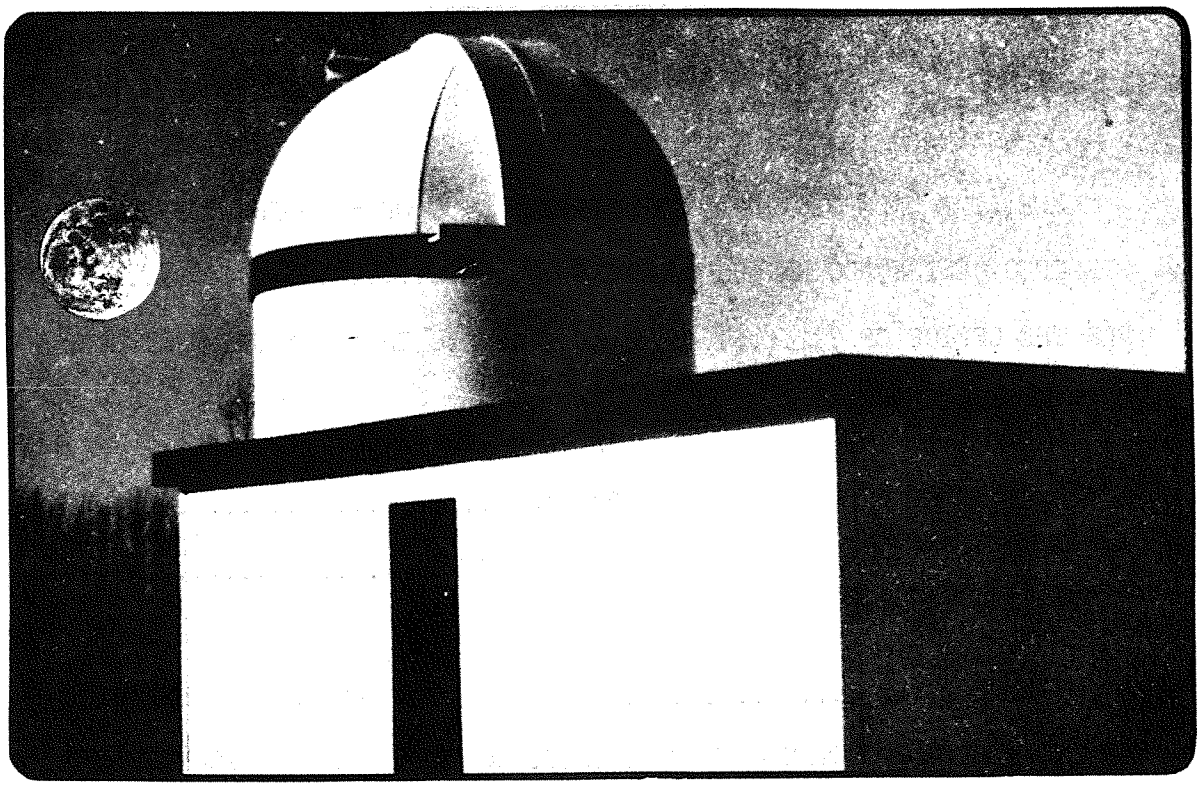

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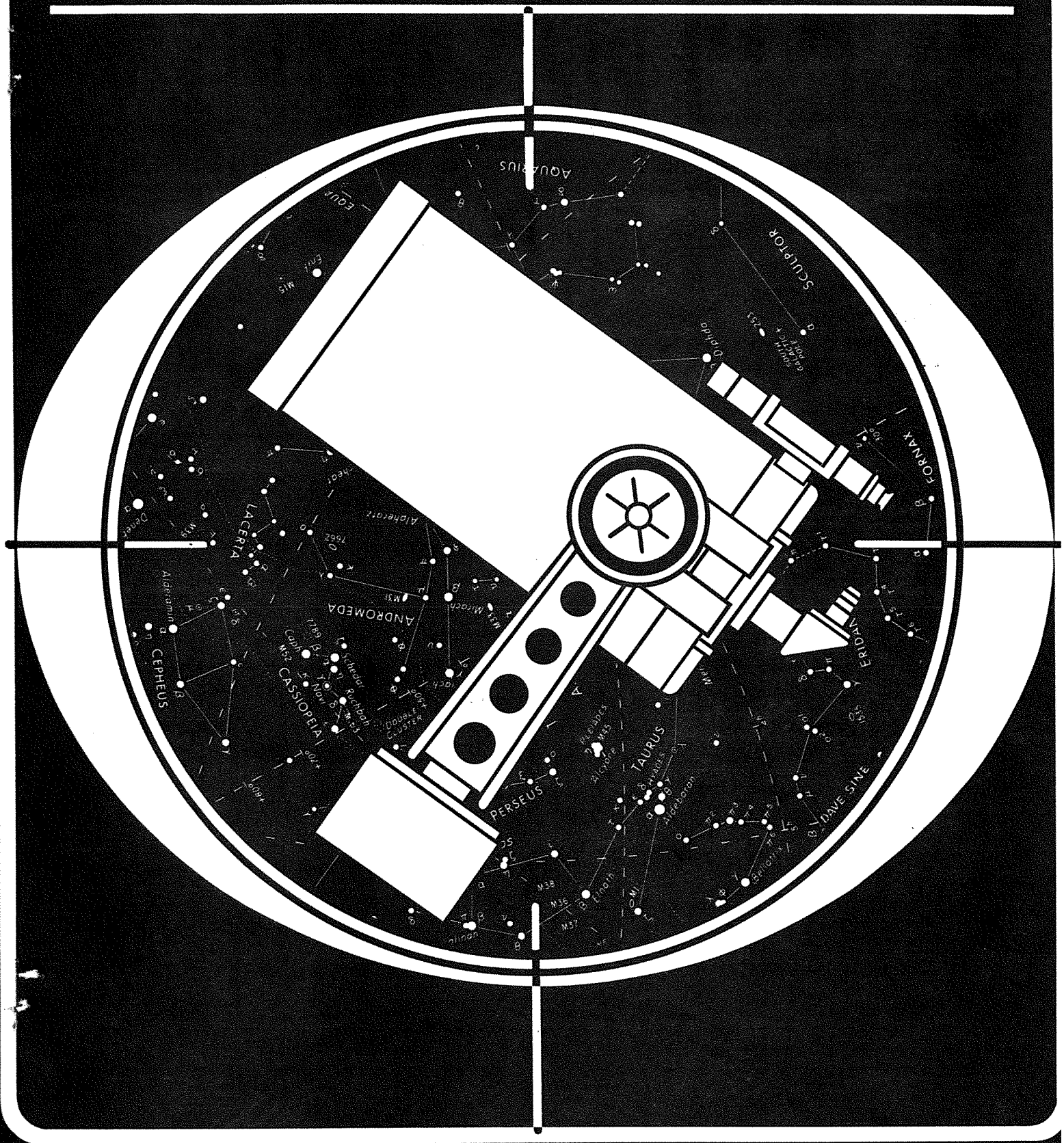

Vol.22 No.3 W I N N I C E N T R I C S 1982
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A message from the President of the Winnipeg Centre, Mr. G Bailey.

337-660 Dalhousie Drive,
Winnipeg, Manitoba R3T 2Z9
29 March 1982.

To the Council and Members
of the Winnipeg Centre:

This is to notify you of my intention to resign as President of the Winnipeg Centre of the Royal Astronomical Society of Canada, effective 20 April 1982. My wife and I are moving to Reston, Manitoba, where I shall be ordained on the Feast of St. Mark, April 26th. My new parish duties will make it impossible for me to continue to function either as President or on Council beyond that date.

I have enjoyed serving the Centre during the past six years, and wish you good fortune and clear skies for the future.

I remain

Yours sincerely,

G. E. Bailey, C.E.T.,
President

cc: Council
Winnicentrics
National Society

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MAY & JUNE MEETINGS.

MAY 14, FRIDAY 8:30pm.

ROOM 217, LOCKHART HALL, UNIVERSITY OF WINNIPEG.

PROGRAM: MR CHRIS RUTKOWSKI WILL BE TALKING ON COSMOLOGY, HE WILL EXPLAIN THE BASIC COSMOLOGICAL CONCEPTS FOR THE AMATEUR ASTRONOMER.

.....

JUNE 11, FRIDAY 8:30pm.

ROOM 217, LOCKHART HALL, UNIVERSITY OF WINNIPEG.

PROGRAM: THIS WILL BE OUR LAST MEETING UNTIL SEPTEMBER, SO HOPFULLY THE SPEAKER MR LEN GAMACHE WILL TELL US WHAT WE SHOULD BE DOING WITH OUR CAMERAS OVER THE DARK? SUMMER NIGHTS.

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WINNIPEG CALENDAR 1982.

APRIL 29th. - Astronomy lecture at Camp Arness, Gimli. Require two volunteers.
MAY 1st. - ASTRONOMY DAY, Display in the Planetarium at the Museum of Man and Nature. Starting at 12:00 noon to 5:00pm. Star Party on the evening of May 1st. (weather permiting) at Lyndale Drive Park, starting at 8:00pm.
MAY 14th. - 8:30 pm. General Meeting. Speaker: Mr Chris Rutkowski.

MAY 21st. - Saskatoon General Assembly. Don't delay, book today.
22nd. Registration forms, schedules, and Exhibit Forms are all
23rd. available from Guy Westcott. (we also have clickers) Ph 269-1499

JUNE 11th. - 8:30 pm. General Meeting. Speaker: Mr. Len Gamache.

JULY 1st. - Public lectures on Astronomy at Riding Mountain National Park.
2nd. also star parties at the Park. Centre Members are required for
3rd. these three days.

If you wish to hold a star party at the Glenlea Observatory, or anywhere else with centre participation please phone Brenda Belkin or Guy Westcott and we will do our best to promote and advertise your event.
To schedule or organize a Centre event contact Brenda Belkin.

For the star party on May 1st. Turn right from the Norwood Bridge, this will put you on Lyndale Drive. Travel along until you reach the curve. We will be setting telescopes up starting at about 7:15pm.

CENTRE SCENE.

MANITOBA ASTRONOMY CLUB: This new club for the young has got off to a very fast start. Already the membership is over 100 and climbing with each meeting. But it does mean a lot of work. Any Centre members that would like to give a talk to the M.A.C. please contact Bill Peters at the Planetarium, your assistance would be greatly appreciated. The R.A.S.C. will one day be drawing its members from the ranks of the older M.A.C. members so a good impression now is essential.
ASTRONOMY DAY....MAY 1st.: The centre is getting ready for May 1st. So far we have five displays , five different types of telescope, slide shows etc. All this will be taking place at the Planetarium during the day from 12 noon until 5:00pm. In the evening there will be a star party at Lyndale Drive Park all Centre members with telescopes are welcome to set up at 7:15. After the star party the donuts and coffee for centre members are on the Centre.
TEXAS STAR PARTY: To be held at Fort Davis Texas, May26-30, 1982. You can literally pick your own mountain top for observing at the 3,500 acre ranch. Hundreds of campsites are available with electricity. The holiday of a life-time. For more information contact Guy Westcott.
UNDERCOVER IN THE CENTRE: We appear to have an undercover astro-photographer in the Centre. Len Gamache came over to see me last weekend and gave me some slides that he has taken at his dark sky site, Sundown. I think he did a sky survey! Thanks Len there are some really good photographs there. When are you starting on the southern constellations?

Condensed minutes of the March and April 1982 General Meetings.

March 12, 1982 Room 217 Lockhart Hall University of Winnipeg.
Attendance: 19 members and 2 guests.

The meeting was called to order by the President Mr Bailey at 8:32pm. Mr Bailey welcomed the members and guests and apologized for his absence at the last monthly meeting. Mr Bailey also brought greetings from the Edmonton Centre through the exchange speaker program.

The newly formed Manitoba Astronomy Club will meet on March 13, 1982. The organizers are trying to hold their meetings on the Saturday after the R.A.S.C. meetings. So far the membership is about 60 members and growing. On Monday 15, 1982 weather permitting the U of M and R.A.S.C. observatories will be having a star night for the M.A.C. members. Arrangements still have to be made for May 1st. Astronomy Day. Miss Belkin the editor of Winnicentrics announced that the newsletter had now officially gone bi-monthly. Miss Belkin said that the new format had received much praise from readers and she read two letters. The guest speaker for the evening was Dr Ian Halliday, R.A.S.C. National President. Dr Halliday spoke on meteor research in Canada. He showed slides and many interesting cases were discussed. A fragment of one meteorite was handed around. The origins of meteors were also discussed. Many questions were asked. For those members that attended Mascon 1981 it was a chance to grasp more fully the intracies of these small bodies. Dr Halliday also spoke briefly about occultations, after the forthcoming occultation between Pluto and a 13th magnitude star was mentioned. The meeting was adjourned at 10:19pm. by a motion from the floor.

April 16th. 1982
Attendance: 27 members and 7 guests.

The meeting was called to order by the President Mr Bailey at 8:32. Mr Bailey pointed out that there were G.A. forms and clickers at the back for members after the meeting. The editor of Winnicentrics and social director Miss Belkin went over all the display ideas and arrangements for May 1st. Astronomy Day. Mr Bailey introduced the speaker for the evening, no stranger to the Winnipeg Centre Mr Alan Dyer. Alan gave the centre a rundown of the Edmonton Centres advances to an observing site with a dark sky. Last year however, Alan and some friends went observatory hopping around Arizona. This of course is not complete unless you have a photograph of David Levy (in shorts and T-shirt). We saw many of the Arizona domes spreading out like mushrooms over Kit Peak. Beautiful telescopes in dust free conditions. The sky on some of Alans photographs seemed grey. I'm sure that this was due mainly to the number of stars in the sky. After the talk, new member Mr. Ted Lemon gave a brief description of some solar eclipse photographs that he took in 1979 and the effort that he made to finally get suitable prints. Mr. Bailey then commented on the Winnicentrics and on the speakers for the next two meetings. Mr Bailey then announced his resignation from the Presidency of the Centre due to his moving house out of Winnipeg. He thanked the centre for the support that had been given to him in his term. The meeting was adjourned at 10:13pm. by a motion from the floor.

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POINT TAKEN.....G. Westcott.
Are we getting our money's worth from the National Newsletter? The Journal is good if you are a professional astronomer or if to you astronomy is more than a hobby. But the thing that I received in the mail today (April issue) National Newsletter is not even worth the 30¢ that it cost to send it out. There must be more news going on in the other Centres than what is printed in the Newsletter. Please next issue let's see more NEWS in the Newsletter.

4. BUMP & GRIND.

The Initial Purchase. By Mario Therrien.

The most important part of the telescope is the "optical train". The rest is just support and trappings. So, if you're going to build that 6" reflector, the best.....actually, the only place to start is with the optics.

Now, you may ask, "What is an optical train?" This has no relationship to C.N. rail. The system consists of one 6 - inch, parabolized, aluminized, overcoated primary mirror (which I'm sure you will enjoy making.), and its support or "cell". Next, there is the flat, elliptical secondary mirror, or diagonal, with its own mount and support structure called a spider. A Newtonian focus rack and pinion eyepiece holder invariably follows, and finally one or more assorted eyepieces. Focal lengths of 12.5 and 25mm are very good choices for eyepieces. It may sound complicated, but all the items mentioned can be purchased from most telescope equipment firms, who advertize regularly in "Sky and Telescope" and "Astronomy" magazines. Catalogues from these telescope companies are usually available on request.

There are companies who advertise kits containing all the fixings for a 6 inch scope. Prices, quality, and exact content of these kits may vary considerably, so it is advisable to shop around. Of course not all the materials need be purchased from the telescope dealer. The only parts that really require direct buying are your secondary (diagonal) mirror, preferrably pre-mounted, and your eyepieces.

The "heart" of your telescope will indeed be that 6 inch primary mirror that you will work long and hard to complete. Your mirror starts out as a glass disk, called a "blank", and it MUST meet certain requirements. Aside from being 6 inches in diameter, it should also be some $\frac{3}{4}$ of an inch thick, with at least one of the surfaces free of gouges and bubbles to a depth of at least $\frac{1}{2}$ of an inch. The glass must also be of a composition that does not change appreciably with changing temperature. The whys and wherefores of this will be explained in a later issue of "Bump and Grind". In order to grind your blank, you will need a second disk called the "tool". The tool must also be 6 inches across, but need only be about half the thickness of your blank, and may contain any number of flaws. It should preferrably be of the same composition as your blank. To initiate the grinding and polishing, you will require abrasives. They should consist of silicon carbide grades 40, 80, 160, and 240, or grades of a similar coarseness; Aluminum oxide in grades 300, 400, 800, 1200, and 2,000; and either jeweller's rouge or preferably cerium oxide polishing compound. These can all be purchased from local stores that sell these abrasives commercially.

Back to our mirror blank, you have three choices. The best type of glass is Pyrex. Ready to use blanks and tools can be purchased direct from Corning Glass Works, Rochester, N.Y. or from a dealer in scope hardware, but this might prove a bit costly for some people. The second alternative is to buy a circular cut piece of glass (tempered plate glass) $\frac{3}{4}$ of an inch thick from one of our local glass works. This will provide quite an adequate blank at a relatively cheap price. The third option is to go for a glass substitute, polycarbonate. Plastic glasses are made of this substance, and it can be purchased from manufacturers of eyeglass materials, as the raw plastic. It can then be set in a makeshift mold to make your 6 inch blank. Polycarbonate does have the disadvantage of not holding its shape well under heat or cold stress, and does scratch easily. These may be outweighed by the advantage of being lightweight and shatter-proof. Not to be forgotten is the tempered pitch. This is a bees wax and pine resin concoction which can be obtained from most scope dealers. Getting all these supplies should take you a mere six months! With that done, we can begin in earnest next issue.....

Flying through an asteroid field?

Terence Dickinson

In the Star Wars sequel, The Empire Strikes Back, the only escape route for the good guys was through an asteroid field. The intrepid Han Solo plunged his space ship into the asteroids, jockeying it between the looming boulders like a stock car in a wreck'em race. This popularized image of asteroid belts as outer-space pinball machines, with craggy crater-pitted boulders practically bumping into each other, makes exciting science fiction, but it totally departs from reality.

Prior to the space age, the number of small objects swimming around in the asteroid belt was unknown. Science fiction writers, always on the lookout for an exciting situation to spice up a story, took the "worst-case" hypothesis, which assumed that there could be lots of debris out there. Although most astronomers did not believe the asteroid belt was a celestial minefield, there was no way of knowing the density of smaller particles until a spacecraft actually went out there.

Between 1973 and 1979, two Pioneer and two Voyager robot spacecraft settled the question by crossing through the belt completely without incident on their way to Jupiter. Far from being a hailstorm of solar system gravel, the asteroid belt is essentially as free of small debris as the region around the Earth.

The situation with regard to the visibility of larger asteroids was vividly demonstrated in the early 1970s when the Voyager trajectories were being planned. Analysts at the Jet Propulsion Laboratory searched in vain for a flight plan that would meet the mission requirements at Jupiter and Saturn and would also come close enough to an asteroid - any asteroid - to allow Voyagers' high-resolution cameras to have a peek. Conclusion: Random trips through the asteroid belt pose no danger; the zone is almost empty.

Suppose you could be transported to an asteroid of your choice - any of the more than 2,000 whose orbits are well known. Examining the celestial scenery, it is doubtful that even one other asteroid would be a naked-eye object. Close approaches of two asteroids to within a distance that would show the surface features of one to an astronaut on the other are vanishingly rare.

The total population of asteroids in the solar system is probably in the neighborhood of a billion objects the size of a house or larger. Large boulders would pass within a few miles of each other fairly frequently, but even then they would still only appear as bright stars to the unaided eye.

The existence of the asteroid belt can only mean one of two things: That a planet was unable to form and the remaining debris is evidence of the aborted process, or that the planet did form and was somehow shattered. The exploded-planet theory has relatively few adherents these days. Like the steady-state theory of the universe's evolution, the observational evidence is largely stacked against it.

The most widely accepted theory to explain the asteroids' genesis visualizes an original family of smaller objects that never coagulated into a major planet due to the disruptive gravitational influence of nearby Jupiter, the most massive planet.

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Toronto Star..... March 13, 1982.

6. MIRA DOUBLE STAR.

by GRANT GUSSIE.

Currently in the south western sky at dusk is the constellation Cetus. Although it is a relatively large constellation, Cetus is rather barren and contains few objects of astronomical interest. However, Cetus does contain Mira, a classic long period variable star. Mira (also known as Omicron Ceti) is the only long period variable that attains sufficient brightness to become a prominent naked eye star. It is also the nearest example of its class, at an estimated distance of 220 light years.

Mira is a multiple star system. The system's long period variable component, (known as Mira A) is a red giant star and is the only member to attain naked eye visibility. Mira A is in mutual orbit with a white dwarf star (known as Mira B). The two stars have an apparent separation of 0.7 arc seconds, so they are theoretically resolvable with the Celestron 14 at Glenlea, although repeated attempts by the author to detect the companion have failed. Exceptional seeing conditions are required to resolve such a close double star, regardless of the size and quality of the telescope. A third star shares the motion of this pair through space, and is generally believed to be gravitationally bound to the binary, although this has yet to be proven. Mira C is a typical star with approximately the same mass and luminousity as our sun. This star forms an easy, low power pair with Mira, with an apparent separation of 118 arc seconds.

Since Mira is a binary star, we should be able to determine the masses of the two stars by observing their motions in orbit. However, the white dwarf was discovered in 1923 by Alfred Joy, and a complete revolution has not occurred since its discovery. It appears that the two stars orbit each other with a period of 260 years, and by applying Newton's Law of Gravity, we find that the total mass for the pair is about 3.7 solar masses. Mira A has only about one-third of this total mass. Earlier estimates of up to 15 solar masses for long period variables are contradicted by observations of Mira and the few other variables with companion stars.

Mira varies in light with a period of about 330 days, although the exact length of the period varies unpredictably from 304 to 355 days. The range of its brightness varies somewhat as well, but the average maximum brightness is magnitude 3.5 and the average minimum brightness is magnitude 9.3. The temperature of the star changes also, with a maximum surface temperature of 2500°K and a minimum temperature of 1900°K. This is compared to the temperature of our sun at 6000°K and the temperature of Mira B at about 30,000°K. Even at its hottest, Mira A is considerably cooler (and thus redder) than Antares and Betelgeuse. When Mira is at minimum light, it is one of the coolest stars known. Interestingly, the average density of Mira A is about 1/5,000,000 that of our sun, so that we could facetiously refer to Mira as a red hot vacuum!

Just why Mira varies in light is not fully understood. We know from the star's spectrum that the star's atmosphere regularly rises and falls like an oscillating spring, so the light variations are due to the star pulsating. However, theories fail to explain how and why the star began to pulsate, although some clues are found in the current models of stellar evolution.

But no matter what mechanism begins these pulsations, one might expect them to die down with time, as any real oscillation would. However, this is not the case. One theory suggests that when Mira

is at its minimum size, the atmosphere is more opaque to outgoing radiation than when it is at maximum size, since the atmosphere is contained in a smaller volume and is therefore under higher pressure. Because the atmosphere is more opaque, it traps more radiation in the interior, and the interior quickly heats up. This forces the atmosphere to expand outward. As the atmosphere expands, its opacity lessens and the interior cools. With decreased radiation pressure from the cooled interior, the atmosphere begins to contract again. In this way each oscillation receives a small "kick" that keeps the oscillation from dying down.

The Mira star system is interesting not only for the long period variable, but for the white dwarf (Mira B) as well. As previously indicated, the mass of this star is about 2 solar masses. But theory places the maximum allowable mass for a white dwarf star at 1.4 solar masses. Of course the determination of the mass of the system is uncertain, since it was derived from observations of a partial orbit, so it may be that both components are somewhat less massive than current observations would indicate. Mira B is also noteworthy because it is very hot, even for a white dwarf. In fact, its temperature and luminousity more closely resembles the stars typically found in the centers of planetary nebulae. The high temperature of Mira B may be the result of matter blown off of Mira A and that falls onto the surface of the dwarf. This idea is supported by the fact that Mira B is also known to be slightly variable; the flow of material onto the dwarf's surface fluctuate as the long period star throws out fresh stellar gas and dust with each pulsation.

Let us now construct a speculative case history for the Mira star system. Sometime in the past, probably some 500 million years ago, the (now) white dwarf Mira B was a red giant star that may have experienced pulsations much as Mira A does now. On the other hand, Mira A was then a typical yellow mainsequence star much like our sun, although probably somewhat less massive and fainter. Mira B ended its career as a red giant by throwing its outer material into space as a planetary nebula. Much of Mira B's atmosphere was captured by Mira A, which in turn grew somewhat in mass and luminousity and became the brighter of the two stars for the first time.

We may speculate that the remaining material from Mira B expanded into interstellar space where it sufficiently compressed the interstellar medium in the area to trigger the birth of the third component star. This star is believed to have about the same mass and luminousity as our sun, and therefore, has about the same mass as Mira A. However, this star must be considerably younger than Mira A, as it would have by now evolved to the red giant phase.

Mira is currently close to its minimum brightness and is now a telescopic object. It may be difficult to find at first, and a good finderchart is a great help. The AAVSO VARIABLE STAR ATLAS and BURNHAM'S CELESTIAL ATLAS contain excellent finder charts which include the magnitudes of some field stars to help in estimating the variable's brightness. The third star of the Mira system is marked on BURNHAM'S finderchart with a "G".

One may wish to use Mira as the subject for a photographic project. By using a 50mm lens and two minute exposures taken about a week or two apart, it is possible to obtain an interesting record of Mira's rise to brightness. Use a wide open lens and fast film to record Mira near minimum. A two minute exposure does not require guiding with a 50mm lens, and can be done from a stationary tripod, although a piggyback mount will give more satisfying, pinpoint star images.

Mira is a fascinating star that will reward anyone who examines it. It offers a great opportunity to observe the dramatic light fluctuations of a long period variable and will challenge the eyesight and telescope of anyone wishing to find its elusive companion. You may wish to try placing a blue filter in the eyepiece when observing the star. This would have the effect of making the dwarf appear brighter than the red star when its light level is low. I really hope that some of the readers will decide to study and observe Mira, and see this fascinating star's light variations.

(condensed and edited for publication)
(by B. Belkin.)

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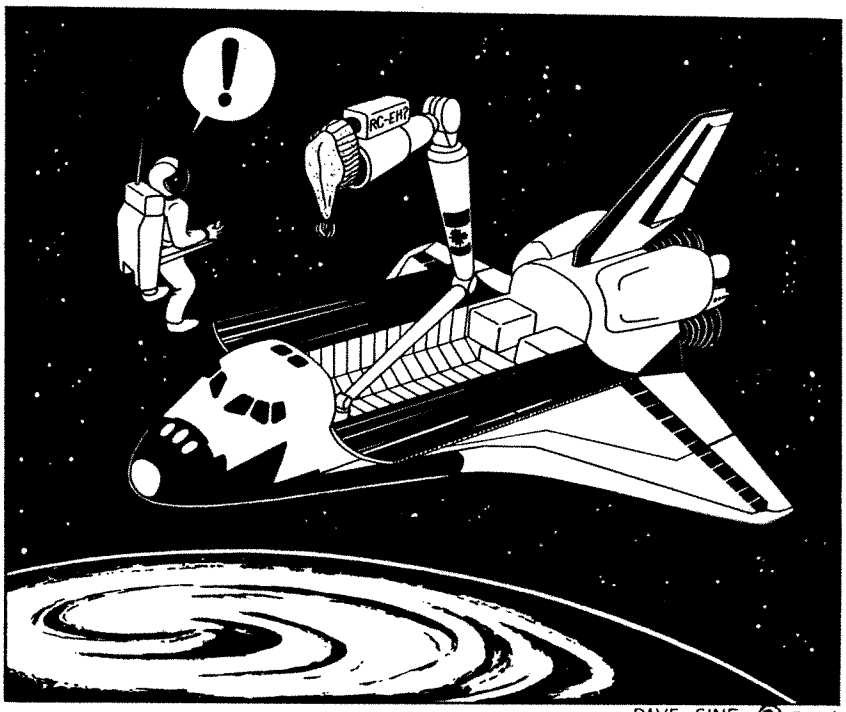
HOSERS IN SPACE.



DAVE SINE © 1982

DATA PROBE

Q. In simple terms, how does a radio telescope work?

A. A radio telescope is a reflecting telescope with a reflecting surface not of glass but of either a metallic membrane or a wire mesh. At the prime focus, an antenna picks up the radio signals and feeds them into an amplifier, which in turn feeds the signals into a recording device that records the intensity of the radio-waves received.

The resolving power of a radio telescope with only one reflecting surface is often very poor. A radio telescope with a resolving power equal to that of an optical telescope would have to have a diameter of 50 miles or more; but it is possible to achieve good resolution by using portions of an otherwise mammoth radio telescope. For example, two relatively small telescopes placed $\frac{1}{2}$ mile apart and electrically connected are as effective in improving the resolving power as one large telescope with a dish $\frac{1}{2}$ mile in diameter. A system of two telescopes placed some distance apart is called an interferometer. It is possible to connect several radio telescopes together several thousand miles apart (for example from the east to west coasts of Canada) and have an effective dish capable of fabulous resolution.

Q. What are "glitches"?

A. A Glitch is the term given to the event when a pulsar (a rotating neutron star) speeds up. One theory suggests that a "starquake" could account for these changes in period. The crystalline crust of the pulsar would fracture and the matter would settle closer to the center of the star, causing the star's rotation to increase due to its conservation of angular momentum. The Vela pulsar was observed to speed up in 1969. The Crab pulsar is the fastest known pulsar having a period of 0.033 seconds. The slowest known pulsars have periods of about 4 seconds.

NOTE: If you have any questions about Astronomy, be it historical, cosmological or observational, let Brenda Belkin know (334-4027) and she will try to answer your question. Questions and answers will appear together in a future issue of Winnicentrics.

TID - BIT.

How distant are Quasars?

Because the preponderance of scientific opinion now is that quasars' redshifts do indicate incredibly vast distances, one of the few remaining dissidents may have his observing time on the big California telescopes cut back. Halton Arp, who thinks these redshifts are caused by some new physics which we do not yet understand, has been asked to give some concrete reason why he should still use observing time trying to prove a theory which is discredited.

The above Tid Bit was drawn from Skynews Victoria, Vol 7, No. 4.

10. SKY NOTES,

by Brenda Belkin.

Summer begins when the sun reaches the summer soltice on June 21 at 17h 23m U.T. In Winnipeg, the sun will reach an altitude of $63\frac{1}{2}^{\circ}$ at local noon.

MERCURY: May 1: RA 3h 46m Dec +22° 12'
May 15: RA 4h 48m Dec +24° 29'
June 1: RA 4h 41m Dec +20° 05'
June 15: RA 4h 22m Dec +17° 12'

Look for Mercury low in the west at sunset for the first half of May. This planet is in inferior conjunction on June 1 at 20h U.T.

VENUS: May 1: RA 23h 47m Dec. -2° 35'
May 15: RA 0h 46m Dec -3° 02' mag -3.6
June 1: RA 2h 00m Dec +9° 59'
June 15: RA 3h 03m Dec +15° 11'

During May and June, Venus rises about $1\frac{1}{2}$ hours before the sun.

MARS: May 15: RA 12h 04m Dec +0° 56' mag -0.4
June 15: RA 12h 25m Dec -2° 31'

Look for Mars in Virgo high in the southeast at sunset. Mars is at descending node on June 21.

JUPITER: May 15: RA 14h 06m Dec -11° 13' mag -2.0
June 15: RA 13h 56m Dec -10° 29'

Jupiter is also in Virgo in the southeast at sunset.

SATURN: May 15: RA 13h 05m Dec -3° 58'
June 15: RA 13h 01m Dec -3° 42'

Saturn is in Virgo near Spica and is high in the southeast at sunset.

LUNAR NOTES

PHASE	MAY	JUNE
Full	8th	6th
Last $\frac{1}{4}$	16th	14th
New	23rd	21st
First $\frac{1}{4}$	29th	28th

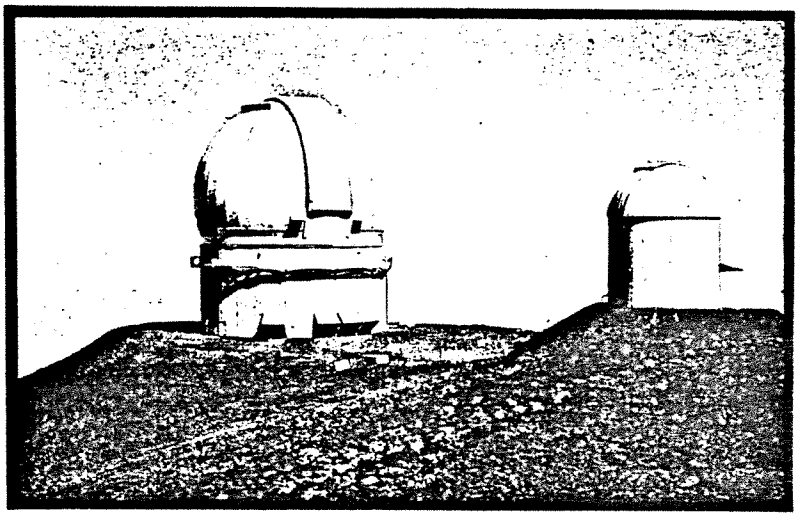
METEOR SHOWERS

The η Aquarid meteor shower will occur on May 4th at 20h U.T. Unfortunately, a full moon may hinder a number of observations. The single observer rate is 20 per hour, and these meteors will hit the Earth's atmosphere at a hard 65 km/s; hence we can look forward to a bright display.

MAUNA KEA, ON TOP OF THE WORLD.

by Dr. Jack B. Marling
© 1981.

Mauna Kea, Hawaii, is one of the best astronomical sites in the world, because of its low +20° latitude, high elevation of 13,800 ft., and generally excellent seeing. It is already the home of many large international telescopes, such as the University of Hawaii 2.2m (88 inch) and the Canada-France-Hawaii 3.6m (141 inch), NASA 3m infra-red and British 3.8m infra-red telescopes. A small 24 inch f/15 telescope was made available for my work, this was used for viewing and photography at f/6.5 using a large focal reducing lens.



Dome housing the Canada-France-Hawaii 3.6m telescope and the smaller dome of the 2.2m University of Hawaii telescope.

The Mauna Kea site is uniquely suited for infra-red astronomy, since its elevation places it above 90-99% of atmospheric water vapor, the primary atmospheric absorber of infra-red light. It is also superb for visual astronomy, since it is clear more than 75% of the nights throughout the year, and seeing is often 1 arc-second and can occasionally be a superb 0.2 arc-second. There are plans at the moment to locate the University of California 10m multiple-mirror telescope on the summit, and evaluation of seeing at various summit site locations is underway.

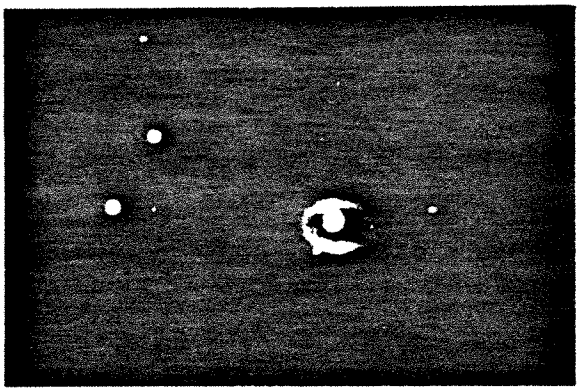
I was able to request time on the little utilized Air Force 24 inch telescope by writing to the University of Hawaii, Manoa Department of Astronomy. For visual use and photography, the 24 inch telescope was set up in the Cassegrain configuration at f/15. The 24 inch f/15 telescope corresponds to an effective focal length of 9.1m or 32 ft. Since only 35mm film was used for photography the effective focal length was reduced by using an 82mm diameter f/4 achromat lens, installed 12cm in front of the 35mm camera. This resulted in an effective focal ratio of f/6.5 for photography and both doubled the angular field of view, and reduced exposure durations about 5-fold from the original f/15 configuration. Unfortunately the lens introduced some curvature of field, causing slightly out-of-focus star images on the edge of the field to a few of the photographs. I used a Lumicon Easy-Guider for off-axis guiding, and viewed with 1¼ and 2 inch eyepieces. The 24 inch telescope was controlled with a "paddle" attached to the control panel by a long cable. At the beginning of each night's observing, I set the right-ascension dial by pointing the telescope to a bright star whose coordinates I knew. All the objects were found by moving the telescope in R.A. and Dec. according to two large luminous dials on the control panel located in the base of the telescope mounting.

I visited the summit twice for just under a week each time, at the end of March and the end of May 1981, during dark moon periods. All astronomers observing on Mauna Kea stay at Hale Pohaku, or the Half-Way House. It is located 1½ km lower at about 9,200 ft. and provides a more comfortable altitude for sleeping, study, etc. Acclimatization at 13,800 ft is difficult for some individuals, and can result in headaches and other forms of altitude sickness. However, it only takes about 24 hours to adjust and all astronomers without exception are required to spend one day at Hale Pohaku before using telescopes on the summit.

All the photographs for this article were taken on gas-hypersensitized film, prepared by baking in forming gas[1]. The 35mm film was unwound on an open reel, and baked at 50°C in a Lumicon Model 300 Hyper-Kit. The 2415 film was baked for 30 hours in 25% forming gas (25% H_2, 75% N_2) at 16 pounds absolute pressure (7psi gauge). Because of the high altitude, 0 psi gauge pressure corresponds to a partial vacuum or only about 9 psi absolute pressure. Two color films were used, Kodacolor 400 and Fujichrome RD100. Most of the color photographs were taken on the Fujichrome RD100, because of its higher contrast and thus richer color saturation. All the film was developed as a negative (including the Fujichrome slide film) using 4½ minutes developing time at 38°C in the Unicolor K-2 Kit developer. The Fujichrome RD100 was hypersensitized by baking in 8% forming gas for 16 hours at 46°C.

The southerly lattitude of +20° at Mauna Kea gave access to nearly the full celestial sphere. The 24 inch telescope was limited to targets above about -50° declination, but I was able to observe more southerly targets using a portable 8 inch f/10 Cassegrain, kindly lent to me by Clifford Livermore, an amateur astronomer living in the nearby town of Kamuela, Hawaii.

Some of the most interesting deep-sky objects that I saw and photographed are shown here.

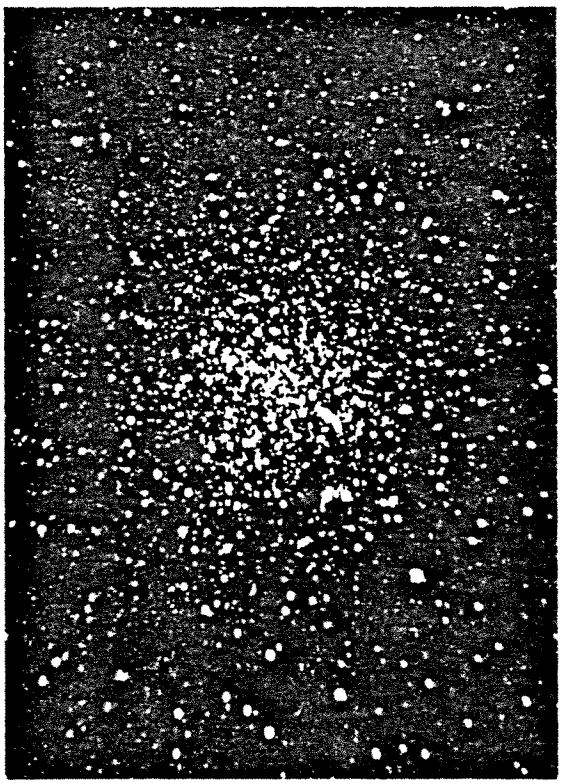


NGC 3132 The "Southern Ring Nebula" Hypered 2415, 10 minutes, 24 inch f/6.5

NGC3132 (10h 05m, -40°). This lovely planetary nebula on the border of Vela was striking at 300X. It is similar in size, shape and brightness to the famous Ring Nebula in Lyra. However it has a bright 10th magnitude central star, at -40° latitude. This lovely "Southern Ring Nebula" is seldom appreciated from North America or Europe.

M-4 (16h 21m, -26°). This bright globular cluster is conveniently located near the star Antares in Scorpius. Visually it has a distinct band of stars, which can be seen in any small aperture telescope. The photograph seen on the right is a 15 minute exposure on 2415. 24 inch at f/6.5

M-57 the famous Ring Nebula ia always a lovely sight visually. I had never before seen the central star, and I wondered if it could be seen in the 24 inch telescope. It was not visible at 200X, but at 500X, it could be clearly seen with averted vision, popping in and out of view. I really doubt that many people can actually see the central star in any telescope under 20 inches aperture, as it was not easy to see, even from Mauna Kea with a 24 inch telescope in good seeing conditions.

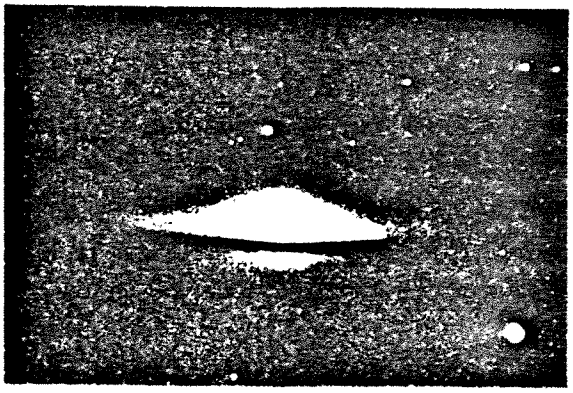


M - 4

Alpha Centauri, our nearest neighbor to the sun holds a special attraction because it is close (4.3 ly), and because it is without doubt the most spectacular double-star in the sky. Both 1st magnitude components of Alpha Centauri were brilliant even though they were only about 10° above the horizon. They both appeared a beautiful gold in the 8 inch telescope, and I couldn't help but wonder about what planets might circle these stars. Terrestrial planets would have stable orbits if located at less than about 2 a.u. from either star, and both are of spectral type G2 and K1 considered most favorable for life. Optical separation of this superb pair is now 20 arc-seconds.

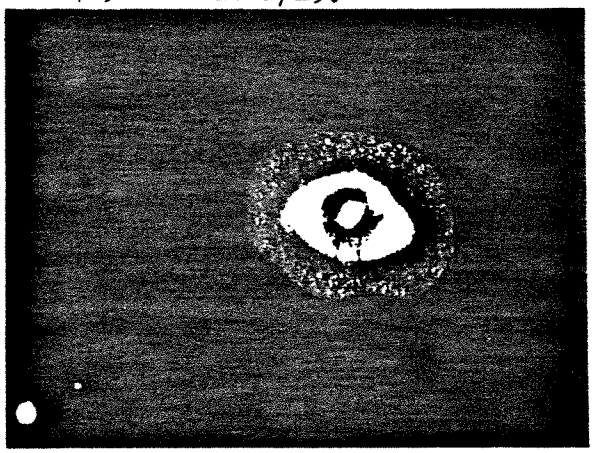
Omega Centauri, what a magnificent globular cluster! At 300X it completely overfilled the field in a continuous sea of thousands of stars. It was BRIGHT! This is one example where actual viewing is more splendid than any photograph.

M - 104 (12h 37m, -11°) The famous "Sombrero" galaxy is seen tilted only 6° from edge-on. It was a lovely sight visually, with the dark lane easily seen surrounded by luminosity on both sides. The photograph on the right is a 30 minute exposure on 2415 and shows the lane in great detail.



M - 104 The Sombrero Galaxy.

NGC 3242 (10h 22m, -18°) I call this planetary in Hydra the "Eye Nebula". It is very bright at 9th. magnitude and gives one a stunning impression of an eye. It was bright enough to slightly excite my color vision to yield a bluish appearance, and is what I would call a showpiece Deep-Sky object. Because of its small size of about 40 arc-seconds, I removed the telecompressor lens and photographed it at f/15. The eye-like appearance can be quite clearly seen in the photograph below. Exposure duration was 14 minutes on 2415 film at f/15.



NGC 3242 The Eye Nebula.

Observing all these beautiful deep-sky objects from Mauna Kea was a very rewarding experience. Although the high altitude and cold, always near 0°C, is a slight handicap, the viewing conditions and southern latitude have yielded a truly delightful astronomical experience.

The view of Omega Centauri, the "EYE Nebula" and other deep-sky splendors will always be with me.

M - 51 (13h 27m, +47°) The great Whirlpool Galaxy in Canes Venatici was visually very lovely. The spiral arms stood out quite distinctly in the 24 inch telescope. The photograph below shows the inner dust lanes and star clusters inside the galaxy. Exposure was 40 minutes on 2415 (hindered by some cirrus clouds)

M - 51 The Whirlpool Galaxy.

OUTSTANDING FEATURES OF THE SPACE SHUTTLE PROGRAM.

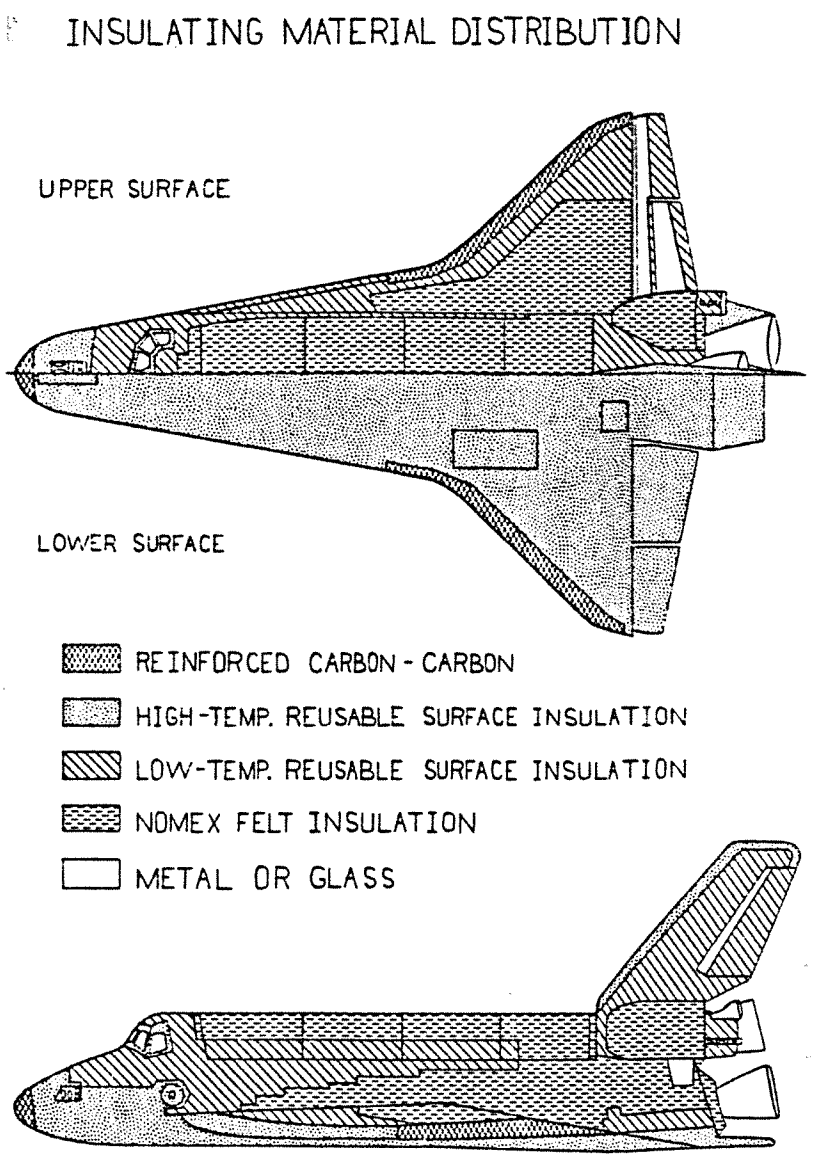
I./ THE THERMAL PROTECTION SYSTEM.

by Robert Hamilton
Engineering, University of Manitoba.

As a space vehicle, the orbiter is to have a life span of 100 missions, with a minimum turn around time. To obtain this goal some form of reusable insulation must be designed. Along with the insulation being reusable, it must be lightweight, able to protect the orbiter from cycling temperatures, and be able to withstand the acoustic pressures applied to it on liftoff and landing. Following is a description of the insulation and ceramic tiles designed to protect the space shuttle.

One type of insulation is a special carbon cloth that has been impregnated with additional carbon. This is called reinforced carbon-carbon insulation (RCC). The high reusable temperature of the RCC (1600°C) comes from the carbon it's composed of. The carbon has a melting point of 3,700°C, thus it can be safely heated to 1600°C without a change in its molecular bonding structure. This makes the RCC insulation very effective on the areas of extremely high surface temperatures. For this reason the RCC insulation is used on the orbiter's nose cone and on the leading edges of the wings. These areas have the greatest reentry temperatures, which can build up to 1300°C. The disadvantage of the RCC insulation is that it is very heavy. For example, the RCC adds a weight of 1400kg. to the orbiter. Since weight is a very important factor, the use of the RCC insulation is restricted to small areas where other types of insulation might fail.

There are three types of ceramic tiles used for insulation on the orbiter. All of these tiles are made of the same insulating material, but vary in coatings and densities. The tiles are made from 1.5 micron diameter silica fibers. During a 4 hour sintering process a colloidal system of silica fuses these fibers together. The resultant tile formed contains approximately 10% fibers by volume, leaving 90% of the tile empty airspace. Once the tiles are cut to shape they are coated with a reaction cured glass (RCG) on five sides. The sixth side of the tile, the bottom, is not covered and will be used for bonding the tile to the orbiter. The reaction cured glass is a mixture of ceramic glaze material which is glazed onto the tiles at 1100°C. This reaction cured glass coating waterproofs the tiles and gives them some abrasion resistance.



The three types of tiles used on the orbiter are:

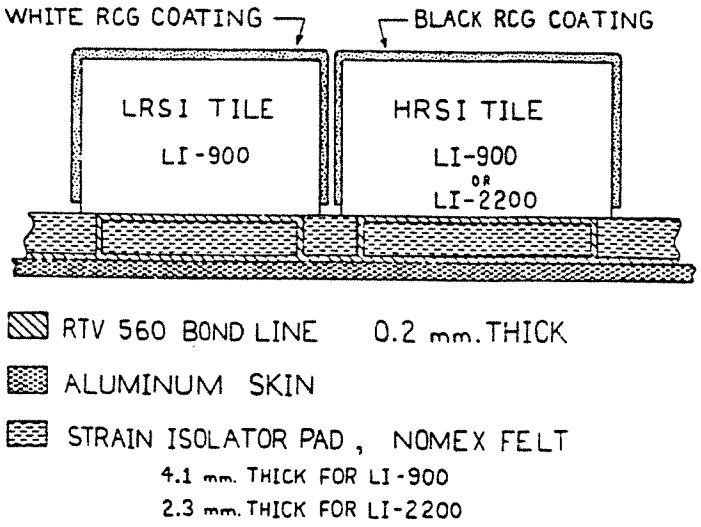
A/ High Temperature Reusable Surface Insulation (HRSI)

The HRSI tiles cover a majority of the orbiter. The temperature range of the HRSI tiles is between 650°C and 1300°C. The HRSI tiles have a black reaction cured glass coating on them which effectively radiates heat away from the orbiter during reentry. These HRSI tiles have a density of 145kg/m^3 and range in thickness from 50mm to 150mm. The total weight of all the HRSI tiles is 5010 kg. The HRSI tiles are mainly used on the underside of the orbiter and cover an area of 480m^2.

B/ Low Temperature Reusable Surface Insulation (LRSI)

The temperature range of the LRSI tiles is between 370°C and 650°C. The LRSI tiles have a white reaction cured glass coating which reflects solar radiation and maintains a low orbiter temperature in space. The LRSI tiles are used on the upper-middle fuselage area of the orbiter. These tiles range in thickness from 12mm to 50mm and cover an area of 255m^2. Since the LRSI and HRSI tiles are made from the same material they have the same density of 145 kg/m^3. The LRSI tiles total weight is 1077kg.

ASSEMBLAGE OF TILES TO FUSALAGE



Both the HRSI and LRSI tiles are given the same designation of being LI - 900 tiles since the insulating material in both of these tiles has the same density.

C/ High Temperature Reusable Surface Insulation (HRSI)

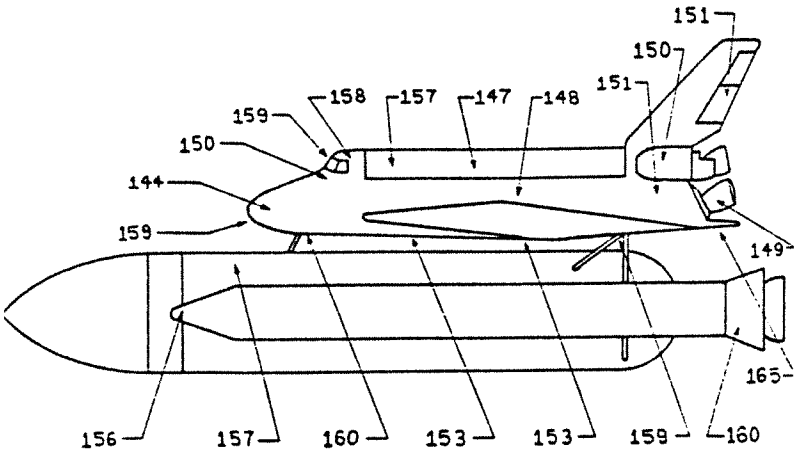
These tiles designated LI - 2200 are made of the same material as the other HRSI tiles designated LI - 900 except that they have a higher density of 350 kg/m^3. With a higher density these LI - 2200 tiles can withstand temperatures up to 1425°C. The density of these tiles also makes them stronger and useful in areas of high loads. The LI - 2200 tiles have the same black reaction cured glass coating as the HRSI tiles. The LI - 2200 tiles are few in number on the orbiter and are found on the landing gear doors and alongside the reinforced carbon-carbon insulation. These tiles are used on the landing gear doors since this area is very crucial and must not be damaged by reentry heating. The LI - 2200 tile is also used alongside the RCC insulation since it is the ceramic tile that can withstand the most heat.

The Felt Reusable Surface Insulation (FRSI) is a blanket of felt (Nomex) which is coated with silicon. The FRSI insulation is rated to withstand temperatures of 350°C. The FRSI is used for protection on the cargo bay doors and on the top of the orbiter's wings. This FRSI covers an area of 333m^2 and has a total weight of 528kg. This untreated Nomex felt will also be used as strain isolation pads (SIP) for the ceramic tiles. Some form of insulation must be used to fill the gaps around hatchways, landing gear doors, and other openings. This insulation must also be flexible to give a good seal to these doors. The insulation developed for this purpose was a ceramic fiber which can be braided into a textile type of material. These fibers have a high tensile strength and maintain their flexibility after being heated to 1450°C. These fibers are braided into a tubular shaped fabric. A flexible metal spring is used beneath this insulation. Around this spring is placed three layers of the ceramic fiber tubing. This insulation is very flexible and able to withstand temperatures up to 1450°C.

During periods of heating and stress the thermal and mechanical expansion of the orbiter's aluminum skin is much greater than that of the ceramic tiles. If the tiles were bonded directly to the skin of the orbiter they would crack as the skin expands and contracts. To avoid this problem the tiles were cut down to have a maximum side dimension of 150mm. The small gaps which are left between the tiles when they are applied, allows the tiles movement when the orbiter structure is slightly deformed during takeoff and landing.

A SIP is also needed between the tiles and the orbiter skin. This strain isolation pad protects the tiles from cracking, by absorbing the strain placed on the tiles as the skin expands or undergoes lateral deformation. This SIP is a nylon fiber pad (Nomex) that is bonded with "room temperature vulcanizing" (RTV) silicon adhesive to the side of the tile which was not coated with reaction cured glass. Each SIP is cut slightly smaller than the tile it will go underneath so it will give the tile some freedom of movement on the pad. The reaction cured glass coating on the tiles does not cover the entire glazed part of the tile. A small space a few millimeters wide is left uncoated at the bottom of the four sides of the tile. This small unglazed space around the bottom of the tile allows the tile to vent off its heat and internal pressure.

ACOUSTIC NOISE LEVELS in dB's



During liftoff and reentry the tiles of the orbiter experience a variety of aerodynamic loads. At points during liftoff and descent the noise levels on the orbiter's surface can exceed 160 decibels. This noise is caused by the engines and air movements past the orbiter, and is responsible for the acoustic pressures on the tiles. At liftoff the tiles' internal pressure is lower than the pressure created outside of them. This high external pressure compresses the tiles into the strain isolation pad and causes the internal pressure of the tiles to slowly increase toward the value of the applied external pressure. As the orbiter increases its height the external pressure drops off quickly, leaving the tiles with a high internal pressure. This internal pressure can only be vented out at the bottom of the tile where it is unglazed. This tile venting process is slower than the rate at which the external pressure is decreased, causing tensile forces to develop between the tiles, the RTV adhesive, and the SIP. If these tensile forces are great enough to break the RTV bond, the tile will fall away, leaving an exposed area on the orbiter. Since the RTV bond to the tile surface is not very strong, it can be broken by these acoustic pressures. Although dumping water on the launch pad at the time of liftoff seems to have decreased the acoustic pressures, tiles still fall off. It should be noted though that fewer tiles fell off on STS3 than on STS2. The chain is only as strong as its weakest link and in this case the RTV adhesive appears to be that weak link. The later shuttle orbiters, instead of having single tiles are to be built with panels of tiles on the underside, nose and other areas where the falling off of tiles has been a problem.

(condensed and edited for publication)
(by B. Belkin.)

NASA NEWS

EXPERIMENT RUINED: Earlier thism month, all the data from an experiment conducted aboard the space shuttle Columbia, was ruined by the failure of a freezer unit at the Johnson Space Centre. When the freezer lost its power human cell samples that had been electrically purified by electrophoresis, started to thaw. The freezing was important because it kept the cells alive in a type of suspended animation for later study. Once they thawed out, they became active and then died.

ROCKET PFTTTS: NRC scientists will try again early next year to see if they can turn off the Northern Lights. This year the effort failed when their rocket ended up in the muskeg a kilometer from the launch site. The rocket was to have detonated in the upper reaches of the atmosphere, spraying water molecules over a large area to see what it would do to the aurora. The test had been done once before and seemed to effect the electrical system in the ionosphere.

NASA TELESCOPE TO CLOSE: Jess Moore, the director of NASA's Earth Planetary Exploration Division, has been told by the Reagan administration to cut back by 29% in his area. Moore has decided that the lunar curatorial centre will no longer distribute samples collected by the Apollo astronauts. The INFRARED TELESCOPE FACILITY in Hawaii, which is the best infrared observatory in the world, will be closed. This will save $3 million. Still some 150 of the 650 scientists supported by NASA will be cut off from their funds. OMB clearly intends to get out of planetary exploration. What's next to go? The Galileo probe? Less spending on his war games and more spending on space science might be one method for the Reagen administration to be reelected.

COMET HUNT.

Skynews Victoria reports that the 1.2 m Schmidt telescope in Australia provided recent photographs of Virgo on which a pair of comets has been found by the Edinburgh University astronomers. The comets are 14 and 17 magnitude, travelling together only 0.75° apart. There is speculation that the travellers are parts of a comet which has spontaneously broken up quite recently. They are, however, moving fast at 0.75 - 1.0° a day at about the distance of Mars's orbit.

P/Gehrels 3. was indeed a temporary Jovian satellite. Two Swedish scientists concur that the orbit figures published by Brian Marsden in 1979, are fairly accurate. They conclude, "This shows definitely that this comet was indeed a temporary Jovian satellite shortly preceding its discovery.

Comet Halley cometh? It is thought that sometime this year or next Comet Halley will be recovered. There's even a competition amoung the observatories of Kit Peak to see who will be first. So to give everyone an even chance regardless of the size of your telescope, here are the next two months predicted co-ordinates (with Perturbations) for Comet Halley.

MAY 1982	R.A.	DEC.	JUNE 1982	R.A.	DEC.
9th	6h 39.879	+10° 46.25	8th	6h 46.186	+11° 01.04
19th	6h 41.661	+10° 52.91	18th	6h 48.796	+11° 02.42
29th	6h 43.786	+10° 57.86	23rd	6h 50.159	+11° 02.43
			28th	6h 51.549	+11° 01.99

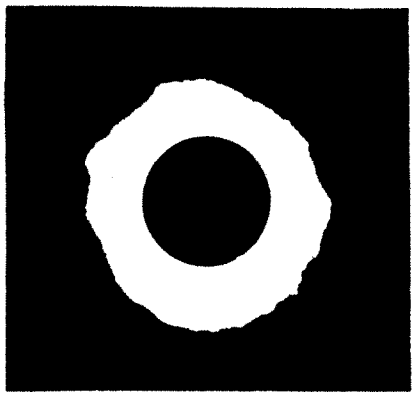
The address for telegrams if by chance you should find something is:
Central Bureau for Astronomical Telegrams,
Smithsonian Astrophysical Observatory,
Rapid Satellite Cambmass, 60 Garden Street, Cambridge, MA 02138.

ECLIPSE 80.

by Guy Westcott with references to J.B.

Jim Brightwell, electronics engineer with a computer firm in north London. Many American and Canadian eclipse chasers may know of him as Jim of Mill Hill. Jim, who has a beard, curly hair, glasses and grows rare plant species in his back garden (legal species only), is in his mid-30s. Jim's passion in life is solar eclipses. Not for him the beaches of Majorca or the cathedrals of France, unless there is an eclipse there, he plans his holidays to coincide with total eclipses all over the world.

In 1979 he travelled to Winnipeg, Canada where, for the four minutes of duration, the eclipse made the temperature drop about 30 degrees in as many seconds. After arriving in Winnipeg during a blizard, jumping off of building roofs into snow drifts, he was now prepared to travel to Gimli to observe the eclipse with the other fanatics. It seems that eclipses have their fanatics like any other sport or passtime, Jim can expect to see the same people in Siberia in 1981, in Java in 1983 and in Mexico in 1991.

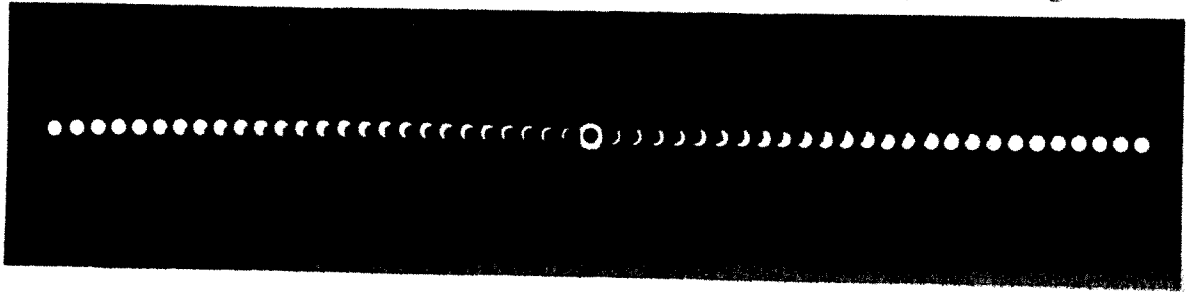


When I spoke to Jim last, he told me, " I did manage to get to India in the end. I had many problems and only managed to get to the eclipse site, a small village near Goa, with one hour to spare! Talk about cutting it fine. Just after midnight, on the 14th of February 1980 a very lonely and frightened man, landed in Bombay. Me, without a single friend in an alien land. Anyway like the American eclipse, I travelled around India and got to love the country and people. I had many adventures, the majestic Taj Mahal in Agra, the Jantar Mantar Observatory in Delhi, chased by bandits outside of Jodhpur, or was that my imagination. The small villages and towns along the centre line of the eclipse could offer no English television or radio, so finding out the weather report proved to be a major problem. Jim finally made it to his site. He set up his camera, the one with the hairbrained shutter, that looks like something out of Star Wars. Pulled out a pair of solar eclipse glasses, well looked after souvenirs of the Manitoba eclipse, and settled back for the most expensive per minute holiday available.

Jim of Mill Hill put down his fork and passed over a batch of dark little photographs. Each showed spots in a row, round ones at the start and finish, crescent ones towards the middle. The very middle one was not a spot but a ring and the rest of the frame was all stygian blackness. This, said Jim, was his own photographic record of the 1980 India eclipse, and the middle ring was the precise and actual eclipse, with the solar corona streaming out around the sun's darkened disc. I gazed at this manifestation of Nature, immensely awed. Do you go to partial eclipses too, I asked? "Oh no, said Jim, I don't bother. I'm only interested in Total Experiences." Well if he waits long enough he can see the next Total eclipse in London, England in 2142.

(Jim sends his best regards to all his friends in the Winnipeg Centre and people he met on his trip around America and Canada after the eclipse.)

All photographs appearing with this article were taken by Jim Brightwell in India.



LETTERS

This month we received quite a few letters from our readers. The first letter was from a very distinguished past centre member, Mr F. Shinn. The second letter was from a current member, Mr Tom Burgin in Oklahoma.

Thank you both for your very encouraging comments on the new format for WINNICENTRICS. We are trying to improve the newsletter so that it holds something for everyone in the Centre, at all different levels of skill.

Tom Burgin writes that he could use some assistance from other R.A.S.C. members. " I am working on a project, and I need help. The small town that I live in doesn't have a good source of information on astronomy. I need information and sources of information on Barnard's star and E Eridani. I need any information on the two stars and their motions."

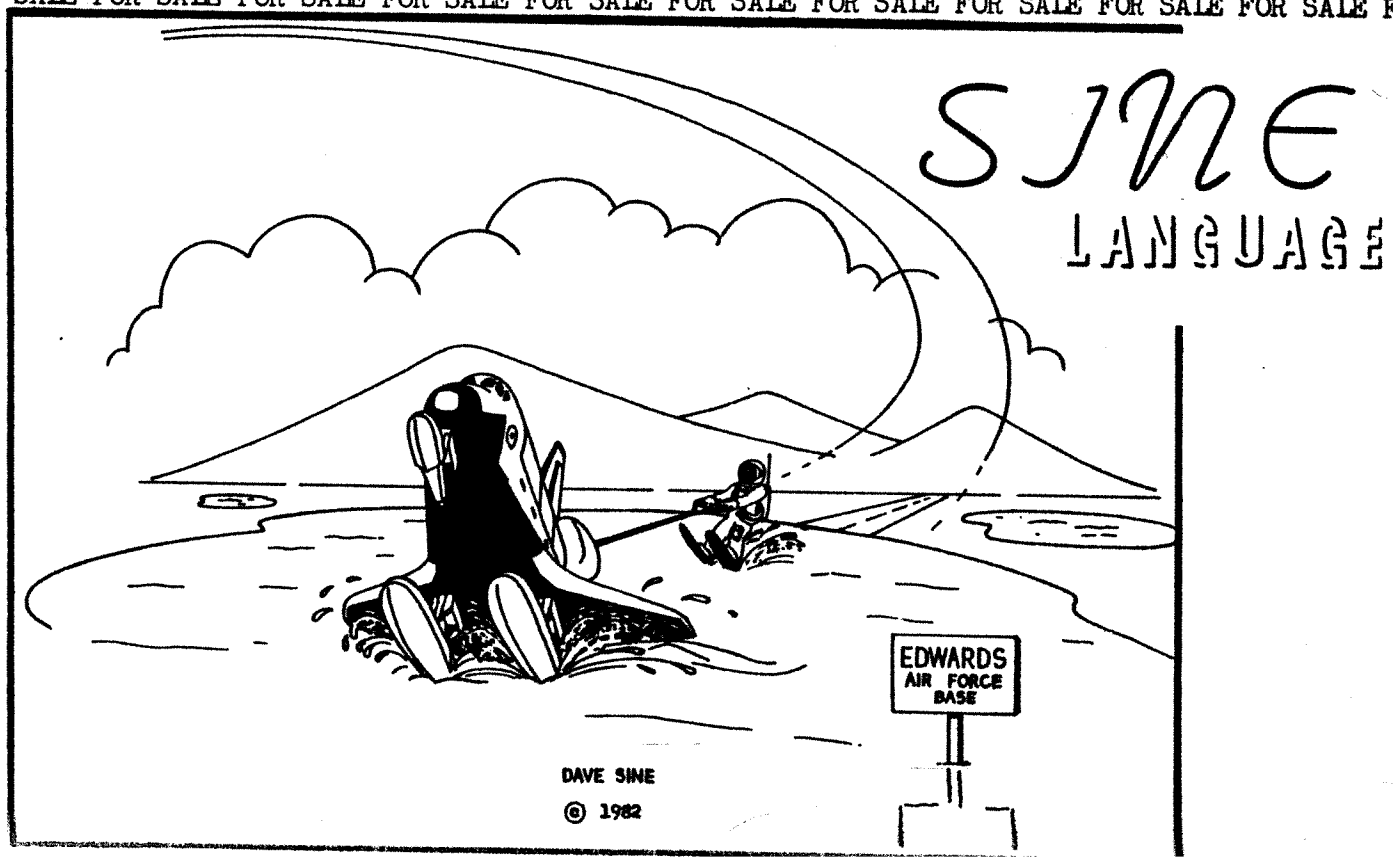
If anyone wishes to help Tom out, his address is: Mr T. Burgin, P.O. BOX 3748, Enid, Oklahoma, 73702.

Also received letters from Mr Terence Dickinson with four of his latest articles for publication and a very interesting article from Dr Jack B. Marling about his trip to Mauna Kea. Jack said to emphasize that you don't have to go to Mauna Kea to get good photograph like the ones he took, He merely wanted to photograph some of the very southern objects that are not easily seen from California. Good viewing and good photographs can be had at any good site.

Last but not least, thank you to all the other R.A.S.C. centres that send us their Newsletters. This month we received them from: Victoria, Halifax, Ottawa, Kingston, Niagara, Quebec & Montreal, Saskatoon, Toronto, Edmonton, and Calgary Centres. I hope to meet all the other editors at the G.A.

SALE FOR SALE FOR SALE FOR SALE FOR SALE FOR SALE FOR SALE FOR SALE FOR SALE FOR SALE F

4½" f/10 **Newtonian** made by Edmund Scientific.

The telescope is two years old, has the aluminium tube, clock drive, equatorial mount and setting circles, 6X finder scope and a 28mm eyepiece. ASKING $390.oo (or best offer) Phone 1-765-4949 or write to: Bill Bramwell, P.O. BOX 31, Shilo, Manitoba. ROK 2AO.

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