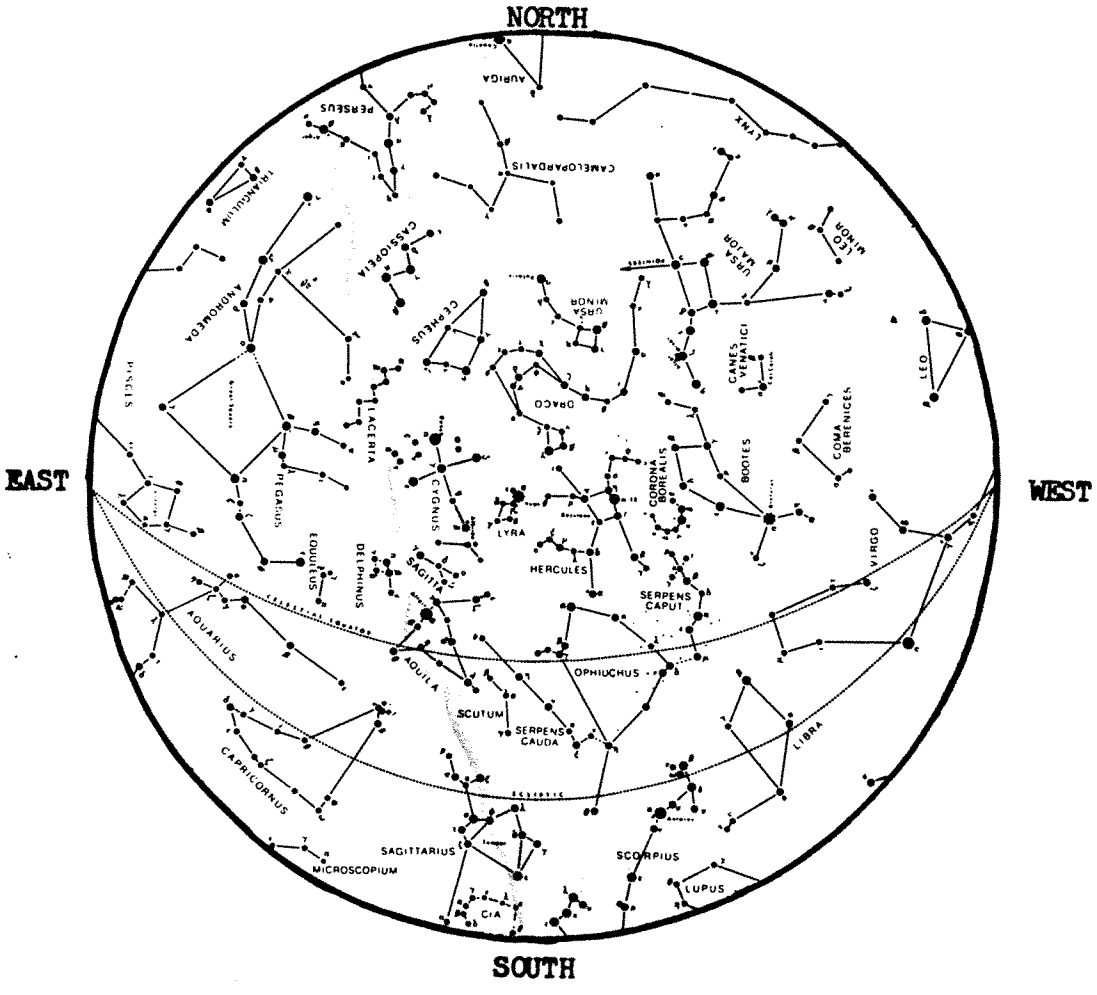
So a sub-stellar companion to the sun cannot be ruled out. Only a detailed all-sky search with sensitive infra-red telescopes will settle the question. Such telescopes have been built over the last decade, and they are ideal for detecting the type of radiation that a dark dwarf would emit.

Reprinted by kind permission of the author.
Toronto Star.....March 20, 1982.

SKY NOTES,

by BRENDA BELKIN.

To use this map, hold overhead and turn it so that the directions marked around the map's horizons match the true directions. This map works best on:
JULY 1st....Midnight. JULY 15th....11pm. AUGUST 1st....10pm. AUGUST 15th....9pm. SEPTEMBER 1st....8pm.



The three planets, Mars, Jupiter and Saturn will dominate the summer skies at sunset, so be sure to take advantage of the warm evenings and do plenty of "planetography".

MERCURY: July 15: RA 6h 45m Dec +23° 21'
August 15: RA 10h 51m Dec +8° 09'

July and August are unfavorable months for observing Mercury, but early in July, it can be seen very low in the east at sunrise. Mercury is at descending node on August 20th.

VENUS: July 15: RA 5h 31m Dec +22°14', mag -3.3
August 15: RA 8h 12m Dec +20°22', mag -3.3

Venus rises 2 hours before the sun in the east and its visibility improves over the two months. Venus is at ascending node on August 6th.

MARS: July 15: RA 13h 11m Dec -8°06' mag +0.5
August 15: RA 14h 16m Dec -14°40' mag +0.9

Mars is 3°S of Saturn on July 10th and 2°S of Jupiter on August 10th.

JUPITER: July 15: RA 13h 57m Dec -10°41' mag -1.7
August 15: RA 14h 07m Dec -11° 46' mag -1.5

Mars, Jupiter, Saturn and Spica are within 15° of each other on the ecliptic for about a month.

SATURN: July 15: RA 13h 03m Dec -4°13' mag +1.0
August 15: RA 13h 10m Dec -4°55' mag +1.1

Saturn remains in Virgo and is low in the southwest at sunset.

LUNAR NOTES

PHASE	JULY	AUGUST
Full	6th	4th
Last ¼	14th	12th
New	20th	19th
First ¼	27th	26th

THERE WILL BE A TOTAL ECLIPSE OF THE MOON ON THE NIGHT OF JULY 5-6.

METEOR SHOWERS

Two major showers will entertain us during July and August--The S. δ Aquarids on July 28 with a single observer hourly rate of 20 and the Perseids on August 12 with a single observer hourly rate of 50. The latter shower will be more spectacular than the first as these meteors will hit the Earth's atmosphere at an impressive 60 km/s!

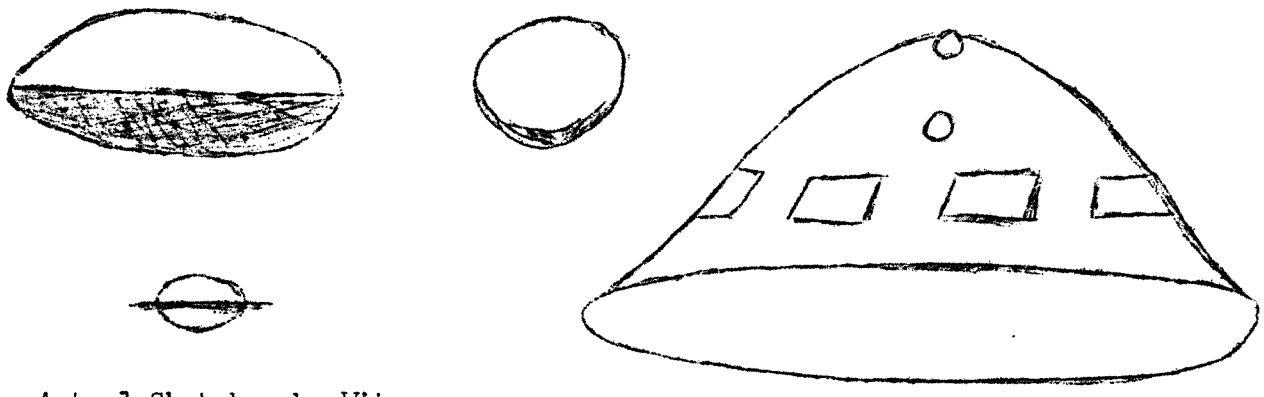
The Revenge of The Space Pet

by Chris Rutkowski.

Friday night, June 18th, 1982, found many Winnipeggers looking into the sky, bewildered. Reports started trickling in to the Planetarium on the next Tuesday, when the Planetarium's resident UFO investigator began receiving reports of an ovoid-type UFO travelling in a slow, flat trajectory over the St. Vital area in the vicinity of the shopping centre. After an appeal on the radio for additional witnesses, over twenty witnesses were eventually located. I interviwed a dozen of them, getting detailed descriptions and sketches of the object, while my co-investigator assisted with the investigation by taking individual witnesses aside, one by one to get an accurate narration, and asking for relevant information.

The sighting was far too good, and we were immediately suspicious. In addition to the large number of witnesses, the were three separate photographs taken by three separate witnesses. The object was thought by all witnesses interviewed to be quite small, perhaps the size of a beachball, pressed into an ovoid. It was silver-grey in color, slightly brighter on its top than its bottom.

By Friday morning, the Planetarium's spokesman had declared the object to be a "Space Pet", a helium-filled silver balloon often sold at fairs and exhibitions. They are currently being sold in Winnipeg at the Red River Exhibition, and someone came forward with the news that they had lost their "Space Pet". All descriptions of the UFO observed match the balloon fairly well, with some notable exceptions (see sketches). It has therefore been assumed that the UFO was the balloon. However, certain aspects of the descriptions of the object raise several questions. All witnesses agreed that the object flew in a level path. At speeds comparable to those reported, a space pet wobbles in the turbulent wind as it sails. Was this turbulence of small scale during the object's flight, and hence no wobble was observed? All witnesses , when asked about the suggestion that the object was a Space Pet, replied to the negative, saying it was "different". Did you see it? What did you think?



Actual Sketches by Witnesses

II. POWER SYSTEM.

By Kelvin Kent
Engineering, University of Man.

The space shuttle's power system is comprised of the Main Engines, the Orbiter Maneuvering Subsystem, two Solid Rocket Boosters, and an External Fuel Tank.

The majority of the thrust for the space shuttle is provided by three main engines. These engines were developed by the Rocketdyne division of Rockwell International. Rocketdyne was awarded an eight-year contract worth four hundred and sixty-five million dollars to produce the Space Shuttle Main Engine (SSME). Each SSME produces 512,000 pounds of thrust running at one hundred and nine per cent and 470,000 pounds of thrust at normal full power. The three main shuttle engines have many special features that help to provide the power.

The Space Shuttle Main Engine has liquid oxygen and hydrogen turbo-pumps that run at 37,000 rpm to provide the fuel to the injectors at the required rate. The fuel is partially burned at low temperatures in the preburners before it is totally combusted at high temperature and pressure in the main combustion chamber. The fuel expands seventy-seven times its original volume as it flows through the exit nozzle. The Space Shuttle Main Engine is considered to be ninety-nine per cent efficient in burning the fuel. The fuel must be pumped at tremendous rates so that the three engines can produce such great amounts of power. The Space Shuttle Main Engines each consume 3,400 gallons of hydrogen and 140 gallons of oxygen per minute.

The SSMEs operate at temperatures of 6,000°F and require cooling to prevent the engines from melting. A brazed network of stainless steel tubes, filled with cryogenic hydrogen, encases the main burning chamber. The hydrogen flows through the stainless steel tubes of one-half inch diameter and cools the engine. This same liquid hydrogen is combusted with oxygen in the main combustion chamber a short while later.

The SSMEs are capable of being throttled down to 235,000 pounds of thrust if necessary. This is done by closing an oxidizer valve and reducing the pressure in the oxygen preburner. The oxygen turbopump slows down and the computer controlling the engine senses this and evens out the fuel mixture, thus reducing thrust. The three main engines can be steered as well as throttled. The SSMEs are situated on gimbal mountings and are steered by way of hydraulics. The engines are capable of moving 11.5 degrees from center in all directions.

The computer that controls the SSME is attached to the core of the engine. The computer checks many of the internal parts of the SSME and relays the results to the pilots. The main engine computer is also responsible for starts and shutdowns of the system.

The twenty-four engines built by Rocketdyne are ground tested at least twice before they are ready to be used in the shuttle. The engines will be reused at least 55 times and will have a 7.5 hour total operating time. The three SSMEs should need only minor repairs and maintenance work between the fifty-five flights.

The Orbiter Maneuvering Subsystem (OMS) is located at the rear of the shuttle in the upper corners beside the main engines. The OMS consists of two hypergolic engines which provide 6,000 pounds of thrust each. Hypergolic engines are rocket motors that ignite upon contact of the fuels. No spark is necessary to start the burning process in a hypergolic engine. Each OMS pod has high pressure helium storage tanks and two other fuel tanks. The two fuel tanks contain Nitrogen tetroxide and Monomethylhydrazine. The OMS engines are expected to last as long as the space shuttle's main engines.

The orbiter maneuvering pods are important for providing power for the shuttle while in orbit. These two engines are used to orbit and de-orbit the shuttle while in outerspace. The pods can produce a velocity change of 305m/sec with a 29,500kg payload in the cargo bay. If more thrust is required from these engines, extra fuel tanks can be placed in the payload area. The orbiter maneuvering engines have a chamber pressure of 125 P.S.I. and a nozzle expansion ratio of seventy-two to one. The OMS engines are steered electronically and mechanically to change the direction of the shuttle.

The OMS also has twelve 870-pound thrusters for controlling the shuttle. In addition to these twenty-four rear thrusters (twelve per side), there are fourteen 870-pound thrusters in the nose section of the shuttle. Six twenty-five-pound vernier thrusters are also located in the nose module. All these small thrusters are used when positioning the shuttle for picking up satelites or other cargo.

The shuttle can also be equipped with six 21,000-pound thrust airbreathing engines for missions within our atmosphere. These engines fasten to the underside of the shuttle and the fuel is located in the cargo bay.

The Space Shuttle Columbia is equipped with enough engines and thrusters to make it very maneuverable. All the engines in the shuttle are important for the various missions it will undergo in the future.

The two Solid Rocket Boosters (SRB), attached to the external tank of the shuttle, provide a great deal of thrust during the launch. The shuttle is the first manned space craft to use a solid fuel motor. The Solid Rocket Booster's fuel is supplied by Thiokal Chemical Corporation and is mainly polybutadiene acrylic acid acrylonitrille (PBAN). The Thiokal Chemical Corporation was awarded a one hundred and fifty-six million dollar contract to supply fuel for nineteen SRBs. Seven of the motors are for testing purposes and the other twelve are for the first six shuttle missions. The boosters each supply 2.7 million pounds of thrust and carry 454,000 kg of fuel. The boosters burn for one hundred and twenty-two seconds and are the most powerful solid fuel motors ever used.

The SRB are one hundred and forty-nine feet long and are reusable. The casing of the booster has a diameter of 146 inches and the nozzle has a diameter of 54 inches. The nozzle reaches a temperature of 5,600°F and extremely high pressures. The nozzles of the boosters can move eight degrees in any direction to help steer the shuttle.

After the space shuttle is twenty-seven miles above the earth, the SRB are jettisoned. The boosters fall into the Atlantic Ocean where they are towed to shore by special tugs. The parachutes are located in the noses of the boosters and have diameters of 115 feet. A parachute of such great size has never been used before. The boosters have three parachutes each that can be reused up to ten times. A range safety antenna, a recovery beacon, and an avinics module are located in the section just below the nose cone of the booster. The shuttle's Solid Rocket Boosters are the first to be retrieved and then restored for another flight. The entire casing must be stripped and reinsulated after the recovery of the rocket booster. The nozzle sections of the boosters detach and fall separate from the main body of the boosters. This helps to eliminate damaging vibrations caused from sound waves shocking the nozzle.

The SRB are controlled and monitored by computers. After 122 seconds, the computer activates four 22,500-pound thrusters which separate the boosters from the moving shuttle. The boosters are equipped with a self-destruct mechanism that can be used if the SRB are falling toward a populated area.

The solid rocket motors are essential for the space shuttles launch since they produce such great thrust. These technologically advanced boosters are a truly outstanding feature of the space shuttle.

The External Tank (ET) of the space shuttle carries the fuel for the three main engines. The Martin Marietta Company was selected to design and develop the complex External Tank. The ET accounts for approximately thirty-seven per cent of the shuttle's total mass. The tank also delivers 709,000 kg of liquid fuel to the shuttle's main engines at 3,930 litres per second. The tank has a diameter of 8.46 meters and a height of 47.28 meters. The liquid hydrogen and liquid oxygen fuels are both stored in the long cylindrical tank.

The External Tank supports the Solid Rocket Boosters and the orbiter until the tank is discarded after the ten minute launch. The ET receives much stress as the SRB and shuttle engines produce great thrust. Basically, the External Tank consists of the upper liquid oxygen (LO_2) tank, the intertank, and the lower liquid hydrogen (LH_2) tank. The ET has fourteen specific locations where the shuttle and SRB are attached to its frame. The shuttle is fastened to the launch-pad by way of the Solid Rocket Boosters.

The LH_2 tank is the largest fuel tank ever designed for a space craft. It is below the Intertank and consists of a forward dome, a main barrel section, an aft dome, and an antivortex baffle. The majority of the shuttle and SRB attachments are located on the exterior of the LH_2 section of the ET. The aluminum LH_2 tank is similar to the upper LO_2 tank. It has a dome end-cap similar to that of the oxygen tank but the barrel section of the LH_2 tank is much larger. The liquid hydrogen tank has an internal volume of 1,573.2m^3 and holds 102,517.7 kg of fuel.

The Intertank section of the ET is basically designed to carry the thrust of the SSMEs and the SRB. The Intertank is made of aluminum just like the LO_2 and LH_2 tanks. This section of the ET is hollow except for the heavy beams and reinforcements it holds.

The External Tank has extensive thermal protection covering its entire casing. This thermal protection is necessary to stop ice from building up on the tank's exterior walls. NASA officials believe that ice from the external tank may have damaged the shuttles thermal tiles during the first launch. The insulation on the ET is up to 5.08 cm thick on the liquid hydrogen end-cap.

The External Tank is an outstanding feature of the space shuttle and is the major structure during the launch. This tank holds all the liquid propellants necessary for the three main engines. The ET is a good example of advanced space technology and is one of the most important components of the entire shuttle program.

ooOoo

COMET HUNT.

by Guy Westcott.

1982d PERIODIC COMET TEMPEL 2: This comet was the question for some time as to the visit by a NASA space probe. A very faint comet, recovered by J. Gibson at m2 = 20 - 20.5 on plates that he exposed on February 3rd and 4th well over a year before its scheduled perihelion on T = 1983 June. Orbit inclination is 12°44 and its period is 5.288 yrs.

Comet BORELL:	July 10	R.A. 18h 03.4	DEC -22 42'	mag 12.6
	20	18h 00.8	-22 48'	12.6
	30	17h 59.4	-22 53'	12.8

When I last spoke with David Levy about our forthcoming visit to his neck of the skies, he said he would try to arrange for our own comet to be visible. I hope its comet Halley that he finds.

Thought of the month: Astronomers are never late, they are just eccentric!

16. JULY LUNAR ECLIPSE

AN AMATEUR'S CHECKLIST.

by Brenda Belkin & Guy Westcott.

On July 5-6, 1982 amateur astronomers in North America, South America, Antarctica and the Pacific Ocean will turn their eyes, scopes and cameras towards the skies in what should be a spectacular total lunar eclipse. Unfortunately, the eclipse falls in the wee small hours on a Tuesday but the warm summertime temperatues should be tempting to even the most modest lunar enthusiast, in spite of the mosquitoes.

Unlike total solar eclipses which occur along narrow paths of the globe, lunar eclipses can be seen from one's own backyard and from all places within the hemisphere where the moon is above the horizon. Also, the beginning and ending of a lunar eclipse happens simultaneously for every observer, unlike a solar eclipse. The makings of a total lunar eclipse is easily explained in the accompanying diagram. The full Moon, Earth and Sun must be in a straight line in order for an eclipse to occur. Because the Moon is smaller than the Earth, it passes through the various intensities of the Earth's show -- the lighter penumbra and the darker umbra.

As the moon moves through the Earth's shadow, its color and brightness changes. Colors in the umbra may vary from one eclipse to the next, but reds and greys usually predominate with blues, browns and other tints encountered on occasion. At mid-totality, the darkness of the sky is impressive. The landscape takes on a somber hue instead of the strong wash of a normal full moon on a clear night. As totality ends, the eastern edge of the moon begins to emerge from the umbra and the moon's brightness increases while the reddish hue lightens. Although many kinds of careful amateur observations can have scientific interest, many of us would rather just watch this splended display of nature. For visual observations, small telescopes two to six inches in aperture are recommended with the use of the lowest-power eyepiece.

TIME OF EVENTS OF THE JULY 5-6, 1982, LUNAR ECLIPSE

	Local Times.	WINNIPEG... START T.	END T.
Moon enters penumbra	23h 22m, July 5th	16°, 182°	-0.4°, 301°
Moon enters umbra	00h 33m, July 6th		
Totality begins	01h 38m, July 6th		
Middle of eclipse	02h 31m, July 6th		
Totality Ends	03h 24m, July 6th		
Moon leaves umbra	04h 29m, July 6th		
Moon leaves penumbra	05h 40m, July 6th		

Note: Sunset July 5, 1982 is 21h 11m Local Time
Sunrise July 6, 1982 is 03h 58m " "

To follow are some visual observing projects that can be done during the eclipse:

1. Coloration. There is valuable information in the careful description of the changes in color seen on an ecliped moon. The hues are more vivid with the nakes eye than in telescopes. In recording color observations, note the time of each description and the instrument used. A labelled sketch of the color pattern will be helpful for later analysis.

2. Darkness of the eclipse. There is a wide range in the brightness of the moon from one eclipse to another. As mentioned before, there are differences in the shadow from one eclipse to the next and it is important to compare the July 5-6 eclipse with others. A five-point scale of lunar luminosity (L) was introduced by the French astronomer A. Danjon to aid in classifying eclipses:

L=0: Very dark eclipse, moon almost invisible, especially in mid-totality.

L=1: Dark eclipse, gray or brownish coloration, difficulty in distinguishing details.

L=2: Deep red or rust-colored eclipse. Central part is very dark, outer edge of umbra is relatively bright.

L=3: Brick-red eclipse with a bright or yellow rim along shadow.

L=4: Bright copper-red or orange eclipse with a bluish very bright rim along shadow.

Examine the moon at the beginning, middle and end of totality.... Naked eye, binoculars or a small telescope can be used but be sure to specify the instrument used in your notes,

3. Penumbra. At what time can you first recognize any penumbral shading on the moon? During the partial stages, examine the penumbral border as the moon slips into the path of umbral shadow. Estimate the visible width of this border as a fraction of the moon's diameter. Note the color.

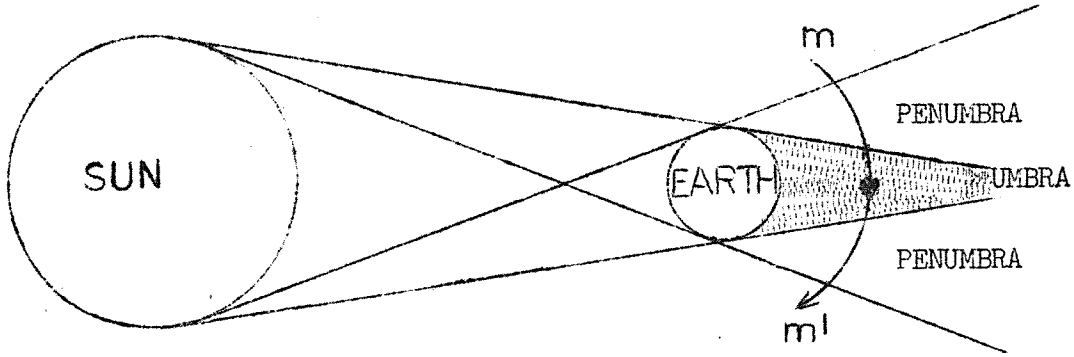
4. Sky brightness during the eclipse. This is a good project for amateurs with some variable star experience. Select a variable star field for which a chart marked with comparison star magnitudes is available. Estimate the magnitude of some stars at about 15 minute intervals (using the same telescope and eye-piece throughout) during the course of the eclipse.

Lunar Eclipse photography is challenging because of the enormous change in brightness that the moon undergoes. For example, the surface brightness of a typical eclipse at mid-totality may be only 1/10,000 of what is was a few hours earlier. It may be difficult to judge in advance correct exposure times, since no two eclipses are alike and umbral shadows may vary greatly. Listed here are some lunar eclipse exposure recommendations.

ASA FILM SPEED.	25-32	64-80	100-125	200	400	800-1000
Eclipse Stage						
Full moon, Sky clear.	1/250 f/5.6	1/250 f/8	1/250 f/11	1/250 f/16	1/250 f/22	1/500 f/22
Moon Deep in penumbra up to 1st. contact and after 4th.	1/60 f/5.6	1/60 f/8	1/60 f/11	1/60 f/16	1/125 f/16	1/250 f/16

ASA FILM SPEED.	25-32	64-80	100-125	200	400	800-1000
Eclipse Stage						
At 2nd and 3rd contacts.	2 f/2	1 f/2	1 f/2.8	1 f/4	1/4 f/2.8	1/8 f/2.8
Mid-Totality	8 f/2	4 f/2	2 f/2	2 f/2.8	1 f/2.8	1/2 f/2.8

Note all times are in seconds or fractions thereof. With Kodacolor films use 1/2 stop larger lens opening than indicated in the table.



During A Lunar Eclipse, The Moon Moves Along The Path Indicated By M To $M\frac{1}{2}$, Thus Passing Through The Various Intensities Of The Earth's Shadow - From Penumbra To Umbra To Penumbra.

Equivalent exposures for aperture ratios other than f/8 may be calculated using a simple conversion:

$$\text{recommended exposure (see above)} \times \left(\frac{\text{actual f/number}}{8} \right)^2 = \text{actual exposure}$$

For example, at the beginning of totality, with an f/4 aperture;

$$2 \times \frac{(4)^2}{8} = \frac{1}{2} \text{ second exposure}$$

For ASA ratings other than 400, adjust the shutter speed in inverse proportion to the ASA value:

For example, at the beginning of totality with an f/4 aperture;

$$\frac{400}{64} = \frac{x}{\frac{1}{2}} \quad x = 3.125 \text{ seconds of about 3 seconds}$$

Listed below are some eclipse photography projects that will not only let you record the events of the eclipse, but will add a spectacular chapter to your collection of astrophotography as well.

1. Series. The progress of the eclipse can be recorded on a single frame of a stationary camera by taking exposures at precisely spaced intervals. Exposures should be taken every 5 minutes with a 35 mm lens on a 35 mm camera.

2. Diurnal Trail. A 35 mm camera with a 50 mm lens can record more than 2 1/2 hours of trailing across the long dimension of the film. Start the exposure when the lunar disk is about half covered by umbral shadow, with the moon near the east side of the field, and continue for the same duration after totality. To avoid overexposure during partial stages, the lens should be stopped down to f/16 for ASA 64 film. During the half hour around mod-totality, the lens must be opened wide to record the faint lunar image.

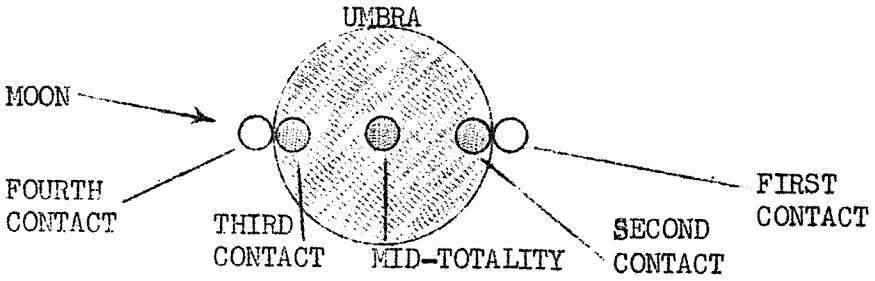
3. Wide-field photography. During mid-totality, beautiful pictures of the colorful disk of the moon surrounded by an assemblage of stars may be taken. Try to include an entire constellation.

50mm lens - 40° by 27.5° field; 135mm lens - 15° by 10° field;
400mm lens gives a 5° by 3.5° field.

A time lapse motion picture record of the eclipse is very interesting. Attach the movie camera fitted with telephoto lens on a sturdy tripod or two axis telescope mounting. Make sure that the film is feeding correctly and that the camera is in focus. It is advantagous to have a point mark on the view finder window so that you can keep the moon in the same position throughout the whole eclipse. Expose a five second run of film every five or ten minutes. Carefully place the image in the same place, on your point mark for each run.

Be sure to obtain the fastest movie film that you can get hold of. ASA 40 Kodachrome for a 8mm with a running time of 15 minutes actual time. If you have an automatic light meter it would be best to cheat it by covering it up so that the camera is always wide open. Some cameras can be locked in the wide open position. If the lens on your camera is removable, try and get the largest telephoto that will fit.

Probably the best way to ensure that the photographs you take will be impressive, is to plan your shots way ahead of time. Write down all your planned exposure times with aperture and ASA ratings. This will eliminate any fumbling that might occur during the excitement of the eclipse, and in the long run will save you a lot of time and possibly save a few photographs that might have otherwise been ruined.



By now you're probably covered with dew, and may have suffered the dubious fate of being eaten alive by mosquitoes, but you have seen the Great Lunar Eclipse of 1982. You might like to take note now that there will be a replay of this eclipse in December of this year, but conditions won't be nearly as favorable. I hope that the members of the Winnipeg Centre will plan and carry out some good visual and photographic projects. Hopefully we can view their successes at the September meeting.

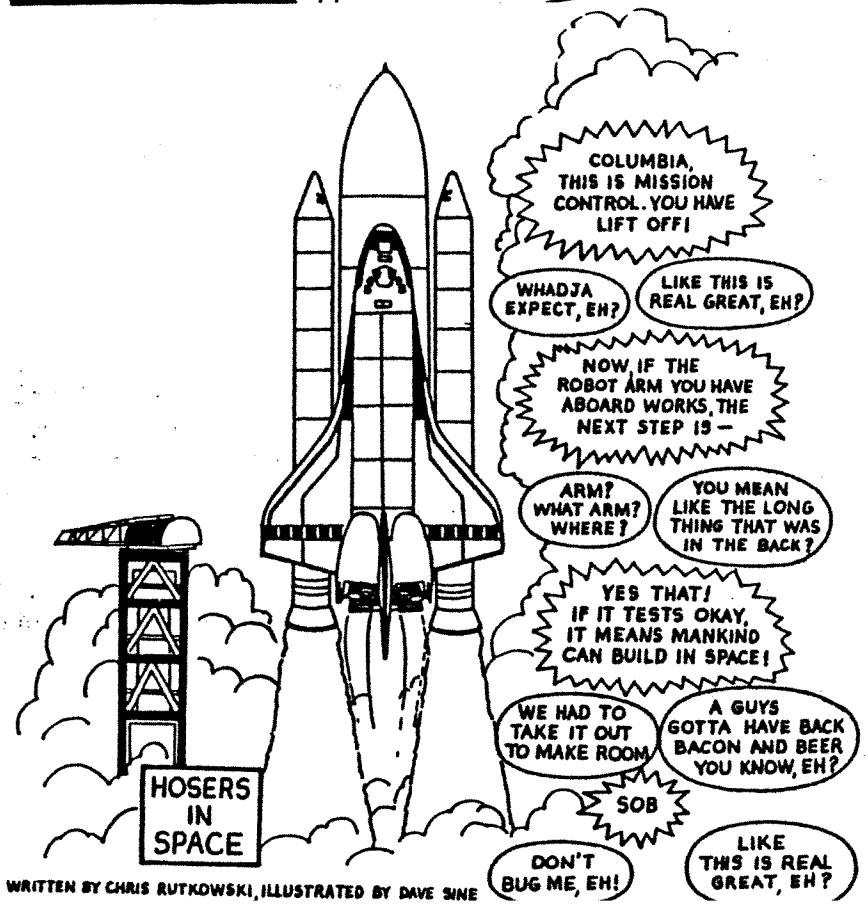
ooOoo

NOMINATIONS COMMITTEE REPORT.

On the last page of this copy of WINNICENTRICS you will find a form for nominations to council positions, there is also a provisional slate of candidates and the offices that they intend to run for. Additions to this slate of candidates, on a proper nomination form, must be postmarked no later than August 16, 1982 and must reach the nomination committee no later than August 20, 1982, (this is our publication deadline). Ballots and addressed stamped envelopes will be sent out in the September/October issue of the Winnicentrics. This is to enable all members in good standing to cast their vote whether they attend the meeting or not. The Centre is paying for the stamps on these envelopes so please return them with your ballot inside, and the supplied adhesive label stuck across the back flap. This will be explained in more detail on the ballot form.

SINE LANGUAGE.

DAVE SINE ©
1982.



WRITTEN BY CHRIS RUTKOWSKI, ILLUSTRATED BY DAVE SINE

DEC. MOTOR SPEED CONTROLLER by Eriks Ekmanis (acknowledgments to Pulsar)
(Kitchener-Waterloo Centre newsletter)

This project originated because of difficulties with the auto guider on a Celestron 14. The response time of the motor was too fast and this coupled with some backlash in the gear train caused a condition of continual positional overshoot and subsequent larger than desired star images with a piggy back 8" Schmidt. There were two possible solutions, one being to increase the gear ratio in the drive train with possible mechanical modifications necessary to accomodate this, and the other was to slow down the motor itself.

A series resistor approach was tried and the motor could almost be slowed enough to be satisfactory, definite improvements in star images were seen but further improvement could be made with a little less speed. Unfortunately the resistor method also greatly reduced motor torque and just before the desired speed could be reached the motor would stall out. A method was needed to reduce motor speed without reducing torque. The circuit shown here with this article provided an electronic equivalent of a continuously variable mechanical gear train.

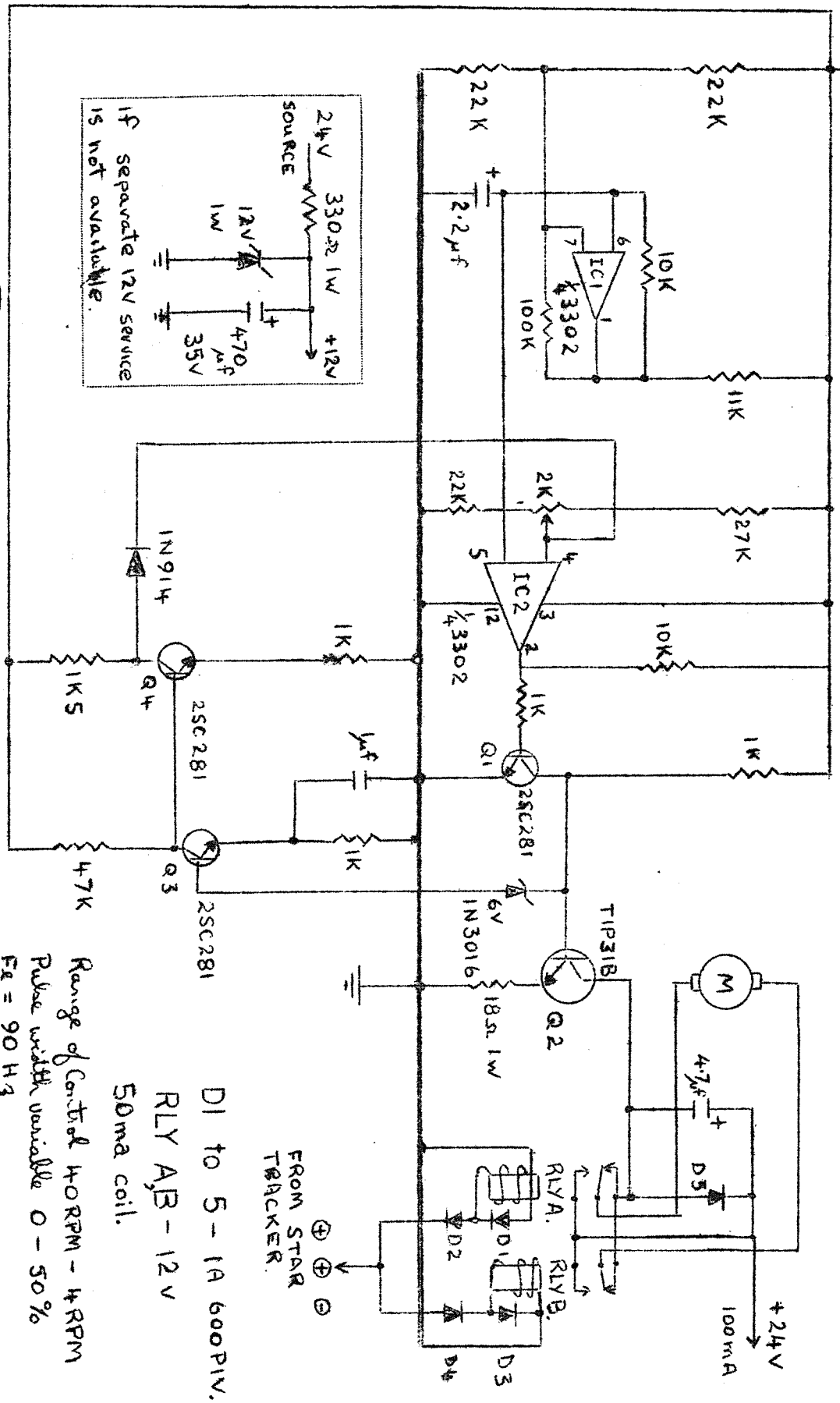
A constant frequency variable pulse width controller was chosen that would supply additional power as required automatically to maintain high torque and constant speed. The range of control is from approx. 40 to 4 RPM from the motor gear train. At very low speeds and high loading, because of the simple nature of the circuitry one can notice very definite pulsing in motor rotation as additional power is supplied to prevent motor stalling. The increase in torque is quite dramatic. The motor shaft could easily be stopped at slow RPM with fingers using the resistor method, however the motor could not be stopped when using the pulse width controller at a similar RPM setting.

Circuit operation is as follows: IC1 and IC2 are part of a 3302 quad comparitor. IC1 is a triangle wave oscillator of approx. 90HZ whose output is fed to IC2, that forms a Schmidt trigger, whose threshold point is adjustable by means of a 2K ohm speed control pot. The output is a constant frequency pulse train of variable pulse width. This is amplified ny Q1 and applied to our control transistor Q2 that sets motor speed and power by ratio of its on to off time.

Motor loading is sensed in the VBE variation of Q2 and is amplified by Q3 and Q4 to be applied back to IC2 to control the threshold voltage and hence pulse width on an automatic basis as motor loading demands. Relay A and B are driven from the Star Tracker circuitry that supplied the +12 and -12 volts that used to run the motor previously. These relays control CW, CCW and off functions of the motor in accordance with tracking needs. All of the circuitry can be housed in a small cabinet for a neat looking project and all of the wiring can be of a point to point variety. If a separate 12V source is not available for the control circuitry, its power can be derived from the 24V line that is used to run the motor by the circuitry shown in the dotted lines.

SEE OVER FOR CIRCUIT DIAGRAM.

22. DEC. MOTOR SPEED CONTROL
C-14.



C B E
2SC281
Q1,3,4.

B C E TIP31B Q2.

IC1,2 - ¼ 3302

Range of Control 40 RPM - 4 RPM
Pulse width variable 0 - 50%
Fc = 90 Hz
all resistors ¼ w unless otherwise specified.

D1 to 5 - 1A 600PIV.

RLY A,B - 12 v
50ma coil.

April 18/82
E. EKMANIS.

RASC WINNIPEG CENTRE.

NOMINATION FORM.

WE, THE UNDERSIGNED, BEING MEMBERS OF GOOD STANDING IN THE RASC WINNIPEG CENTRE, DO HEREBY NOMINATE .....

FOR THE OFFICE OF ..... IN THE ABOVE MENTIONED CENTRE.

1/ SIGN .....

2/ SIGN .....

DATE.....

I,..... BEING A MEMBER OF GOOD STANDING IN THE WINNIPEG CENTRE OF THE R.A.S.C. DO HEREBY ACCEPT NOMINATION AS A CANDIDATE TO THE AFOREMENTIONED OFFICE.

SIGN .....

DATE.....

RETURN NOMINATION FORM TO: R.A.S.C. WINNIPEG CENTRE, NOMINATIONS. P.O. BOX 215, ST. JAMES POST OFFICE. WINNIPEG, MANITOBA, R3J 3R4.

PROVISIONAL SLATE FOR ELECTION 1982/1983.

PRESIDENT..... Mr Guy Westcott.

FIRST VICE-PRESIDENT..... Mr Andrew Lawless.

SECOND VICE-PRESIDENT..... Mr Dave Sine.

TREASURER..... Mr Bud Fairley.

COUNCIL POSITONS..... Miss Brenda Belkin.
Mr Lorence Mlodzinski.

ALL POSITIONS ON THE EXECUTIVE ARE OPEN FOR ELECTION, AND THREE POSITIONS ON THE COUNCIL: TWO OFFICES FOR 3 YEARS AND ONE OFFICE FOR 2 YEARS.