MACARTHUR ASTRONOMICAL SOCIETY Inc.

Journal

PRIME FOCUS

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President's Report

Sadly this will be my last President's report, and after almost 5 years at the helm it is hard to leave the position but absolutely necessary.

This year has been a good one for the Society in having more of our local talent come and talk and show their expertise to all of us.

I would like to thank everyone in the society for their help and contributions whilst I was at the helm. However, I must especially thank: Bob Bee for his outstanding contribution with Prime Focus. I started doing the first edition and thankfully he took over and the Journal has grown from strength to strength, with The Campbelltown Library holding every copy in its Local Studies section, plus his enthusiastic help and knowledge at star nights;

Noel Sharpe who without his tireless efforts as Treasurer, Vice President , mailing out the Prime Focus, Star nights and site hunting and most of all taking over running the Monday nights when I was either sick, working or just plain burnt out, etc; this club would not be in the healthy state it is in today with 70 + members;

Daniel Ross the quiet achiever organising the room every monthly meeting, setting up the Internet site, committee contributions and coming and assisting at many star field nights.

Other special mentions must go to Pete and Bobbie for opening their house for committee meetings, their advanced knowledge of astronomy and organising the suppers;

Peter Dreary for his wonderful talks, star nights and observing tips, plus helping in the committee;

Chris Barnett for his constant output with Internet and library information;

Eric Brown at the start of the Society for treasury and observing nights and camps;

John Rombi for being a great help to the Society on star nights and writing articles;

plus all the other members who wrote articles for Prime Focus, my sincere thanks goes to you all. Anyone I have forgotten you know you contribution was very much appreciated.

Phil !

LATEST NEWS

More Planets !

Astronomers in Britain have located 13 free floating planets outside any solar system but near a Nebula. The planets are at least 13 times larger than Jupiter and are regarded as gas giants in No Man's Land. Also located in the Orion Nebula are over 100 brown dwarfs (failed stars).

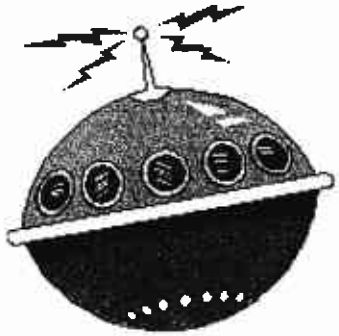
Mars:

The scientists are now saying after two failed landings that the surface of Mars is too rocky to land a Polar Lander type spacecraft and may have to revert back to Pathfinder 'crash and roll' method of landing (let's hope they steer clear of that idea when a manned mission is happening.

The scientists with all their budget cuts apparently knew of a fault in the Polar Lander but didn't fix it (possibly due to lack of funds and time constraints).

Movie:

Whilst not exactly Astronomy, I must tell you "Mission To Mars" the movie starts on April 6th and I'll be the first through the doors to see it, review next issue. (*Red Planet* made in Sydney will be showing in December this year, another movie I won't miss.)
Spaceviews has given a review on the movie which I would like to share with you.



The movie 'Mission To Mars' starts with the first mission blasting off in 2020, just when NASA really plans to send a manned mission. The first mission loses contact with Earth, thus a second rescue mission is planned and sent pronto.
Technically the movie is extremely well done. The space walks and surface of Mars with habitats are very realistic (thanks to Story Musgrave NASA astronaut.) The acting by Tim Robbins and Co, is also quite good, however, the plot is weak and story a little shallow.

Space enthusiasts (like me) will probably like the movie, however it is apparently not much of a sell to the general public and won't do much to gain interest in a manned mission to Mars in the near future. My review of the movie will be in the May edition of Prime Focus. Being a Mars nut, I won't miss this movie for anything!

President's apology :
The SETI article won't be in this issue as stated last February. I hope to complete my writing of it by May this year.

Phil.

Mars's Dust Devils

New images from NASA's Mars Global Surveyor spacecraft have caught dust devils and landslides in the act of changing the surface of Mars, giving scientists more clues about how Mother Nature's vandals are leaving their mark on the changing Martian landscape.

Since Mars Global Surveyor arrived in September 1997, its high-resolution camera has been snapping pictures of puzzling dark streaks and lines that seemed to defy simple explanation -- until now. In December 1999, scientists had their first solid evidence, a picture of a dust devil caught like a graffiti artist in the act of etching the surface of Mars.

"Dust devils are spinning columns of air that move across the landscape and look somewhat like miniature tornadoes," said Dr. Ken Edgett, a staff scientist at

Malin Space Science Systems, San Diego, CA. "We've captured them in the midst of sweeping up dust and leaving behind a dark streak. This is the 'smoking gun' that explains the wild, sometimes twisted 'spaghetti' of dark streaks and trails we have been seeing. I get the feeling when I look at these pictures that something is 'moving'. These things send shivers down my spine."

Dust devils are a common occurrence in dry and desert landscapes on Earth as well as Mars. They form when the ground heats up during the day, warming the air immediately above the surface. As the warmed air nearest the surface begins to rise, it spins. The spinning column begins to move across the surface and picks up loose dust. The dust makes the vortex visible and gives it the "dust devil" or tornado-like appearance. On Earth, dust devils typically last for only a few minutes and the same is probably true for Mars.

...we have seen as many as five to 10 devils at a time...

"What is exciting about this dust devil finding is that we are witness to one of the processes that help explain the cause of some of the seasonal variations in the bright and dark surfaces on Mars. The dust devils remove some of the bright dust and cause the surfaces to appear to darken in the spring and summer seasons. Each little dust devil that runs across the landscape makes the surface in that region just a little bit darker," Edgett explained. "This isn't happening everywhere, but it seems to be most common in the mid-latitudes of Mars. In recent weeks, we have seen as many as five to 10 devils at a time running across the floors of the giant impact basins of Hellas and Argyre."

Scientists have known for decades that winds change the surface of Mars, but Global Surveyor has also captured other dark streaks that scientists now believe are the result of recent landslides.

"This is the first time we have been able to detect from orbit a change caused by some other geologic process. Gravity is acting to move loose dust and sand down these crater slopes," said Edgett. "It's not a big surprise, but it is exciting to have captured the results of several new landslides that occurred in less than one Martian year." Mars Global Surveyor's camera is observing how often these streaks form, which will provide scientists with some idea of the rate at which Martian slopes are modified. "Knowing how long it takes for any process that changes the landscape to occur can tell us more about the how the planet came to look the way it does today," said Edgett.

(Quotes from JPL article)

Vice President's Report

Firstly, I would like to thank all those who braved the rainy conditions to attend last month's meeting and would especially like to make welcome our newest members. I think you would all agree that Peter Druery's talk on 'Visual Astronomy' was excellent, interesting and I'm sure, like myself, you would have learned a little bit more about our own eyesight. Well done Peter.

For those who have attended for the first time, it would appear that many 'first time' telescope users require assistance and guidance. This has not gone un-noticed. Astronomy is such a wonderful hobby and everyone has to start somewhere. To that point I give my assurance that we can help you with your telescopes, observations and knowledge. If you are keen and dedicated then please join us. As a member you receive a monthly Journal, access to observing nights (which are not open to the general public) and use of the Society's telescope, MacDob (after a qualifying period.)

At the moment we are assessing several new observing sites. I know that we have not listed locations as yet. However, when assessment is finalised, I'm confident that many hours of fine observing under dark skies will take place for many years to come.

Yours Astronomically,

Noel Sharpe ■

Starry, Starry Night

This is a famous line from a Don McLean song, but it is also every astronomer's dream, to be able to venture out at night, look up and be able to lose yourself in the infinity that is our Universe. Most amateur astronomers are bitten by the bug early in their lives, for others it is a more gradual process that can take years.

As a very keen 12 year old, way back in 1967, I read books, listened to the Apollo launches and bugged my parents for a telescope. Christmas-67 came and a shiny new Tasco 40mm scope with a table top tripod was under the tree. That same night, I took the scope into the backyard, pointed it skyward and was overcome by the feeling of amazement that all of us as astronomers have felt. A year later I purchased the Unitron telescope I have now. This allowed me to see the fainter Deep Sky objects that I had not been able to see before.

After a few unsuccessful attempts, the telescope was relegated to the wardrobe where it lived until August 98. At this time I joined MAS, where the enthusiasm of the members reignited my Passion. Two very knowledgeable and friendly fellows, by the names of Dick Everett and Lou Timpano, took me under their wing. They then took me on a tour of the sky that awakened the wide eyed child of many years ago. Not wanting to lose this rekindled fire, I spoke to our newly appointed Deep Sky section leaders Pete and Bobbie Elston. Their advice was to start on the Messier List, the brightest of the deep sky objects. There are 110 to see, but unfortunately only 100 are visible from Sydney.

Some of these objects are visible with the naked eye, the rest need binoculars, for a more detailed look a telescope is recommended. The book "Messier Marathon Field Guide" by Harvard Pennington was recommended. I could take this with me to any observing site. So far I have catalogued 55 Messiers using the star hopping method.

I realise that there are computers that can guide you to any star in seconds, but I guarantee you gentle reader that nothing compares to the Hunt, Stalk and final bagging of the object, the dimmer the better.

The weather has not been on our side the last four months, but we must keep the pilot light burning. I hope this article has helped rekindle any wavering ambitions. Remember if you not having fun observing, you're working too hard.

John Rombi ■

The photo above will show you the lengths that some people will go to so as not to put their eye to an eyepiece. What you see is Dick Everett's famous Blue and White 8" Dobsonian. (Maybe we should name it BullDob? Up The BullDob!)

In the eyepiece he has put a garden variety miniature security camera and attached it to an ordinary TV set. What was the picture quality, Dick? Oh, by the way, it would work better in the dark.

The advantage is, of course, if there are clouds, you can always pass the time watching "The Bill" or "Seven Days."

Star Nights

The following dates have been set for our Star Nights for the next few months.

3rd June

1st July

29th July

26th August

Vice President's AGM Report

Our AGM is an important event in any organisation and marks the official passing of one year to the next.
Thankfully MAS is no 'BHP' or'NRMA', so I'm sure that tonight will be handled in our usual style. My report to you this month will contain aspects of my official AGM Report to our membership and to the year ahead.

The Year just past: 15/3/99 to 17/4/00:
- 26 field nights, including wash outs.
- 13 general meetings at UWS Macarthur
- 7 external presentations i.e. general public, other clubs etc.

...our 5th year will be our biggest and best...

The above mentioned, combined with the installation of the observatory telescope; the many contributions to our Journal *Prime Focus*; the excellent 'Heavens Above!' series of articles in the Chronicle; the Messier Hunt; the ever expanding astro-photographers; the many new telescopes purchased and a membership now officially as at 17/4/00 peaking at 73... all I can say is...
... phew! What a year.

It would personally be remiss of me not to thank all those who have made many contributions to our Society, but there are just too many of you to list by name. So I might just say a simple and sincere... thank you.

To the Year Ahead:

An expected change in the management committee; our own website up and running; regular monthly access to the University's observatories combining with telescope workshops; younger members joining to learn more; increased reliance on our own members to become guest speakers; better and darker field nights; larger spread of contributions to *Prime Focus*; core group membership renewing to say 50 or more; identification of members with similar interests and expertise; training and up-skilling of astronomers to use the observatories' telescopes, availing ourselves to assist university observing programs when required.

I might point out the above mentioned is a guide only as to how I see the year going personally, and does not necessarily reflect an official position. But one thing I'm sure of is that coming into our 5th year it will be our biggest and best with highlights being the coming on line of the observatories. These alone auger well for the future.

Good Luck and Good Observing.

Noel Sharpe (Vice President)

Image & Quality--Slow & Fast Seeing

You probably think that image quality in a telescope begins when light bends through a lens or bounces off a mirror right ? Wrong !
Most of the time telescopes don't work at their best because of what's called 'Bad Seeing', air turbulence along the path that the light from the object you're viewing takes. This turbulence could be several thousand metres up. There are several clues that will allow you to identify and hopefully avoid it.

Saturn is in your eyepiece, the image is doing a slow dance around the field of view, this is slow seeing. This is caused by nearby sources that radiate heat into the cool night air.

Avoid observing over roofs, large areas of concrete roads, etc. Taking certain precautions with your telescope will also help. Let the telescope's temperature equalise with the surrounding air for at least one hour.

Some telescopes with open tubes (eg, Newtonians) could be hooked up to a battery powered fan to speed up the process.

Telescopes with closed tubes (eg; Refractors) cannot use this option, and must wait out the cooling period. This may not be as bad as it sounds, a closed tube won't belch out warm air like an open one.

To check this type of 'Slow Seeing' slightly defocus a star's image into diffraction rings. Look for slow moving blobs that cross the image plane. These are currents of warm air escaping the tube.

Don't set up in a depression or low lying area, cold air sinks into such places causing turbulence and you will more likely be affected by fog. A good example of this has happened to us at Cobbitty.

Fast Seeing -- High-Altitude turbulence comes from eddie currents only a few inches across that form a layer between warm and colder air. All it takes to create a turbulent layer is temperature differences as small as a few 1/100ths of a degree.

These boundaries lie near areas where different types of air meet and blend eg; jet streams, cold fronts, eddies or clouds. Such mixing causes images to boil, but stay put in the field of view. This effect happens quickly running across an image in a fraction of a second. Hence the title 'Fast Seeing.'

Although it is easy to detect, there's not much to do but anticipate it. Count on plenty of turbulence and blurry viewing immediately after a cold change. The skies may look transparent, but they are not steady.

The best views come when the sky is under the influence of a high pressure system, and the air is calm. Even armed with this information it's rare you'll avoid bad seeing entirely. Larger scopes are especially sensitive to unsteady nights. Why? It's because they have better resolving power than smaller telescopes. Atmospheric turbulence spreads light over a circle appropriately called a 'Circle of Confusion' that effects a wider range of telescope apertures.

As turbulence dies down the eddies responsible for smearing the light get smaller, as do the resulting 'Circles of Confusion'.

While observers with smaller scopes might perceive an improvement in seeing, those with large apertures see no change at all.

Larger scopes continue to resolve the blurring effects of still lingering eddies. Consequently larger scopes are more susceptible to some forms of 'Bad Seeing'.

An example would be :

1. A 10 inch scope capable of resolving detail down to 0.5" see this turbulence as a "Fast" form of 'Bad Seeing'
2. A 60mm (2.4") scope which can resolve down to 2" reveals a relatively sharp image.

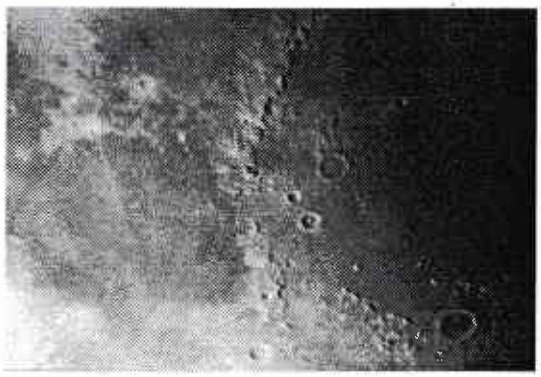
For the most part, smaller apertures only detect courser, avoidable forms of 'Bad Seeing'. So remember, patience is often the most overlooked factor when dealing with 'Bad Seeing.'

Your eye can grab a lot of detail in a fraction of a second when the 'Seeing' clears. With this information at hand I hope you will be able to better plan your observing night and sight.

Good Viewing

John Rombi. ■

Moon Glow



The photograph above of the Moon is by our Noel Sharpe. It shows a view of the Apennine Mountain Range and some sharply defined craters. Well done, Noel. (Exposure 1 second. ASA100 Fuji film, eyepiece projection 10 mm.)

The Early History of the Hubble Telescope

By John Casey

The idea of putting a large space telescope in orbit was proposed immediately after WW2 by a study group lead by the Princeton astronomer Lyman Spitzer, but it would take four decades for the idea to become reality- with the space telescope being placed in orbit by the Space Shuttle Discovery on April 15, 1990. The first official mention of what was originally called the Large Space Telescope [LST] was a 1962 report of the US National Academy of Science. At this time America's space program was only four years old. At that time the telescope was envisaged as being a 120 inch aperture reflector. But there was surprising little support for the idea of a LST from astronomers at that time [perhaps due to the expected high cost, and the worry of putting all your eggs in one basket]. These astronomers would be at least proven right on the cost- which exceeded the combined total cost of the world's top 40 ground based telescopes! For a time NASA and the scientific community concentrated on smaller, less expensive astronomical satellites. The first of these was the Orbiting Solar Observatory OSO-1, followed later by OSO-2 and OSO-3. Then came the Orbiting Astronomical Observatory, the Small Astronomy Satellite, and the High-Energy Astronomical Observatory series.

In 1972, another review by the National Academy of Science listed the LST as a desirable long range goal, but ranked its priority as low- behind a number of ground based facilities, an advanced space observatory for X ray astronomy, and with the top priority given to a very large array radio telescope to be built in New Mexico.

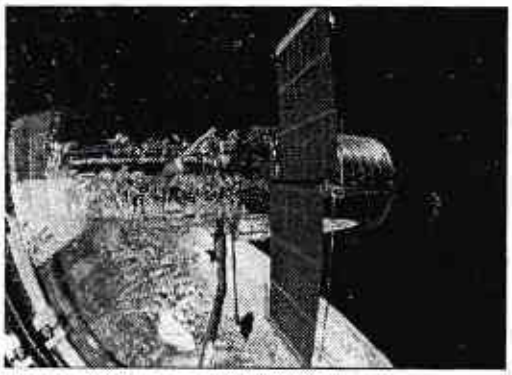
President Nixon's ...low opinion of science was well known...

It was 1972 when the United States Congress approved the space shuttle program. However politics came into it when NASA top management showed some enthusiasm for the project in spite of the poor support by astronomers. This came about because, after the Apollo program of landing man on the moon, they had lost community support and funding, and they were desperate for a large prestigious project that would need the support of the Space Shuttle. Opinion polls showed that over half the population wanted to see substantially less money spent on space, and under 20% wanting to see more spent.

By 1973 NASA had selected a working group of scientists to begin preliminary design for the telescope and instruments, but had little money available to support it. Previously, Presidents Kennedy and Johnston had shown enthusiasm for science in general, and space in particular. But this was President Nixon's term and his low opinion of science was well known, and shown by his abolishing the office of Presidential Science Advisor. This was the era of Vietnam, campus and race riots, the first oil crisis and then Watergate. NASA's 1974 submissions to the Congressional Subcommittee on Appropriations did include the LST, but the committee deleted it and suggested a less expensive and less ambitious project be considered as an alternative. Spitzer then solicited new supporters from congress, as well as influential allies in Europe who were prepared to collaborate on a joint project. After this, the Appropriations Committee reconsidered and restored $6.2m for LST planning studies. Then Nixon resigned on 9 August 1974, and the new President Ford implemented an immediate austerity program. The LST study budget was slashed in half, and even then was conditional on substantial participation of other nations

and in a less expensive project.

In 1977 NASA appointed a new team of 60 leading scientists, representing 38 institutions around the country, to design and develop a smaller Space Telescope. The design, development and construction of the telescope became the responsibility of the NASA Marshall Space Flight Centre in Huntsville, Alibama. The "Large" was dropped by NASA, and congress formally approved the Space Telescope in 1978.



(The HST is deployed from the Space Shuttle bay)

The project then named the Edwin P Hubble Space Telescope, and the original 120 inch aperture cut back to 94 inches. The Hubble Space Telescope [HST] would use a 94 inch concave primary mirror, with a small convex secondary mirror 16 feet in front of the primary mirror, and directing light back through a central hole in the primary mirror to where various scientific instruments were placed.

The task of producing the most precise and accurate telescope ever constructed was awarded to Perkin Elmer Corporation in Danbury, Connecticut, and the actual spacecraft would be constructed by the Lockheed Missile and Space Company of Sunnyvale, California. The European Space Agency agreed to construct the solar panels and one of the instruments on board.

It took Perkin Elmer over four million man hours to manufacture the ultra accurate mirror. The primary mirror was made of ultra low expansion glass [ULE], to handle the temperature extremes in space. One inch thick slabs of ULE glass were fused to each side of a 12 inch thick honeycomb slab to act as the mirror blank. Most large telescope mirrors are accurate to about one wavelength of a helium-neon laser light, but the HST mirror had to be 1/80 wave accuracy. This specification in itself was challenging the limits of technology, but as well as this, the mirror had to operate to this tolerance in a weightless space environment after the vibrations and high G of lift off and injection into orbit.
Distortion of the primary mirror under the effects of gravity can be seen by the fact that if the mirror was supported on its periphery and ground and polished on Earth, the centre of the mirror would have sagged under its own weight by 17 waves, or over 1000X the required accuracy.

It took Perkin Elmer over four million man hours to manufacture the ultra accurate mirror...

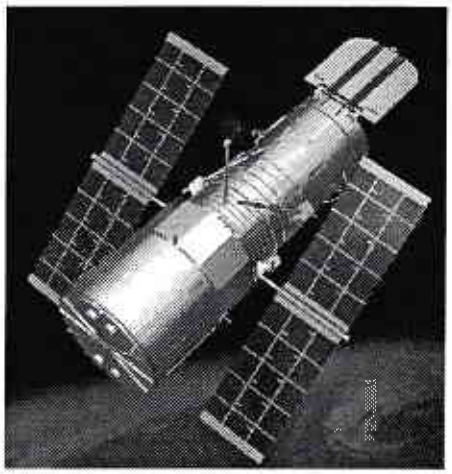
To overcome this problem, it took 50 engineers 3 years to build a zero gravity simulator that would support the glass slab on 138 special support rods, with each exerting a precisely known force on the back surface of the mirror so as to EXACTLY counteract the force of gravity. The figuring process then used a computer controlled polisher together with a laser contouring map to highlight imperfections on the mirror surface, and slowly remove the high points. It took 28 months of polishing, with removal of 200 lbs of glass to achieve the precision required, of less than 10 nanometres error from the ideal contour.

The mirror glass was now ready to be coated with aluminium to give the reflective mirror surface. This had to be done quickly, and under high vacuum to prevent

any of the aluminium oxidising, as any oxidation would seriously degrade the mirror performance at ultraviolet wavelengths. The coating would also have to be extremely uniform so as not to degrade mirror precision and accuracy specifications. This was successfully done, with a coating of aluminium one hundredth of a micron thick. To prevent oxidation of the aluminium, another layer, at half this thickness, of magnesium fluoride was applied over the aluminium surface. The secondary mirror was prepared to the same accuracy and precision, to give the HST a design resolution of 0.1 seconds of arc. This is equivalent to resolving the left hand headlight from the right hand headlight of a car in California, when viewed from New York, on the other side of the American continent.

The HST was housed in an aluminium cylinder 4.3 m X13m, and had 5 instrument packages, each separately housed, but capable of being able to be brought into the telescope focus. These packages were
1)the faint object camera, supplied by the European Space Agency. This had a small field of view, and examined light in the UV, visible and near infrared regions.
2) another camera which had a 40 X wider field of view, but with a lower resolution
3) a high resolution spectrograph
4) a faint object spectrograph
5)a photometer to measure light intensity with high accuracy.

The HST had developed into a maze of equipment and systems, and finally consisted of a fat cylinder at the back end, with a narrower cylinder attached at the front end, with this being divided into two segments- the light shield, and the forward shell- making this portion 26 feet long and 10 feet diameter. At the front end, there are a number of baffles to block stray light, and a movable door is fitted to shield the mirrors during launch and during space manoeuvres that could point close to the Sun. The structural pieces are made of aluminium and magnesium, and are covered with thermal blankets to minimise heating and cooling, as the HST orbits between sunlight and shadow as it passes around the Earth. The thermal blankets are multilayered Kapton, a flexible plastic, coated with aluminium to make the surfaces reflective [just like a thermos flask]. The outer most layer of the 15 layers is Teflon, again coated with aluminium, with all the layers held in place with rivets and special reflective tape. On the back of the primary mirror is mounted a reaction plate containing an array of heaters that can be used as necessary to maintain 21 C on the mirror at all times, even when the HST was in the Earth's shadow. There are also 24 small motors that can be used to bend the mirror slightly, to make small corrections to its shape if necessary.



The smaller secondary mirror is just over 12 inches diameter, and 16 feet forward of the primary mirror. During operation it must be located within one ten thousandth of an inch of its correct location, using small electrical motors to make minor adjustments to its position.

Power is supplied by two 40 foot long solar panels, each containing 24,000 solar cells, to deliver a maximum output in full sunlight of 5 kilowatts. These charge rechargeable batteries that continue the power supply when the HST is in the Earth's shadow.

To overcome exhaust haze from manoeuvring jets when changing direction in space, the HST used a different system. Instead , it uses 4, 100 pound reaction wheels, each angled in a different direction, and spun very fast by electric motors. By selectively braking or accelerating the spin of one or more of the wheels, rotational energy is transferred to the telescope and it rotates.

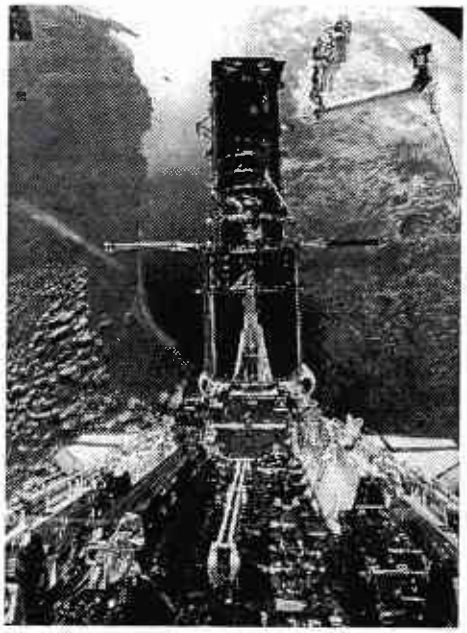
The HST was launched by the Space Shuttle Discovery on April 15, 1990...

The HST has a planned 15 year lifetime, so it was designed to be serviced in space by shuttle astronauts in space suits, and to enable this there are 26 different orbital replacement units that may be periodically exchanged or upgraded..

The HST was due for launch in the Space Shuttle in Oct 1986, but the Challenger disaster put the launch back until the Shuttle was redesigned to overcome safety issues that caused the explosion. The HST was launched by the Space Shuttle Discovery on April 15, 1990. After release, there were some minor problems- the aperture door initially refused to open, but this was overcome. Then, when the pointing accuracy was being checked it was found that there were small jitters caused by expansion and contraction of the solar panels as they moved from full sunlight to darkness and back again. A partial solution was devised, by using the electric drive motors that deployed the panels to make slight adjustments in the tension of the panels. Done correctly this would dampen out most of the vibration. Later, modified new solar panels would be installed that did not have the problem.

About one month after being placed in orbit, after all the preliminary testing, the "First Light" took place, with the telescope directed at an open star cluster in the constellation of Carina.
The wide field image showed finer detail than possible from ground based telescopes, but not the spectacular image it was designed to deliver.

Shortly afterwards, much to the embarrassment of both NASA and Perkin Elmer, it was discovered that the primary mirror had a spherical aberration error in its focus that resulted in blurred images. The error was that the HST primary mirror was too shallow and spherical in shape, by one fiftieth of the thickness of a human hair, but enough to make rays from the edge focus about one inch away from where a ray from the centre of the mirror focused. Investigations showed that the mirror was perfectly ground, but there was an error in the measurement instrument used to verify the mirror's shape, and this caused the mirror to be corrected to the wrong shape. The investigation team found that 3 separate tests should have caught the mistake, and two technicians were aware of the error, but failed to report it. The company was not aware of the problem at the time, and neither was NASA.



(HST is serviced by Shuttle)

The mirror error mostly affected the wide field planetary camera, and the high speed photometer, and the fine guidance sensors would hardly be affected at all, and the Goddard High Resolution Spectrograph

would still be able to work in the UV wavelengths, as could the Faint Object Camera Computer manipulation could recover some of the clarity of images. One of the results of the poorly focused telescope is that star images are surrounded by halos or fuzzy rings, produced by the stray light that doesn't come exactly into focus. The problem with the halos is that the halos can block the light of much fainter stars beyond and close to the bright star. Computers could be programmed to subtract the halos from the images, and leave behind the brighter stars nearby. When the stars are close packed however, the halos overlap and some faint stars will be subtracted, along with the halos, from the image as well.

It was 1993 before another Space Shuttle mission captured the HST and installed corrective optics. This greatly sharpened the optical images, but at the expense of a reduced field of view. In 1997 a further Shuttle mission installed new instruments, upgraded the computer, and repaired the insulation around the telescope tube.

Since the repairs to the HST, the optics have approached their original specification, and huge numbers of astronomical events have been recorded. The embarrassment of the finding of the error in early missions has turned to awe as the HST looked further out, and backwards in time, well beyond the view of Earth based astronomers. Almost every month new data, images and theories have come from this telescope in orbit. Few would now consider it a mistake or poor investment of resources. Hindsight always gives the clearest view, and as the HST can see fainter, further out objects, then it is also looking further backwards in time as well.- It might also be said that the HST has the best hindsight of them all!

John Casey ■

A Hole in the Roof

A darkness falls and colours and shapes merge into a ghostly hue, pots and pans topple in the confusion and the people go hungry.

The remedy to all chaos is simply to install a skylight in our kitchen, a large light-well with a clear perspex top. It's enormous and floods the area in natural sunlight.

But what of the night? Can stars be seen, can you set up a telescope underneath? Well, yes you can, and this strange obsession started with a young 2 year old.

To all and sundry who enter our house, our son Daniel would inform them at the top of his voice: "There's a hole in our roof," or "There's a hole in Dad's roof."

One morning while young Daniel was attempting to feed himself Wheet-Bix, he excitedly told his Mum: "Mum, look. A moon in Dad's roof." After initially dismissing this suggestion, my son's determination paid off and when mother glanced upwards through the sky-light – there it was, as large as life. When I returned from work, my wife informed me of my young son's discovery. I then had the idea that some form of magnification could enhance our viewing.

On display and clearly appearing was Orion, Sirius and other stars. Through binoculars it's good, through a view finder – still good. Through a telescope – really really bad. The light coming through the clear plastic perspex distorts into the most amazing shapes and colours. My wife is having me committed, or at least have some form of professional counselling.

My outlook is that you can do astronomy anywhere, anytime, even if it's through a "hole in dad's roof."

Noel Sharp
(Soon to be committed) ■

What's to See This Month (17th April – 14th May)

We are in a period when most of the conjunction action has just happened or will be happening in the next Prime Focus month. What is viewable this month is very close to twilight and can be classified as 'difficult to view.'

Mercury and Venus are both morning morning objects, but very close to sunrise, so set your alarm clocks carefully.

On 18th April, they are about 5° apart but slowly approaching each other. They reach a minimum separation of 0.3° on 29th April, but this is well into twilight. After that, they rapidly separate and head into the Sun's glare.

Mars is virtually unobservable due to its proximity to the Sun. The diehard Areophiles may try view the Mars/ Moon conjunction (4° apart) on May, but it is only 30 min after sunset and very close the horizon.

Jupiter and Saturn are lost to the Sun's glare this month. They will return in the dawn sky at the end of May and early June, again presenting some lovely conjunctions. It may be inconvenient but if you enjoy Jupter/Saturn conjunctions, now is the time to make the most of it. Remember, after they separate at the end of this year, you won't see them in the sky together for another 20 years. Parting is such sweet sorrow – bye Jupiter.

Uranus and Neptune provide more fun than their larger siblings. On 27th April, Neptune (mag. 7.9) is only 0.8° from the Moon, while on 28th April, Uranus (mag. 5.9) is 2° from the Moon. So, on those nights, find the Moon and sweep your binoculars or low power telescope around it. Who said blue and green should never be seen?

Constellations:

We're into that time of the year again when some of our favourite constellations are presenting themselves overhead.

Crux is at its best aspect for the next two or three months, standing bolt upright and looking like a ... cross. Just in time for Easter. It is high in the sky, providing a nice aspect for study of:

- The Jewel Box, a glorious wedge shaped cluster about 7 o'clock from Beta Crux.
- Alpha Centauri, the double star and First Pointer.
- Omega Centauri, about two Cross lengths above Beta Centauri (the Second Pointer). This is the most magnificent globular cluster in the whole sky.
- NGC4833, a largsh 7th magnitude globular cluster in Musca, directly below Crux.

Scorpius will be directly overhead if you want to wait up to about midnight. See the scorpion's heart, Antares, blazing like a ruby. Search for M4, a 6th magnitude glob, one of the closest. Because it is less conentrated than Omega Centauri, it is not as easy to spot, but is still visible in binoculars on a dark night. You'll find it about 3° north of Antares.

Leo is well placed in the north this month. You can't miss its sickle shape, which is the Lion's rearing head seen upside down. The bright blue-white star at the base of the sickle's handle is Regulus. If you have a telescope, even a small one, you may be able to spot the 9th magnitude spiral galaxies M65 and M66, and the 10th magnitude spirals M95 and M96 located along the 'belly' of the Lion (at the top of Leo as we see it.) Also close to M95 & M96 is another messier, M105, a giant elliptical galaxy.

Meteor Shower: This is the month of the Eta-Aquarids, a very popular shower as the particles come from the remnant of Halley's Comet. You'll need to be up a few hours before dawn, but the display of 30 to 50 meteors per hour may make it worth while. Look towards Aquarius in the East and enjoy. These Eta-Aquarids are reputed to provide lasting meteor trails, but are also very fast. The display should last from 19th April to 28th May.

Bob Bee ■

Bikini Bottom – - Bikini Top

Last August., our illustrious editor (aw, shucks!!! - Ed) Bob Bee brought to our attention that the constellation Capricornus had been nick-named by Southern Astronomers as the Bikini Bottom. He asked is there a Bikini Top ?

The answer is yes! Those of you that have a Chandler Star Wheel, look at the Constellation Puppis. It's a good astronomical version of one of Madonna's outfits.

John Rombi

BORROWING MACDOB

The Society's own telescope, a 6" Dobsonian, is available for loan for members. It is easy to transport, set up and use. If you would like to borrow MacDob for a month, speak to Phil Ainsworth who is its custodianship. Though there is no hiring fee, members are invited to make a donation of their choice which will go towards the upkeep and upgrade of MacDob

SECTION LEADERS

The following members have offered themselves as leaders (or coordinators) of those members with special interests in particular fields

DEEP SKY:
Pete & Bobbie Elston
Phone 02 46474491; e-mail: eclipse@lightstorm.com.au

ASTRO COMPUTING:
Daniel Ross (02 9790 5838)

AMATEUR TELESCOPE MAKING: Dick Everett
Phone 02 96051564

OBSERVING SITE: Phone Noel Sharpe for conditions. Mobile 0410 445 041.

TELESCOPES : NOVICE/INTERMEDIATE Noel Sharpe
ADVANCED: Peter Druery.

ASTROPHOTOGRAPHY: NOVICE: Noel Sharpe
ADVANCED; Peter Druery

Membership Fees

This is to remind existing members that renewel of your membership is now due and required to be paid by the end of April. Please see the Treasurer at the end of this meeting or mail your cheques to the Society's PO Box. (See the header of this Journal.)
Fees are:
Full : $25 p.a.
Family $45 p.a.
Student/Penshioner: $15 p.a.

University Open Night

On Saturday 6th May, the UWS Macarthur will be holding a Public Open Night. The main purpose is to show off its new Observatory with its fantastic Meade 16" SCT telescope.

The University has asked the Society to provide additional telescopes and operators to supplement the 16". Weather permitting, these will be mounted on the large viewing slab installed as part of the Observatory installation.

A large crowd is expected, as there has been intense interest by the general public about 'those white things on the hill.' This will be a great opportunity for the Society to further display its skills to the people of Campbelltown and, as well as provide a community service and support to the University, gain kudos and possibly new members.

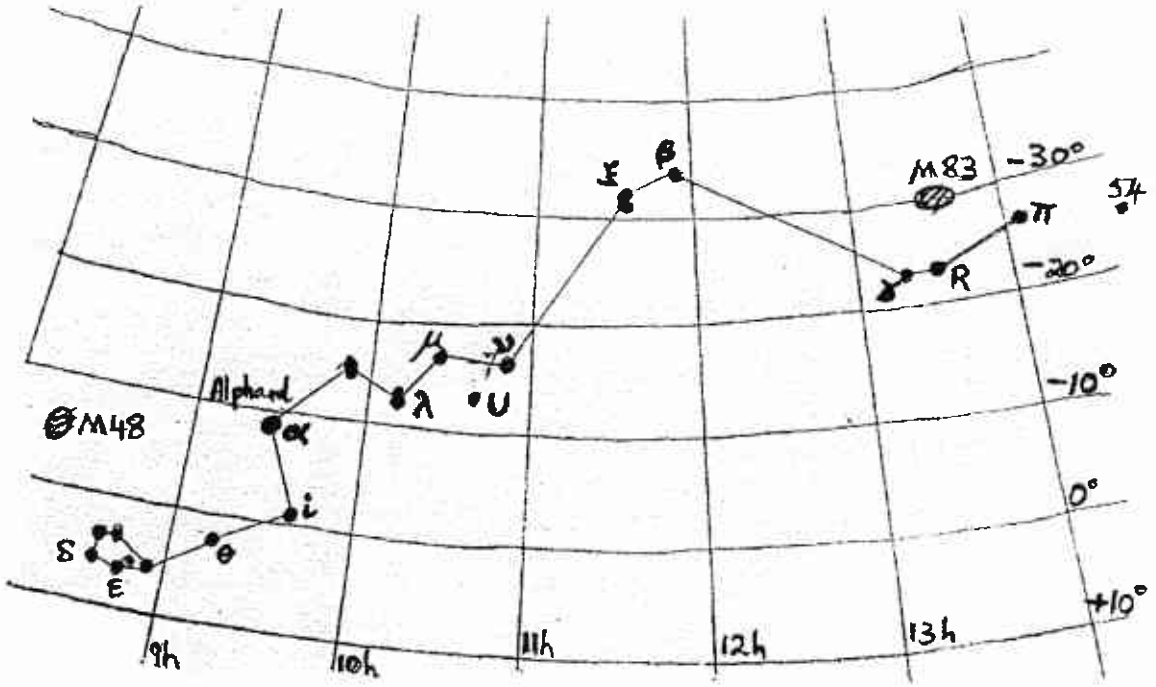
So, all those MAS members with telescopes, please indicate to the members of the Committee if you will be able to attend the night with your telescope. Also, you might indicate if you'd like additional support to help explain the sky to the people who will line up to look through your scope.

Full details will be provide at the April MAS Meeting.

Remember, Saturday **6th May**.

Hydra - The Water Snake

From the latitude of Sydney, Hydra, being such an inconsiderately long constellation (about 100° long), April - May are the only months when its head and tail and everything in between are at observable heights above the horizon.



In Greek legend, Hydra was a gigantic monster with nine heads, the centre one being immortal. The destruction of Hydra was one of the 12 labours of Heracles (or Hercules). However, in this starry version of the myth, Hydra has only one head and is demoted to a water snake.

Hydra is not very easy to identify, mostly because its component stars are relatively faint. With the exception of Alpha Hydrae, the others range from mag. 3 to 5. However, the head is quite distinct and attractive. The six stars are easily recognisable in a kind of fives sided polygon. They are located immediately above the constellation of Cancer (with the Beehive Cluster at its centre).

From the head, on a clear dark night, it is fun (with the help of a star map) to try and trace the snake to its tail, 100° away across the sky. The head starts at R.A. 8.5hr, +5°, and the tail ends at R.A. 14 hr, -26°. But in April-May, around 9pm, you should be able to see it all.

Let's look at some of Hydra's main components. Overall, there are about 13 stars which make up its body and six in the head. Naturally, there are many more stars and objects which fall in the area of the sky associated with Hydra.

α (Alpha) Hydrae: one of those stars with a name – 'Alphard' (the Solitary One). It is an orange giant, mag. 2.0 about 65 l.y. away.
(9 hr 28m, -9°)

β (Beta) Hydrae: about 1/3rd from the tail end. An ordinary blue-white star, mag. 4.3, about 330 l.y. away.

γ (Gamma) Hydrae: down near the tail end, a yellow giant, mag. 3.0, 100 l.y. away.

δ (Delta) Hydrae: in the snake's head. A blue-white star, mag. 4.2, about 150 l.y.

ε (Epsilon) Hydrae: also in the head, next to δ. It's a double star, 250 l.y. away

with contrasting colours of yellow and blue, mags 3.4 and 6.8. (A double in more ways than one.) The pair orbit each other every 900 years. To resolve them, you'll need a telescope of at least 75 mm and apply high power. (8 hr 47m. +6°)

R Hydrae: to the right of γ at 13hr 30m, -23°, R is a Mira type variable, a giant red that varies between mags 3 and 11 every 390 days.

Now, a couple of stars found off the snakes body are also very interesting.

U Hydrae – just to the right of λ. an irregularly fluctuating deep red variable from mags 4.3 to 6.5. (10 hr 38m, -13°)

54 Hydrae: beyond the tail's end (as shown) is a pretty double resolvable by small telescopes. It's yellow and purple stars are mags. 4.9 and 7.2.

Inevitably we come to the galaxies and clusters. (I've said before that I believe NGC really stands for Nebulae, Galaxies and Clusters.)

M48 (NGC2548). On a clear dark night, this large cluster of about 80 stars is just visible to the naked eye. Even better in binoculars or a low powered telescope. Approx. triangular in shape. (8hr 14m, +6°). It is about 2,000 l.y. away.

(See the photo in next column).

M83 (NGC5236): This is a beautiful 'in your face' spiral galaxy. (See photo below.) At 8th mag. it's visible in a small telescope and has a bright central nucleus. Those of you with apertures of 150mm or more, see if you can trace the spiral arms. You should be able to. This is what our Milky Way probably looks like from 10 million l.y. (13hr 37m, -30°)

M68 (NGC4590): An 8th mag. globular cluster, estimates at about 46,000 l.y. away. This one is a mystery to me. Could someone please observe this and give me feedback on its degree of visibility, denseness, size of instrument needed to observe it. (12 hr 39m, -26.5°)

NGC3242: This 9th mag. planetary nebula has been dubbed "The Ghost of Jupiter" because of its similar apparent size to Jupiter's disk. 2,600 l.y. away, it can be spotted in small telescopes at low magnification, looking like a blue-green disk.

If you have a larger scope, you should be able to see it as a bright inner disk with a faint halo. Can any member give me feedback if they observe it? (10 hr 25m, -19°).

NGC6594: This is a tester. An 11th mag. globular cluster, it is one of (if not the) most remote globs in our galaxy, at about 100,000 light years. (14 h 37m, -29.3°)

Bob Bee ■

A GLOSSARY OF ASTRONOMY TERMS

The following is a glossary of some common astronomical terms. It is in no way exhaustive.

ABSOLUTE MAGNITUDE: The brightness of a celestial object as seen from a distance of approx. 33 light years. Brighter objects have smaller numerical values. eg The Sun has an absolute magnitude of +5.
APPARENT MAGNITUDE: The brightness of a celestial object as seen from the Earth. The Sun has an apparent magnitude of -26.
BINARY STAR: A star system containing two or more stars that rotate about each other.
BLACK HOLE: A region of space (usually a collapsed star) where mass is so dense that even light cannot escape its gravity.
OPEN CLUSTER: A group of stars of common origin in relative proximity to one another.
CONSTELLATION: One of 88 recognised groups of stars named for some object, animal or mythical figure.
DEEP-SKY OBJECT: Non-stellar objects located beyond the Milky Way galaxy. They include star clusters, nebulae and other galaxies.
ECLIPTIC: An imaginary circle on the celestial sphere along which the Sun appears to travel.
GALAXY: A great system of stars, dust and gas. There are three basic types. Spiral, elliptical and irregular.
GLOBULAR CLUSTER: A spherically shaped cluster of hundreds of thousands (or millions) of stars.
LIGHT YEAR: The distance light travels (at 300,000 km/sec) in one year. Approx. 5.86×10^{12} miles or 9.45×10^{12} km.
MESSIER OBJECT: One of the 110 non-stellar objects (nebulae, galaxies and clusters) in a list published by Charles Messier in 1787. Identified on charts by prefix M.
MILKY WAY: The spiral galaxy that contains our Sun. We see it as the band of light circling the ecliptic. There are estimated to be up to 300 billion stars in our galaxy.
NEBULA: A more or less clearly defined region of luminous gas or dust that can be optically observed.
NEUTRON STAR: An extremely dense collapsed star comprising almost entirely neutrons.
NGC OBJECT: One of a listing of non-stellar objects in the New General Catalogue published in 1888. eg Andromeda Galaxy is NGC #224.
NOVA: A star that suddenly flares in brightness by hundreds or thousands of times.
PARSEC: Astronomers' measure of distance. The distance to a star with a parallax of one second arc (1") from the baseline of Earth's orbit about the Sun. Equals 3.258 light years..
PLANETARY NEBULAR: A shell of gas given off by a dying star which glows from energy radiated by that star.
PULSAR: A rotating neutron star that emits radio energy in short regular 'pulses'.
RED SHIFT: The lengthening of visible light waves from a celestial object as it travels way from us. The greater the red-shift, the more remote the object.
SUPERNOVA: The explosion and devastation of a massive star. Results in a brilliant flash that can sometimes outshine its parent galaxy.
VARIABLE STAR: A star whose apparent brightness varies regularly.