Cover image - IC2944 & IC2948 taken at the MPAS Briars site on the 17th June 2017
Gum 39 - nebula top right - the head of the chicken
Gum 41 - nebulosity bottom left
Telescope ED80 with TSFLAT2 field flatter @ F/7.5
Canon 5Dmk3 full frame - Lights: 3 x 5 minutes @ 1600 iso - Darks: 8
Processed with Deep Sky Stacker. *By Andrew Nilsson*

SCORPIUS

THE JOURNAL OF THE
MORNINGTON PENINSULA ASTRONOMICAL SOCIETY INC.

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The Mornington Peninsula Astronomical Society (formerly the Astronomical Society of Frankston) was founded in 1969 with the aim of fostering the study and understanding of astronomy by amateurs and promoting the hobby of amateur astronomy to the general community at all levels.

The Society holds a focused general meeting each month for the exchange of ideas and information. Regular public and private observing nights are arranged to observe currently available celestial objects and phenomena. In addition, the Society encourages the service of its members for on-site or off-site educational presentations and observing nights for schools and community groups.

Andrew Nilsson

MPAS - https://www.facebook.com/mpas0/

MPAS Members - https://www.facebook.com/groups/MPAS1/

Scorpius MPAS - https://www.facebook.com/Scorpius-MPAS-1694951307446763/

President's Report 2016/2017

First I would like to say thanks to everyone for the support throughout this year, my second term as MPAS President.
The next AGM is only a few weeks away now, from which I will be absent. I hope the proceedings go well and I encourage all members to consider nominating for a position, as fresh ideas keep the society vibrant & relevant.

We have just completed another busy year in the Society with a popular School & Scouts schedule, large public viewing night attendances and a few major construction projects at the Briars. The fresh appearance of the main building, together with the insulation and pending climate control, should enhance the overall experience of our visitors and members alike.

This year we also implemented the Members Vests to aid the public identifying members for questions and comments. I have had positive feedback on this from the public and members alike. We have also started to retail small add-on items at the PVNs – beanies, red lights and hope to add planispheres and spectroscopy glasses in the near future.

The Society has also nominated itself to host the 2019 VASTROC to coincide with the 50 years milestone. Early planning is already underway for the event and, like all major projects, we are always looking for members to help steer this project. The current construction work at the Briars is partly driven by this event.

Later this year we have 2 astrophotography workshops (1 public and 1 private), the Society dinner and, if all goes to plan, a special speaker at our August members' night. While on the topic of the members' night, as some of you will be aware, next year we need to move the meeting venue from the Peninsula School due to construction works. The committee has yet to decide on the next suitable venue and are still reviewing options.

Our website and Trybookings are working well together; public attendances and bookings are up again from previous years and so the Society is currently in a strong financial position (figures will be available at the AGM). The on-line bookings have noticeably reduced the amount of admin. for the committee as well as streamlined the door entry on the PVNs. We do, however, need to do further work on the website with more content and improved mobile browsing capabilities. The society needs to keep up with these technologies to stay relevant to the younger audiences, so if we have any *techy* volunteers offering to do some website tweaks, please have a chat with me.

This year we have had a record attendance at a public night with 176 attendees. It now appears those winter nights with only a handful of the public are becoming rare. Lately we are deciding whether to run a second concurrent session or close the booking off, a good problem to have! I attribute a lot of this to our sponsored social media campaigns and the work of Tony & Sky's with the local media outlets. I also want to thank the members who help out on these nights.

The scheduling of the Peter Lowe Observatory has worked well; plenty of members are now trained to use the telescopes and it is safe to say every new moon weekend the site is utilised. The next natural step is adding a camera to one of the telescopes for live streaming to the public or member imaging. The training for these cameras I would like to include in next year's astronomy classes.

While thanking people, I would again like to single out Greg (and Pia) for their tireless work in the society with organising working bees, attending just about every event and also putting in the time for the quality Society magazine.

The future of the Society is bright; we are doing the right things as a society and are looking in good position for the future. We however need to keep up the innovation, motivation and entertainment value of the Society so the member enjoyment is still there and the opportunity for research and collaboration remains in the members reach. Additionally the Society's public outreach is increasing with both the younger school/ scout groups and general public. I anticipate this will grow further with the 50th anniversary of the moon landing and a manned Mars mission on the horizon.

Myself, I have nominated again for a third and final term at the helm, although I will happily withdraw if anyone else wants the role. With starting a new business, my spare time has reduced even further and I can't give this year the same time commitment. My next aim is to move into a public talk role by supporting Trevor and Peter (both hard to top!).

Thank you to the current committee and good luck to the next.
Additionally, thank you to the membership that makes up this Society; without your support, none of this would be possible.

Clear Skies, *David Rolfe* MPAS President 2015 - 2017

Right - Steve Mohr's 50th Birthday party a few weeks ago.

From left to right - Greg Walton just out of frame in the blue shirt, Jamie Pole, Mike Sidonio, Paul Albers, Dave Rolfe centre stage as usual, Steve Mohr & Alex Cherney.

A great night with excellent food, wine & company, mostly astrophotographer's from MPAS & ASV making up the numbers. Steve produces some of the best deep sky astronomy images I have ever seen. Over the years we have spent many a night under the Milky Way at Heathcote on those Moonless nights, listening to all the cameras & telescopes wearing away, over a glass of port just to keep the cold away. *Greg Walton*

Steve is now working on a story for Scorpius. We can't wait.

Society News

By Greg Walton

Viewing Nights Benton Primary School - Wednesday 3rd & Thursday 4th May. It was a busy time for MPAS with 3 viewing nights in a row. The first Benton's viewing night was 100% clouded out, with all telescopes pointing at street lights, just to show how telescopes magnify things. About 75 students listened to Peter Lowe's updated solar system talk inside while outside on the telescopes were Sky Murphy, Tony Nightingale, Phil Holt, Peter Skilton & Greg Walton. The second Benton's viewing night was mostly clear. So we decided to get the 75 plus students to look through the telescopes before Peter Lowe's updated solar system talk. On the telescopes were Alex Cherney, Sky Murphy, Tony Nightingale, Peter Skilton, Greg Walton & Phil Milligan. The smaller telescopes were on the Moon, while 2 bigger scopes were on Jupiter. Alex's monster scope showed a selection of deep sky objects. *Greg Walton.*

Benton Primary School

The two viewing nights at Benton Primary School in Mornington, near the racecourse, last Wednesday and Thursday went ahead with very different weather conditions. Both were around 75 year 5 students each, and Peter Lowe gave a solar system talk each and showed his meteorite. Unfortunately the Wednesday group was completely clouded out and had to make do with viewing street light bulbs. On the upside, these were easier for the telescopes to track than the stars. Just 24 hours later, the sky was completely clear and the enthralled group had really good views of the Moon and Jupiter, plus others for the larger scopes such as Omega Centauri, Orion nebula and others. Thanks outside on the Wednesday to Sky Murphy, Tony Nightingale, Greg Walton, Phil Holt and Peter Skilton, and on the Thursday to Sky, Tony, Greg, Peter, Alex and Anika Cherney, Heinz Rummel and Inge Marcinkowski. Regards, *Peter Skilton*

May Public Night - Another busy night for MPAS with 120 in attendance - 20 members and exactly 100 members of the public. Tony Nightingale, Pia Pedersen & I arrived at 5pm to move the library back against the back wall of the big shed, to make room for all the 100 chairs. We also cleaned the toilets & kitchen area. Other members opened the observatory & set up telescopes, as the public tend to start arriving around 7pm, hoping to get a look through the telescopes prior to Trevor Hand's talk at 8pm. The light-blue safety vests with MPAS logo's had arrived, so (President) Dave Rolfe made certain all MPAS members wore them, which helps the visitors know who is running the telescopes & to whom to direct any questions. All worked very well & made the event look more professionally run. The sky had patchy clouds rolling though, but once it cleared the public got to see Jupiter with its Great Red Spot, Saturn with its moons, M42, NGC104, NGC5139, NGC3372 & the first quarter Moon. The night was not too cold, so many stayed till midnight, making it a late night for the members who were heading off to Vastroc the very next day. *Greg Walton.*

Full House *by John Cleverdon*

Friday evening 12th May MPAS visited Cornish College in Bangholme again. There were about 45 year-8 students present, as part of their science unit this year, to hear Peter Lowe start the solar system talk, reaching the Sun and auroras before moving outside to the telescopes. Unfortunately, despite Cloud Free Night predicting for Melbourne about 60% cloud cover and no rain, it ended up 100% cloud cover and slight drizzle, so everyone was pointed to distant street lighting and shown the basics of how a telescope works, as well as being able to look through a pair of diffraction grating glasses that Sky brought along. Out in the field with instruments were Greg Walton, Pia Pedersen, Heinz Rummel, Inge Marcinkowski, Sky Murphy, Jamie Pole, Peter Skilton and Tony Nightingale. There were a few damp telescope tubes by the end of the evening. Regards, *Peter Skilton*

The following night, Saturday, was then off to a scout hall in Doveton to visit the Narre Warren South Scouts. These were mostly young Joey level, plus some siblings and parents added in. We ended up with 100 people present, in what was basically suburbia and an industrial estate. Needless to say, but a lot of light pollution was present, in addition to the moonlight. Cloud Free Night had predicted for Melbourne a lot of high level cloud, but it ended up with almost no visible cloud present all evening, so it shows the importance of always turning up to these nights regardless of the best of weather predictions. Peter again gave the solar system talk and showed his Campo De Ciel specimen. Outside on the telescopes were Simon Birch, Tony Nightingale, Heinz Rummel, Greg Walton, Pia Pedersen and Peter Skilton. Great views were had of Jupiter, Saturn, the rising orange-coloured almost-full Moon, Omega Centauri and the Jewel Box. The Scout Leader at the end of the evening was extremely delighted with their experience and our willingness to go out to visit them and share our expertise so readily. Thanks to all the passionate volunteers involved in pulling together these evenings and being able to attend, often at considerable distance from their homes, as they couldn't occur without you. Regards, *Peter Skilton*

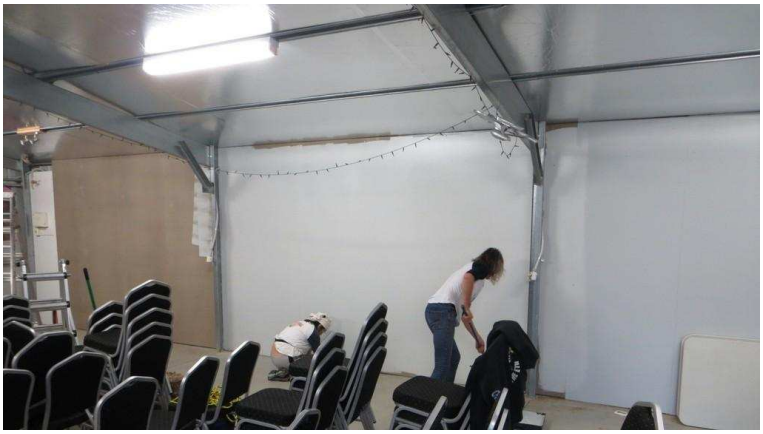
Narre Warren South Scouts

May Society Meeting - saw about 30 members in attendance. Dave Rolfe (President) chaired the meeting and talked about what has been happening at MPAS & upcoming events, also showed video from the Cassini space probe. Then our speaker, Sabine Bellstedt PhD Student from Swinburne University. Talked on 'Lenticular Galaxies; Understanding the Mystery' & as usual the speaker draws the raffle. Then Greg Walton did Sky for the Month & showed latest photos of comet Johnson, after which members chatted over coffee.

Right - Sabine with Ian Sullivan.

May Members' BBQ & Working Bee on the 20th - Starting at 12 Noon, we completed insulating, fixing the yellow-tongue boards & painting the west wall in the big shed, thanks to Mark Hillen, Heath, Tony Nightingale, Sky Murphy. Heath also moved the power points. We cut back the trees east of the observatory, thanks to John Cleverdon, Sky Murphy and myself, while Charlotte Swart loaded the branches in the back of my ute for dumping. I also mowed & did repairs to the mower & fence near the gate. Sky Murphy removed the mirror from the 12 inch Dobsonian telescope & she will take it to the ASV Instrument Making Section for recoating. Pia prepared the food for the BBQ with the help of Marj Cleverdon & Charlotte Swart. Ian Sullivan & Mark Hillen cooked the meat, while others cleaned up & set up tables. Then afterward Andrew Nilsson scrubbed the BBQ. Andrew Nilsson & family opened the observatory & started up the telescopes. Many other members came for the BBQ as the sky was clear. Viewing on the night, we looked at Jupiter, Saturn & many deep sky objects, winding up around 11:30pm. On behalf of the committee, a big thanks to all those who helped out on the day. *Greg Walton*

Photos below by *John Cleverdon*, see link - https://drive.google.com/drive/folders/0ByvkxzZGI9g_TUM1Zkk3NVFrclE?usp=sharing



Below - We cut back the trees east of the observatory, thanks to John, Sky, Charlotte and myself. Trees now all cut low to the same level. I think we last cut them 18 months ago.

John Cleverdon emailed members about an Iridium flare at 6:28 on the night of the members BBQ. But I think we were all so tired after the working bee, we forgot all about it! Even when John called out, only a few stirred. Luckily Peter Lowe, who could not be at the BBQ, was on the ball & was able to photograph the event. See right

I decided to try photographing the predicted Iridium flare using my point-and-shoot Sony. It seems to have come out OK. Cheers, *Peter Lowe*

Working Bee on YouTube - https://youtu.be/gugveSjbKlA


Naranga Special School

Karingal Viewing Night - It was an unusually early start for us at Naranga Special School on May 22nd at 6 pm, with twilight still present. We had about 30 students across all year levels briefly look through the instruments, with many more indoors who didn't venture outside. The organising teacher was a Dance and PE teacher, who also had an interest in the skies due to her father owning a small telescope while she was growing up. We were part of their Education Week activities and they only required telescopes (*and operators*) since they already had a speaker on other non-astronomy topics. As it turned out, after a clear day the clouds then quickly and completely encroached early evening as we were setting up, and no doubt this kept many from even venturing outside to see us. Some were able to see Jupiter though early on. At the end of the evening, the teachers were nevertheless very impressed with our enthusiasm to try to bring the night sky to them, with the activity really being aimed at suggesting other hobbies or careers to their students and parents. Thanks in the field with instruments to Pia Pedersen, Greg Walton, Tony Nightingale, Peter Skilton, Peter Lowe, Heinz Rummel and Inge Marcincowski. Regards, *Peter Skilton*

June Public Night - Tony Nightingale, Sky Murphy, Pia Pedersen & I arrived early to clean up after the last working bee. Sweeping the floor, putting out all 100 chairs, cleaning the toilet & kitchen, we then put some of the posters back up on the newly painted walls. *Greg*

Under 99.9% cloud cover for the entire evening, we had 109 people turn up at the Briars for the monthly public night. I'm glad it wasn't hailing, windy and lightning, as otherwise we would have doubled that attendance, based on our past bizarre experiences of public nights over the years. As it was, bookings had necessarily closed a day early and we were actively turning enquirers away in the days beforehand, redirecting them to July or August's public nights instead. Thanks to those hardy members who still came to help out, regardless of the overcast (but not too cold) weather, as the visitors still were able to see the observatory facilities and look at the one telescope set up out on the concrete pads. We had one fascinated horticulturalist who keenly looked at the roll-off roof arrangements for translating them similarly to her plant propagation sheds as an innovative idea. The visitors included about half being general public, and the remainder drawn from four different scout groups, together with their parents and grandparents. There was, in descending order of attendance, the 2nd Mornington Sea Scouts, Rosebud Scouts, Tootgarook Scouts and Red Hill Scouts, all vying for their astronomy badges, and listening hopefully to the talk by Peter Lowe for snippets towards it. Thanks for helping out around the field goes to Sky Murphy, Greg Walton, John Cleverdon (despite his parents being seriously injured recently), Jamie Pole, Tony Nightingale, Dave Rolfe, Simon Hamm Steve Pemberton, Charmaine Compton, Fred Crump, Peter Skilton and Mark Stephens. If I've missed anyone lurking in the dark all evening, or who didn't sign the observatory register, or simply due to my memory waning, then please email back and accept my apologies. Regards, *Peter Skilton*


Baden Powell Scouts

Scout Viewing Night - 7th June Scout Hall, Humphries Rd & Baden Powell Drive, Frankston. With completely clear skies last night, 40 Joeys from the Baden Powell Park Scouts were visited at their hall in Mt. Eliza by MPAS and five and a half telescopes. The main objects on show before the talk started were the nearly full Moon, Jupiter and Saturn, which gave good, surprisingly steady views over the tree tops after some judicious placements of telescopes on the ground. All seemed to enjoy the experience. Earlier in the day around mid-afternoon the sky had been totally clouded out, so they were fortunate for the blanketing layer to have moved on. As a precaution, the talk was given indoors by Peter Lowe after the main viewing concluded, though a small number of parents continued looking through the telescopes while the Joeys were indoors. Outside on the instruments were Sky Murphy, Pia Pedersen, Greg Walton, Peter Skilton, Jamie Pole and David Rolfe. One telescope was half there, with the tripod being left at home. Regards, *Peter Skilton*

I thought I was the only one who left things at home. Whoever it was sound like Presidential material to me !! The talk inside went surprisingly well. While the telescope viewing continued outside, I started the Stargazing Live movie and in no time the Joeys were setting up the chairs as a cinema watching the film. There's a lesson there. I've been experimenting with my Joey presentations to get a more age-appropriate (5-7 year old) show and tell night, I seemed to have struck it right. The Joeys were very attentive, quiet(?) and asked lots of appropriate questions. Everyone seemed happy. It's nice to see the kids excited about the telescopes, planets and the solar system. I think all up we score a home run. Well done guys. I'm sorry I didn't get a chance to go round the scopes, Cheers *Peter Lowe*


McClelland Galley

McClelland Gallery Viewing Night 9th June - It was a great viewing night at McClelland Gallery on Friday, with 150 artistic visitors ushered around the sculpture park in the dark and with us as the final attraction. Most of those visiting had never seen through a telescope before, so they were in for a treat outside of their usual experiences. There was no talk by us but, aside from the telescopes, Peter Lowe had set up his large binoculars and his meteorite on a stand, being a token sculpture. The initially very overcast skies blew over nicely during the evening, enabling good views for everyone of the full Moon, a rising Saturn with rings easily visible, and the mighty Jupiter sporting 2 satellites initially, then with another two budding off its opposite limb later in the evening with a shadow transit. Thanks go to Sky Murphy, Greg Walton and Peter Skilton for bringing their instruments and helping the 3 groups of 50 see the sky. I've attended almost every outreach viewing night for schools, groups and the public in the last 30 years, but this is the first I can recall **being served hors d'oeuvres and warm mulled wine at the telescopes** by tray-carrying hosts who were dressed for the occasion. All that was missing was a classical orchestra in the background. Perhaps this sets the benchmark for our future visits to other groups and becomes one of our requirements! Regards, *Peter Skilton*

McClelland Gallery & MPAS was mentioned in the Peninsula Essence magazine https://issuu.com/peninsulaessence/docs/pe_june_2017

School Viewing Night @ Camp Manyung
13th June - Almost complete cloud cover greeted those members who attended the school night for Camberwell Grammar at Camp Manyung on Tuesday. Viewing started immediately, and in parallel with the indoors talk, so as to try to maximise the cloud free breaks which were few and far between. So the fifty year-6 students came outside to the telescopes in four separate batches and, fortunately, all were able to see Jupiter and 4 satellites on one side of the planet - some through thin cloud - and a really fortunate subset saw Saturn through cloud as it rose in the East. Inside, Peter Lowe gave the talk, while on the telescopes were Greg Walton, Sky Murphy, Phil Holt and Peter Skilton. Regards, *Peter Skilton*


Camp Manyung

June Society Meeting - saw about 30 members in attendance. Dave Rolfe (President) chaired the meeting and talked about what has been happening at MPAS & upcoming events. He was also our speaker for the night, talking on Deep Space Communication (see page 15). Then the raffle was drawn. Jamie Pole did Sky for the Month, after which members chatted over coffee.

June Members' BBQ & Working Bee on the 24th - We had a good turn out for the working bee. Massive effort by MPAS members with another wall insulated, lined with yellow-tongue chipboards & painted. A mountain of electrical work slowed up progress, with Dave & Heath working non-stop moving power points, cables & light switches. John Cleverdon & I arrived early to clear away chairs, cupboards & take down posters. John also put the left-over wads of insulation in the kitchen & did some gardening. Rod Brackenridge sawed chipboards for the new library shelves. Sky Murphy cut trees, adjusted telescope bearings & painted walls. Mark Hillen & Stewart Gangell fitted insulation & wall boards. Many other members worked on the multitude of smaller jobs, cleaning & running the BBQ. I could see everyone was tired by nightfall & happy that the day was over. After the BBQ, and more painting, everyone headed home by 8pm. No viewing on this new Moon as the sky was 100% clouded out.

Just one more wall to go now, which should be completed at the next members' BBQ & working bee. Other jobs remaining are: complete library shelving, build a new & bigger projection screen, and put up posters. Thanks for a great effort. *Greg Walton*

Photos below by *John Cleverdon*, see link - https://drive.google.com/drive/folders/0ByvkxzZGI9g_TGR2bHB1cEtWSjg?usp=sharing

Important - The Mornington Peninsula Astronomical Society has had a long association with the Peninsula school, more then 25 years. But now the Peninsula School has decided to demolish the theatre that we use, early next year. We have asked if we can use the other larger theatre, but have had no response as yet. We know the larger theatre has a greater demand & a higher cost. Also next year that theatre will be put under greater pressure from the many different users. So most likely **we will need to find a new theatre or move the society meeting to the MPAS Briars site**. This year our venue has undergone many upgrades: insulation of the big shed almost completed, new larger screen & projector being purchased, also looking into purchasing a large heating system. Last year we purchased 100 padded steel chairs. Next year we will upgrade the kitchen area.

We need to make a decision on this as soon as possible, as there are lots of work to be done & changes to be made accordingly, e.g. website, Scorpius newsletter, reprinting of MPAS pamphlets, MPAS calendar, all MPAS members informed by post, marketing contacts informed, other astronomical societies & Quasar publication informed.

MPAS members please send your thoughts & concerns to the MPAS committee.
We will keep all thoughts & concerns confidential.
Post to the Secretary MPAS. PO Box 596, Frankston 3199.
Email : welcome@mpas.asn.au

New Members Welcome

PAPIYA HALL FAMILY
JULIET MACRI & DANIEL BEALE FAMILY
TERRY-ANN DAVIES
SCOTT GELLATLY FAMILY
CLAIRE & ALISTER McHARRY FAMILY
ROBERT BAKKER
ALAN BRYGEL
MICHELLE & NATASHA NOTTINGHAM FAMILY
SUSHMA ASHWIN FAMILY
LANCE O'FARRELL

MPAS members please consider a position on committee, as we have much work to be done over the next 2 years, leading up to the MPAS 50th year celebrations & Vastroc.

MPAS - Society AGM

The AGM is in July each year.

Current Committee
President: David Rolfe (0466232783)
Vice President: Peter Lowe (Acting)
Secretary: Peter Skilton
Treasurer: Jamie Pole
General Committee: Trevor Hand, Fiona Murray, Fred Crump, Tony Nightingale & Greg Walton

Life Members are automatically committee members

AGM Invitation
19th July 2017 at 8PM
Peninsula School
Senior School Theatrette,
Building T, Wooralla Dve, Mt.Eliza

Agenda
1. Apologies
2. Confirm Minutes of previous AGM
3. President's Report
4. Treasurer's Report
5. Election of Incoming Committee
6. Special Business (none notified)
7. Other Thanks
8. Close of AGM.

We hope to get more members on committee.

If you feel you would like to get involved in the society business or have a particular skill you think would be useful to the society as a whole pleases give some thought to becoming an Office Bearer or committee member.

The Annual General Meeting will be held on Wednesday, 19th of July 2017. In this edition of Scorpius there is a 'Committee Election Form' that can be used for the submission of nominations for the next committee. This can be posted to MPAS. PO Box 596, Frankston 3199. Alternatively nominations can also be submitted electronically to welcome@mpas.asn.au , stating which position on the committee you would like to nominate for.

2017 AGM Committee Position Nomination - (Leave blank if not applicable)

I ……..…… would like to nominate for the position of (circle)
PRESIDENT VICE PRESIDENT SECRETARY TREASURER GENERAL COMMITTEE
for the Mornington Peninsula Astronomical Society committee of 2017/2018.
Seconded By ……..…… Dated ……/……..……/ 2017
Both the nominee and the seconder need to be financial members of MPAS at the time of the AGM. Nominations must reach the Secretary by the 13th July 2017.

PUBLIC NIGHT THANK-YOU

Recent public viewing nights and school viewing nights have continued to be very well received by the attendees. It is no coincidence that this is due to the efforts put in by the members that help out at these events. To everyone that has helped out over the past months, a very big thank-you goes to you all. Your efforts are very much appreciated, and are being very well received.

MPAS SUBSCRIPTIONS 2017

The ticking over of the New Year also means that society fees are now due to be paid. The society has worked hard to ensure that 2017 fees are still the same as last year's prices. So to assist the society in maintaining the facilities and service we provide, we appreciate your prompt payment for the 2017-year ahead.

As a reminder, the following structure of the fees are:

SOCIETY FEES

$50 – Full Member
$45 – Pensioner Member
$65 – Family Membership
$60 – Family Pensioner Membership

Subscriptions can be paid in a number of ways:
- **Direct Cash payments to a committee member**
- **Send a cheque or mail order to the society mail box MPAS. P O Box 596, Frankston 3199**
- **Make a direct electronic payment into the society working bank account.**

The account details are BSB 033-272 Account 162207. Remember to add your name and details to the transfer so we can identify the payment in the bank records. If you have any concerns please talk to a committee member.
Click on the link for farther information - https://drive.google.com/file/d/0ByvkxzZGI9g_NXZ4cWxHbERTdEE/view?usp=sharing

A word from the Scorpius editing team.
Members please write a story about your astronomy experiences and add some pictures.

Send them to:
Greg Walton
gwmpas@gmail.com

Brett Bajada
Peter Lowe
Bruce Renowden

CALENDAR July / 2017

Red Days indicate School Holidays

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
30	31 **First Quarter**	**Working Bee will be on the 22nd starting at 12 Noon. Jobs will be finish insulating, fitting yellow tongue boards & painting the south wall in the big shed.**				1 **First Quarter** Jupiter above Moon Comet Johnson
2	3	4	5	6 Moon @ 405,934km	7 **Public Night 8pm** Saturn above Moon	8
9 **Full Moon**	10 Pluto at opposition	11	12 ASV Meeting	AC 13 **Astronomy class** Venus left of Aldebaran morning	14 Neptune 4am very close to the Moon	15 Comet 41P Tuttle next to NGC6517
16	17 **Last Quarter**	18	AGM 19 **Society Meeting 8pm**	20 Moon left of Aldebaran morning	21 Venus above crescent Moon	Working Bee 22 **Members Night BBQ 6pm** Moon @ 361,236km
23 **New Moon**	24	25 Regulus & Mercury above crescent Moon	26 Committee 8pm	27	28 Jupiter above the Moon	29

Monthly Events July

Southern Comets website - http://members.westnet.com.au/mmatti/sc.htm

Public nights - 8pm on the 7th @ the Briars

Astronomy class (AC) - 8pm to 10pm on the **13th** @ the Briars (Peter Lowe's winter classes "Stars & How They Work")

AGM - Society Meeting - 8pm to 10pm on the 19th @ the Peninsula School

Members Night BBQ - 6pm on the 22nd @ the Briars also Telescope & observatory training 7pm

CALENDAR August / 2017

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1 Comet Clark 0.3 deg south of NGC6256	2 Jupiter next to NGC4941	3 Saturn above the Moon @ 405,024km	4 **Public Night 8pm**	5 Pluto 2deg south of the Moon
6	7	**Full Moon** 8 Partial Lunar eclipse 4am 10% @ Briars	9 ASV Meeting Comet Clark 0.6 deg south of NGC6302	AC 10 **Astronomy class** Neptune 1deg north of the Moon	11	NSW 12
NSW 13 Uranus 4deg north of the Moon	NSW 14	NSW 15 **Last Quarter**	NSW 16 **Society Meeting 8pm**	NSW 17 Comet ER 61 Panstarrs 0.7deg south of M45	NSW 18 **Public Night 8pm** Moon @ 366,121km	NSW 19 **Members Night BBQ 6pm** **Venus crescent Moon**
NSW 20	21	**New Moon** 22 **Total solar eclipse seen from Hawaii & America**	23 Committee 8pm **Scorpius Deadline**	24 Comet V2 Johnson close to Kappa Centauri	25 Jupiter above the Moon	26 Comet Clark 0.6 deg south of NGC6441
27	28	29 **First Quarter**	30 Saturn above the Moon @ 404,308km	31 Pluto 0.05deg SE of star HR7276	**Working Bee will be on the 19th starting at 12 Noon. Jobs will be build shelfs for the library & paint.**	

Monthly Events August

Southern Comets website - http://members.westnet.com.au/mmatti/sc.htm

Public nights - 8pm on the 4th & 18th @ the Briars

Astronomy class (AC) - 8pm to 10pm on the **10th** @ the Briars (Peter Lowe's winter classes "Star Clusters & How They Work")

Society Meeting - 8pm to 10pm on the 16th @ the Peninsula School

Members Night BBQ - 6pm on the 19th @ the Briars also 7pm Telescope & observatory training

NSW - National Science Week - 12th to 20th

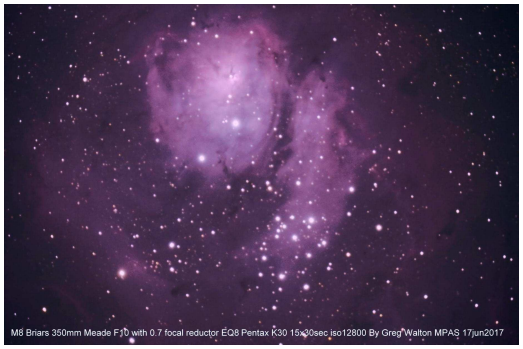
Please… we need helpers to keep the MPAS Observatory open to members on Saturday nights.
If you can help contacted Greg Walton on 0415172503 or email - gwmpas@gmail.com

Saturday 17th June @ the Briars Observatory

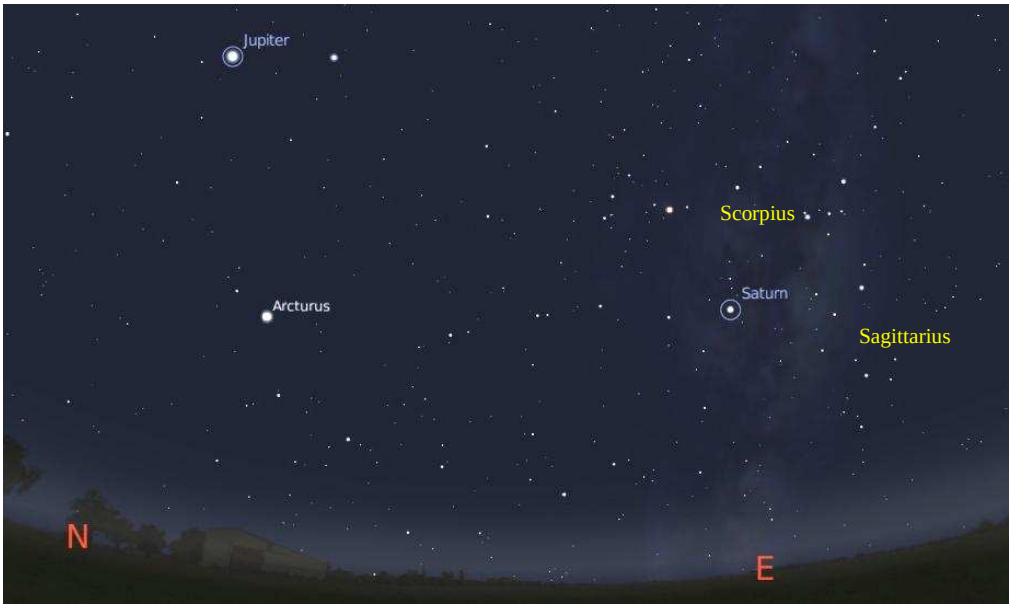
Despite the fog rolling over the hill just when I arrived at 7:30, a reasonable night was had. I think there were 5 of us in total across the night. Seeing conditions were superb and the fog cleared enough not to pose a big problem. My dew heaters were set to 11 and worked okay. Everything else was dripping with water. Initially, processing of my images of comet V2 Johnson showed a decent tail in the comet's path, I guess dust rather than gas (20minutes of 30s exposures). Imaging of IC2944 was cut short by thin clouds rolling in. *Andrew Nilsson*

It was a good night. When I arrived at 6pm, I found a member waiting for the members' BBQ, I told him he would have a bit of a wait, as it's next weekend. I got many images of comet Johnson with galaxy NGC5566. Also imaged M8, M20 & M22 with the 14 inch Meade before the clouds rolled in at 11pm. Background photo shows fog in the east. I have seen this fog many times in the past. The good site the MPAS observatory enjoys, sees that the fog rarely stops us from viewing. See video just click on link below. *Greg Walton*

Link - https://vimeo.com/223072954



Time to come to the Briars & join in the fun. Bring your DSLR camera & we will see you get photos like these. Winter is the best time to catch those beautiful Deep sky objects in Scorpius & Sagittarius. Saturn is at opposition now & sits just below Scorpius, while Jupiter rides high in the north.



Produced on Stellarium *by Greg Walton* You can download Stellarium free @ http://www.stellarium.org/

ASTRO NEWS

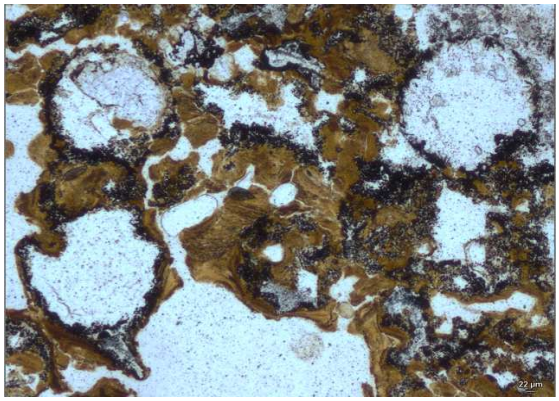
By Peter Lowe

New Zealand Launches its First Satellite.

New Zealand has joined the space faring nations with the successful launch of an orbital rocket from a private pad on the Mahia Peninsula, north island. US-New Zealand aerospace company Rocket Lab announced it had successfully launched its Electron rocket from its facility in the remote Mahia Peninsula, between Napier and Gisborne. The launch is the first time a rocket has been sent into orbit from a private facility, and makes New Zealand the 11th country where an orbital rocket has been launched. Electron is designed to carry small satellites into low orbit cheaper than present alternatives, and this launch is planned to be first of three test flights

Oldest Evidence of Life on Land found in Australian Rocks.

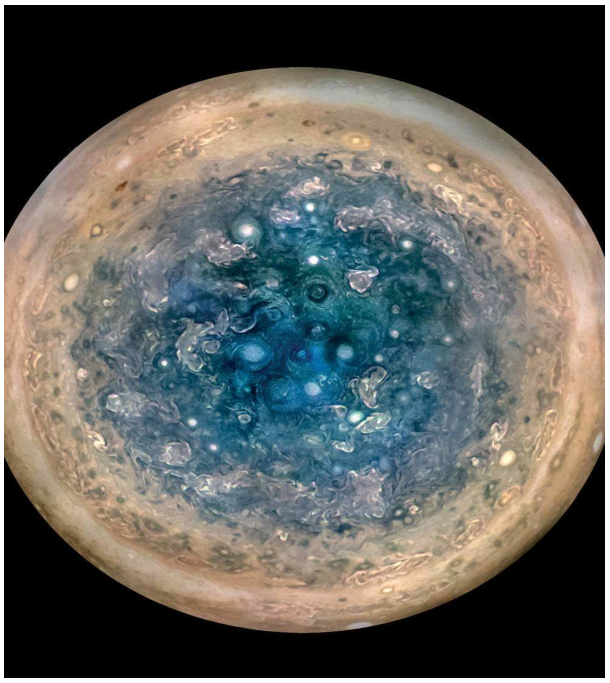
UNSW scientists have discovered fossil evidence of early life in the Pilbara of Western Australia. The 3.48 billion year old hot spring deposits pushing back by 3 billion years the earliest known existence of inhabited terrestrial hot springs. This has significant importance in the search for life on Mars, which is known to have had similar surface conditions at that time in the solar system's early history. Previously, the world's oldest evidence for microbial life on land came from 2.7- 2.9 billion year old deposits in South Africa containing organic matter-rich ancient soils. This new evidence suggests life inhabited the land much earlier than previously thought by up to 580 million years and may have implications for the origin of life in freshwater hot springs on land, rather than the more widely considered view that life developed in the ocean and adapted to land later.



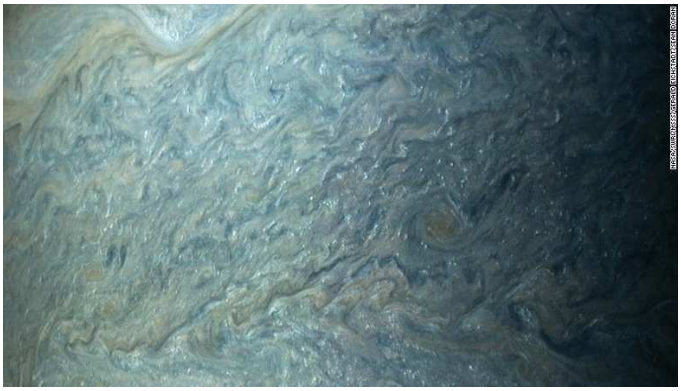
The Pilbara deposits are believed to have formed on land, not in the ocean, by identifying the presence of geyserite - a mineral deposit formed from silica-rich, near boiling-temperature water found only in a terrestrial hot spring environment. Within the Pilbara hot spring deposits, the researchers also discovered stromatolites layered rock structures created by communities of ancient microbes and other signs of early life including fossilized micro-stromatolites, microbial palisade texture and well preserved bubbles that are inferred to have been trapped in a sticky microbial substance that preserved the bubble shape. The finds showing a diverse variety of life existed in fresh water, on land, very early in Earth's history.
The two principal hypotheses regarding the origin of life are that either life began in deep-sea hydrothermal vents, or alternatively that it began on land in what Charles Darwin called "warm little ponds. The discovery of potential biological signatures in these ancient Western Australian hot springs provides a geological perspective that may lend weight to a land-based origin of life.

Today Mars is a desert-like; volcanically dead planet but three billion years ago Mars was a watery planet with highly active volcanic surface conditions that were very earthlike. The new findings have major implications in the search for life on Mars, because the red planet is believed to have ancient hot spring deposits of a similar age to the Dresser Formation found in the Pilbara. The top three potential landing sites for the Mars 2020 rover, Columbia Hills are designated as hot spring environments. If life can be preserved in hot springs so far back in Earth's history, then there is a good chance it could be preserved in Martian hot springs too.

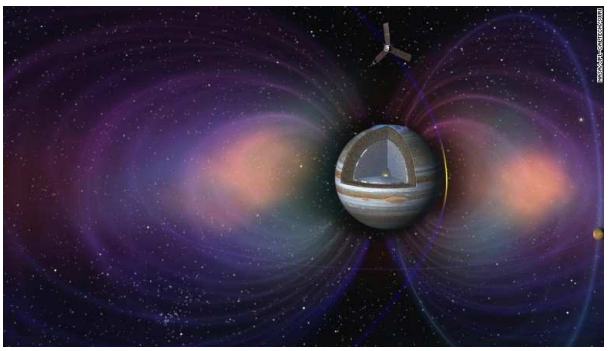
Astronomers set to get a close-up look at Red Spot.



NASA's Juno space probe is in a polar orbit that skims just above Jupiter's clouds. The craft has been orbiting the planet and every 53 days performs calculated flybys over the clouds, going from the North to South Pole in about two hours. These new close-up studies show the gas giant to be highly chaotic and variable across the planet. During the flybys, observations and data showed Jupiter's previously unseen poles. Bright ovals at the poles were revealed to be gigantic cyclones spanning 870 miles. Juno was also able to probe the cloud cover and discover wells of ammonia that form giant and violent weather systems in the deep atmosphere. The giant cyclones at the poles are new to researchers. Further study could reveal whether these are like the Great Red Spot, which has been observable for at least 300 years, or more ephemeral.



A close-up of the bright clouds at right shows the turbulent atmosphere in the south tropical zone. Juno revealed that Jupiter's magnetic field is 10 times stronger than the strongest magnetic field on Earth and twice as strong as anticipated, exceeding researchers' expectations. The mission had an encounter with the planet's "bow shock," akin to a type of stationary shockwave, when exploring Jupiter's magnetosphere. Close up the magnetic field looks lumpy: It is stronger in some places and weaker in others. This uneven distribution suggests that the field might be generated by dynamo action closer to the surface, above the layer of metallic hydrogen. Every flyby we execute gets researchers closer to determining where and how Jupiter's dynamo works. Even though Jupiter is the largest planet in our solar system, astronomers don't know much about its origin. The Juno mission was designed to collect data and observations that will reveal the origin and evolution of the gas giant. Its other objectives include mapping Jupiter's gravitational and magnetic fields, observing auroras, measuring the amount of water and ammonia in its atmosphere and finding evidence of a solid core. Jupiter was most likely the first planet to form in the solar system and contains some of the same ingredients of the collapsing nebula that formed the system. Knowing more about Jupiter can provide greater insight about its beginnings. The next flyby will happen July 11 and will go directly over the Great Red Spot no doubt giving us unique, close up views of this great storm. Go Galileo.



Neil Armstrong's Lunar Sample Bag goes to auction.

The suit sample bag worn by Neil Armstrong during the Apollo 11 moonwalk has been put up for auction in the US. The bag was accidentally put out for general sale several years ago for $940. When the oversight was recognized NASA went to court to recover the historic artifact however the court decided the lady purchaser had legally acquired it and NASA had lost possession rights. The current owner has decided to auction the bag and NASA will have to bid in open auction if it wants it back. The auction house expects bidding to start at $5 million. In original condition the bag still has lunar soil inside. It's amazing the things you can pick up at a trash and treasurer sale.

MPAS @ the 2017 Victorian Astronomical Societies Convention (VASTROC)

Above - Peter Lowe (left)

VASTROC is a biennial convention at which Victorian astronomical society members meet to swap ideas, experiences and to celebrate common interests. This year the Mt Burnett Observatory (MBO) hosted VASTROC 2017 at Emerald. The event was held at the Emerald Secondary College with an associated BBQ/Observing event at the nearby MBO observatory.
As an opening address Professor Matthew Bailes, The Director of the ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav), Swinburne University gave an excellent overview presentation of the current researches into gravitational wave detection and their cosmological significance. Apart from the expansive technological advancements required to detect these vanishingly small ripples in space-time, they provide a unique insight into the universe's highest energy processes and herald another frontier for exploration in astronomy.

Other presentations were: -

Australian Indigenous Astronomy: A Convergence of Science and Culture	Dr Duane W. Hamacher	Monash University
Addressing the gender imbalance in astronomy	Dr Louise Hartley	MBO
Observational astronomy: How to get started, tips and tricks	Perry Vlahos	ASV, AAVSO, MBO
Women astronomers who made history.	Barry Cleland	ASV, MBO
Occultation's & the Pluto flyby	Jacquie Milner	MBO
Great Melbourne Telescope	Barry Clark	ASV
The career path of a teenage asteroid hunter	Peter Lake	ASV, AAVSO, MBO, VSS, iTelescope
The many types of Supernovae	Bruno Zielke	ASV
Cloud Free Night Cloud Forecasts for Australian Astronomers	Robert Dahni	ASV
Spherical coordinate systems. Finding your way in four dimensions	Alan Garner	ASV, MBO
Massive galaxies in the early universe	Professor K. Glazebrook Swinburne University	Director, Centre for Astrophysics & Supercomputing
Astrophotography	Neil Creek	ASV
Where is Amateur Astronomy going in the 21st Century?	Dr. Peter Lowe	Mornington Peninsula Astronomical Society
CONSTELLATIONS, Origin and Development	Ian Sullivan	Life Member - MPAS & ASV
VASTROC – Past, Present and Future	Judith Bailey	Ballarat Astronomical Society
STEM Education	Daniel Mulino	ASV
Colour imaging indwell	Michael Fritzgerald	MBO
Making our skies dark again	Adam Carey	After Dinner Speaker

On a more general note, I have attended every VASTROC since its inception in 1967. Its format is essentially NACAA-like; consisting of speaker presentations followed by discussion periods over refreshments. The MBO volunteer members and organising committee are to be congratulated for a very pleasant and enjoyable event. Events such as VASTROC provide an insight into the broader tapestry of amateur astronomy across Victoria, something society members rarely have an opportunity to experience. Personally I enjoyed both the event and the opportunity to refresh old acquaintances and make new ones. Personally this is my reason for attending plus an opportunity to see what others amateurs are doing.

On a slightly negative note, the attendance at this VASTROC was somewhat disappointing and while MBO did an excellent job, their efforts were over-shadowed by unusually low speaker representation and topic diversity from the wider Victorian societies. This VASTROC was academically heavy with very little direct amateur contribution. Apart from those academic representatives, the astronomical societies represented were MBO, ASV, MPAS, BAS, Bright AS, and Latrobe Valley AS. Declining attendances have been a hallmark trend over the past few VASTROC, a trend MPAS plans to reverse when in hosts the 2019 VASTROC. *By Peter Lowe*

See more photos @ links below
Mt Burnett Observatory on facebook - https://www.facebook.com/MtBurnettObservatory/
MBO members - https://www.facebook.com/pages/Mt-Burnett-Observatory/1614355842152698
Mt Burnett Observatory website - http://www.mtburnettobservatory.org/

MPAS members who attended VASTROC were: Peter Lowe, Ian Sullivan, Peter Skilton, Jim Blanksby, Ian Barry, Ross Bernier & Greg Walton.
I still have not seen the domed observatory at Mt Burnett, because I was helping out at the Briars on the Friday public night, which was the same night the MBO opened for a VASTROC meet & greet. Saturday there was some solar viewing with the ASV solar telescope, thanks to Russel Cockman, even though the sky was grey & wet for most of the time. The highlight for me was the food, they was a large range & plenty of it, 3 different types of slices (I tried them all) & scones with jam & cream for morning & afternoon tea. Lasagne, soup, sausage rolls, salad & fruit, for lunch. I kept going back for seconds hoping nobody wish to talk to me & stop me from filling my face. I think the main purpose of Vastroc is to catch up with other amateur astronomers for a chat. The first time I have heard of the Bright Astronomy Club, who demonstrated their mobile observatory / trailer, I found them an inspiration & wish them all the best, see next page. *By Greg Walton*

Bright Astronomy Club @ Vastroc. First time I have seen this new society & good to see they are very active, judging by their facebook page. They are into astrophotography & travel around schools in the Bright area with their fully equipped trailer which houses a 16 inch Dobsonian telescope.

Bright Astronomy Club - http://brightastronomy.webs.com/
Bright Astronomy Club on facebook - https://www.facebook.com/groups/856298011051513/
Vastroc photos - https://drive.google.com/drive/folders/0ByvkxzZGI9g_VDVNVUFEeXQxZmM?usp=sharing

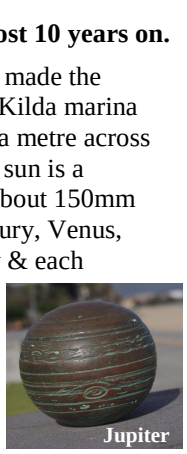
Photos by *Greg Walton*

Planet Walk at St Kilda

Above.. Me back in 1/12/2008

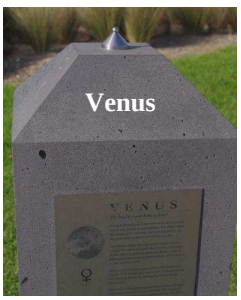
Planet Walk at St Kilda foreshore almost 10 years on.

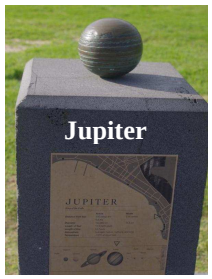
I remember meeting the young artist who made the planets back in 2008. Just north of the St Kilda marina we started at the sun, which is more than a metre across & made of bronze. Just south close to the sun is a bronze Proxima Centauri, which is only about 150mm across. Walking north we could see Mercury, Venus, Earth with its Moon, & Mars, all close by & each machined from stainless steel as a ball on a conical shaped base. Jupiter was a fair distance from the inner planets, walking north and past the two restaurants. At first Jupiter looked more like a squashed cricket ball made of bronze & was about half the size of Proxima Centauri. I saw it was sporting its red spot. Saturn was a fair distance to walk to, at the other side of St Kilda near the Royal Melbourne Yacht Club. We returned back to our car & drove north to find a bronze Saturn in the car park in front of the Royal Melbourne Yacht Club Marina. Saturn looked a bit beat-up with some big dents in its northern hemisphere & looked like someone had had a crowbar underneath to lever Saturn off its plinth. Back in the car heading north we spotted Uranus on the footpath about half way to the Tasmanian ferry terminal & then further on to Neptune. We drove past the Tasmanian ferry terminal, through Port Melbourne, finding Pluto half way between the Tasmanian ferry terminal & a new shipping container wharf. *By Greg Walton*

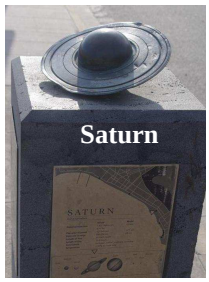


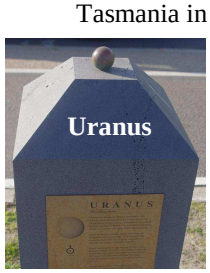
The images of the Sun above, Jupiter left, Earth & Moon have been roughly scale, so you can see the huge difference in size.

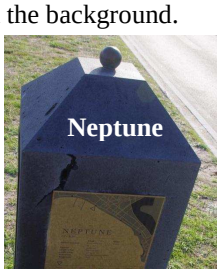
Above - Pluto with the Spirit of Tasmania in the background.











Planet walk map link - https://drive.google.com/file/d/0ByvkxzZGI9g_b2pFTFk3M1VpUjA/view?usp=sharing

Deep Space Communications, *by Dave Rolfe*

Inspired after a visit to the Canberra Deep Space Communication Complex at Tidbinbilla, ACT.

Ground Based Facilities

The Canberra facility has 4 primary dishes, 3x 34 metre and a 70 metre. There are also some smaller training, decommissioned and support dishes on site. Each can transmit and receive telemetry and data from distant spacecraft as well as perform some radio astronomy tasks. There are two other similar sites approximately equi-distant around the Earth in Madrid and Goldstone USA as part of the integrated network. NASA/ JPL handles the scheduling and control of this installation and pays the $20m per year to run. The 70m dish here is the largest steerable parabolic antenna in the Southern Hemisphere and is just 6m larger than the Parkes Dish.

Image : Author – 70m Dish, DSS43

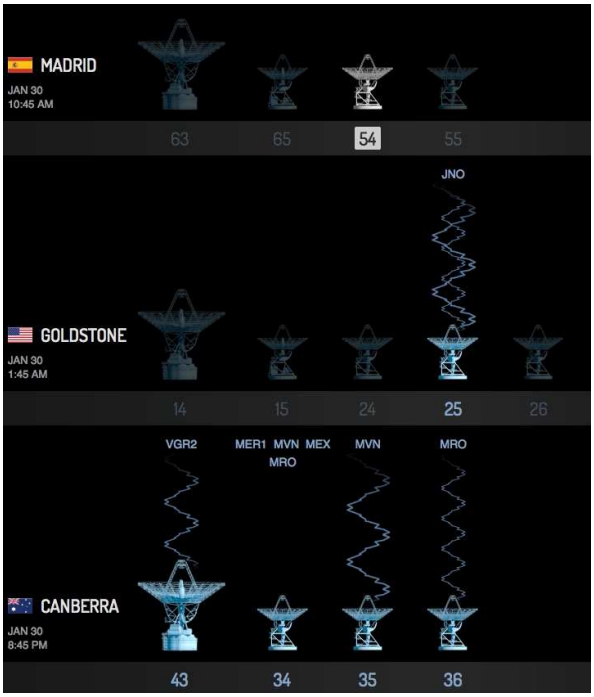
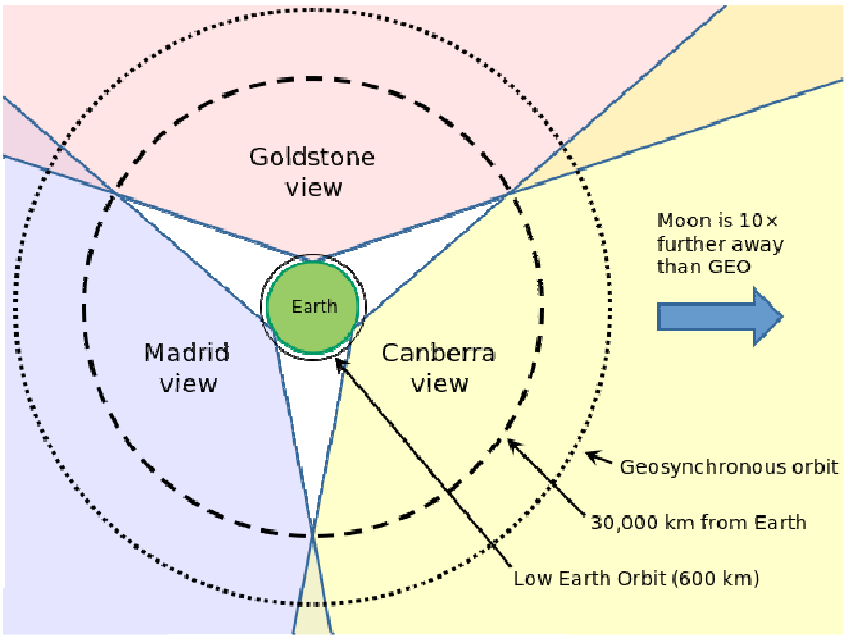


Image: www.eyes.nasa.gov/dsn/dsn.html

The system employed by the deep space network uses frequencies of 7.20 GHz Up-link (Send instructions) and 8.45 GHz downlink. The power transmitted can be scaled up to 20kW (set so it does not overload distant receiver) and has a receive sensitivity of better than 4.5 x 10^{-22}kW (-153 dBm). When I observed it communicating with Voyager 2 at 17.08 billion km.

The deep space network itself will turn 50 years old next year as it was originally built for the Apollo program. Parkes is technically part of the network and can be added (or arrayed) at any time if needed; however it is a listening-only dish (no transmitter). It should also be highlighted that Canberra seems to be the busiest and most crucial of the 3 sites as it is the only transceiver able to communicate with probes deep in the Southern Hemisphere (i.e. Voyager 2)



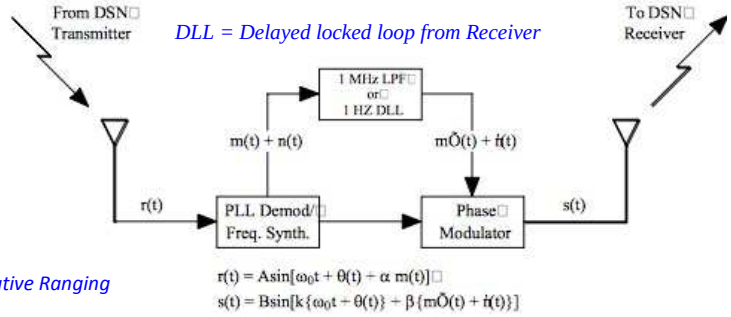
Network Reach

System Funding Issues

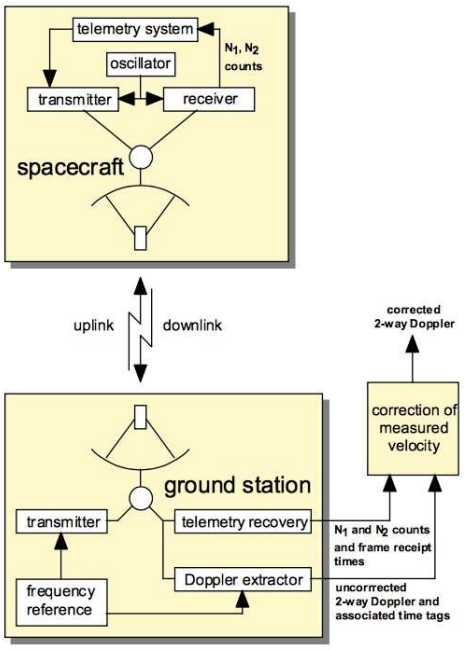
In January 2016, the NASA Cassini spacecraft was climbing from an orbit around Saturn's equator to a polar orbit, which would allow the spacecraft to cap its 13-year exploration. The mission was to end with the craft running through the rings to perform a final dive into the atmosphere. The system was not able to communicate at a critical time, known later, as the 'The Cassini incident'. This was one of several recent glitches in the Deep Space Network. On 30 September 2016 at NASA headquarters officials briefed the scientists on the network's status. Many are still worried that budget cuts and age of the network will endanger the complex manoeuvres that Cassini and Juno, a spacecraft now at Jupiter, will require over the next few years.

Navigation Support

The Deep Space Network is starting to use millisecond pulsars (better than 100nS period) for timing as the GPS network has potential issues of selective availability and a variable accuracy of up to 10nS. This is used for the best Time of Arrival (toa) and frequency accuracy that is needed for Doppler distance and velocity ranging (better than 0.1mm/s), as with the vast distances involved, slight errors will be greatly compounded.



Regenerative Ranging



Non-coherent Doppler Tracking

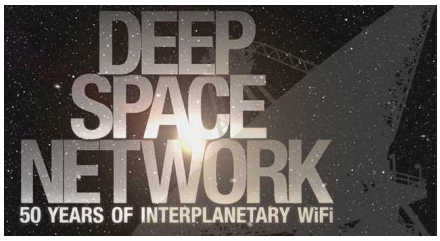
The system is based on a comparison of the spacecraft frequency reference with the uplink frequency received by the spacecraft. This comparison information is included in downlink telemetry. The ground stations measure the downlink Doppler to provide range information and can determine corrections that may need to be done to suit the Ultrastable Oscillator frequency (can be caused by varying spacecraft spin rates – see later on). It's also worth noting that the delay from transmit to receive can be over 9 hours and multiple sites are needed with earth rotation.

International Systems

The CCSDS (Consultative Committee for Space Data Systems) was established in 1982 to develop standards for space agencies that ensure their systems do not interfere with each other. These have been supported by most agencies (Italian, Canadian, France, Japan, India, Russia) that have their own space tracking and communication networks. The collaboration has also created a foundation where standards in protocols and transmission types could allow inter-agency cross support.

Did you know?
The first pictures from the Apollo moon landing actually came from Honeysuckle Creek tracking station in ACT (which has now merged into Tidbinbilla) and not Parkes.
Could the movie 'The Dish' been fundamentally wrong? [answer: yes]
Did Man even go to the moon? [answer: yes]

They certainly make that point known when visiting!



Space Based Equipment

Spaced based probes can have a great proportion of its weight and power requirements consumed in communication & power systems. These include backup and safe mode's as a probe in space with no telemetry is just a waste of time and money! Weight is also expensive to launch so any system needs to be as light and electrically efficient as possible.

Some probes not venturing too far from the sun use solar power (like Juno which I have focussed on), others like Voyager use Plutonium based Radioisotope Thermoelectric Generators that now (in 2016) generate about 250W of 30V electricity, steadily decline about 5% every 5 years. New Horizons that recently visited Pluto (plutonium powered) had just 255W available at launch. The Solar powered Juno on the other hand has solar cells that (when at earth distance from the sun) generate 14kW of energy while now at its Jupiter destination generates just 400W!

Juno's radio communication subsystems have been designed to use a maximum of 70W of power in the x-band and 116W in the X/Ka bands. Systems also need to operate in a vacuum, survive up to 25 krads of radiation and the magnetic field effects from Jupiter as well as endure close to absolute zero temperatures. To solve this a lot of this equipment is enclosed in a 200kg heated radiation vault that also helps to shield RF from the sensitive science experiment modules. Most other probes have a similar arrangement and share many proven designs. Juno's radio gear is an extension of systems already used in the previous Cassini mission.

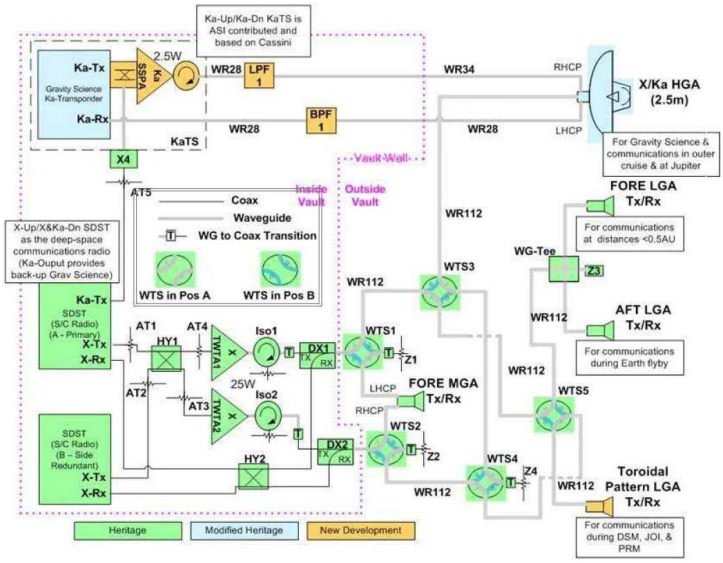


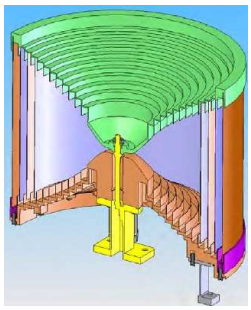
Diagram : JPL / NASA

The diagram at right shows the radio block diagram as well as the radiation vault.

Juno includes special communication hardware to allow the spacecraft to pick up a ground Ka-band signal, which is then processed by a special communication box called KaTS. This new signal is sent back the ground station on X-band radio. This allows the velocity of the spacecraft over time to be determined with a level of precision that allows the measurement of the gravity field of Jupiter.

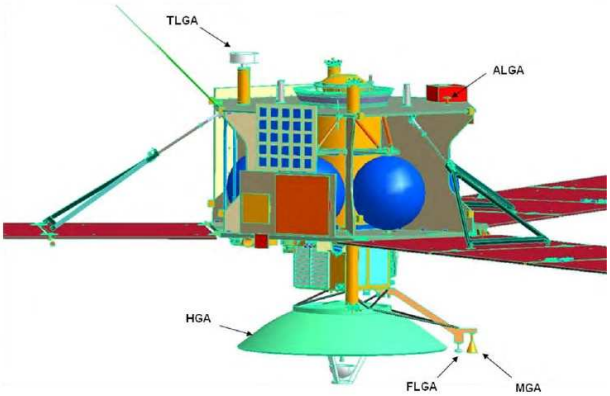
There are five antennas on Juno;

HGA: high-gain antenna *(Picture side on antenna array diagram)*
X Band : Right hand - Circular Polarized. Beamwidth +/- 0.25 deg RX/TX, 44dB Gain
Ka Band : Right hand - Circular Polarized (Down), Left Hand (Uplink).
Beamwidth +/- 0.25 deg RX/TX, 47dB Gain
Weight : 23kg

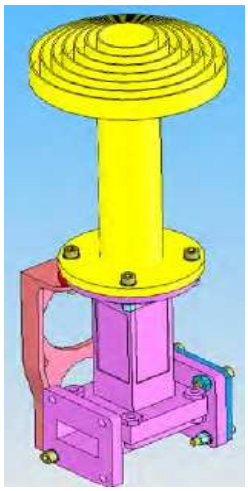


TLGA: Toroidal low-gain antenna
Right hand - Circular Polarized.
Beamwidth +/- 10 deg RX/TX, 6dB Gain.
Weight : 1.9kg

Used for some special events when HGA not pointing towards Earth.

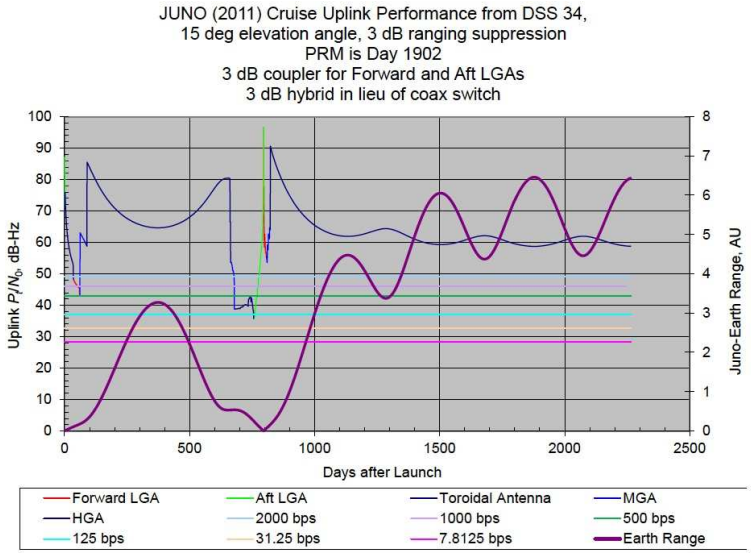


Juno Space Craft Antenna Array

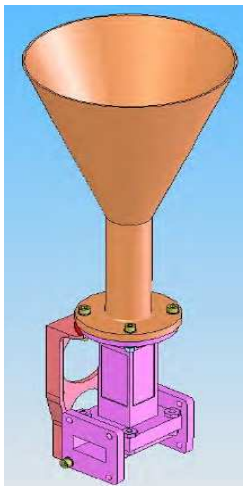


FLGA: Forward low-gain antenna & ALGA: Aft low-gain antenna
Right hand - Circular Polarized.
Beam width (3dB) +/- 40 deg RX/TX,
8dB Gain
Weight : 0.5kg

Chocked Horn Design.
Used Close to Earth and for backup MFSK Status Tones when spacecraft main High Gain Antenna not pointing Earthwood.



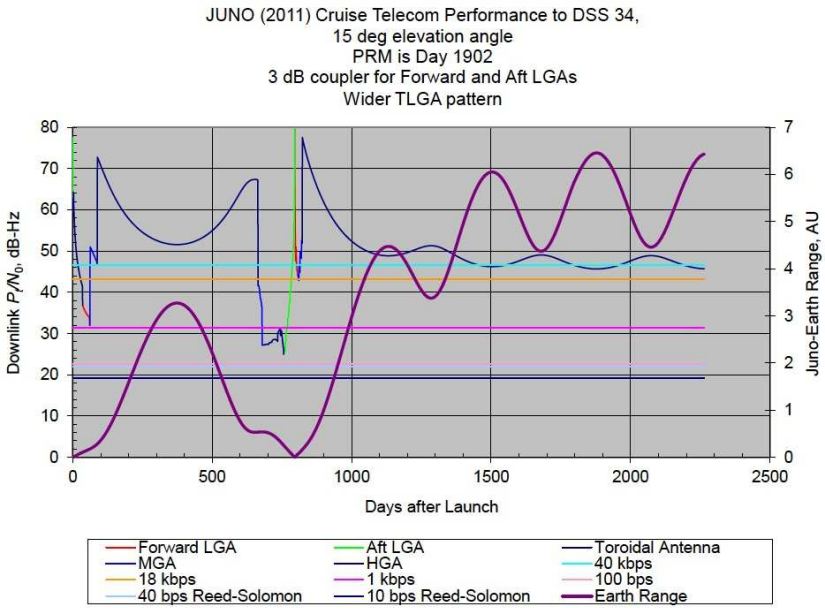
Uplink Performance Prediction



MGA: Medium-gain antenna
Right & Left hand - Circular Polarized.
Beam width (3dB) +/- 10 deg RX/TX, 18dB Gain
Weight : 0.5kg

RF Conical Horn Design.

Same design as on Mars Rovers.
Used for Safe Mode.



Downlink Performance Prediction

As you can see on the charts beside there is a need for all these antennas in the mission with forward predictions of all maneuvers and earth distances calculated.

All telemetry is digital. Horizontal lines on graphs are various data rates expected from 40kbps to 10 bps.

Ultrastable Oscillator

Most ground based microwave systems use GPS signals as a locked oscillator reference, but these signals are not available in deep space. In space they use a 30MHz ultrastable oscillator (USO) with an aging rate of better than $1x10^{-11}$ per day MHz per day and for best stability the 5MHz oscillator is in a temperature controlled enclosure. The 30MHz signal has the correction 100kHz added (includes correction from the Doppler calculations calculated before) to produce a 30.1 MHz carrier tracking reference.

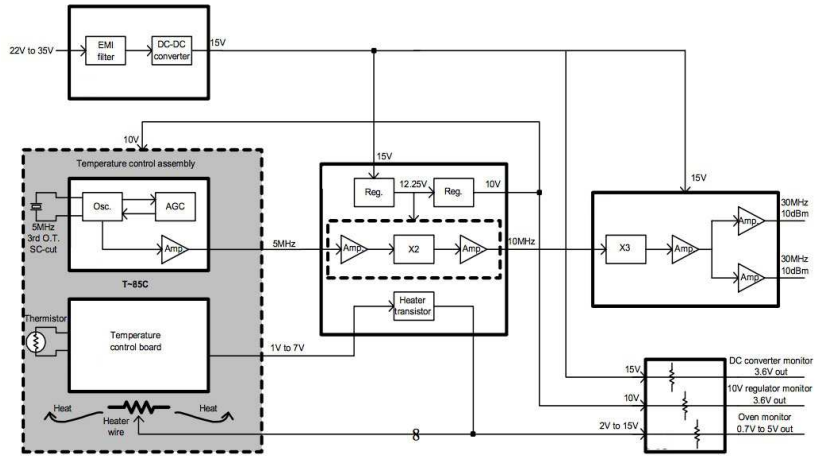


Diagram : USO block diagram and component picture

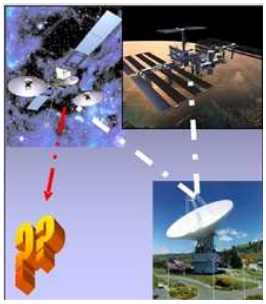
Communication Time & Distance

Radio travels at the speed of light, so with spacecraft like 'New Horizons' at Pluto distance, the signals take 4.5 hours to travel each way. This makes standard data correction (i.e. CRC data corrections) algorithms not viable, so new protocols and data redundancy were needed. This also includes data compression to minimize bandwidth. A lot of this technology has found its way into Public domain. An example is JPEG are too complex, images are sent using ICER format, which has a 10:1 compression ratio and is more robust.

Due to the inverse-square law in radio communications, the digital data rate (all signals are digital as no one volunteered to ride along) used in the downlinks from the crafts reduces as the distance increases. Voyager for example had a data rate from Jupiter at 115kbps. That was halved at the distance of Saturn, and it has gone down to about 300bps at the moment (best rate given the dB Signal). In 1985 the diameter of the DSN three largest dishes was increased from 64 m to 70 m, dramatically increasing their areas for gathering these weak microwave signals as these probes get further away.

Protocols

Well that's a secret! With the dollars at stake and the possibility of malicious attack it is on a need to know basis.
I did see it asked on a forum and here was the reply.



'Reliable communication between ground and spacecraft is central to mission success, especially in the realms of digital communication (data and command links). Seen in the light of recent events, these communication links are vulnerable to malicious intrusion. If terrorists or hackers illegally listen to, or worse, modify communication content, disaster can occur. The consequences of a nuclear powered spacecraft under control of a hacker or terrorist could be devastating. Therefore, all communications to and between spacecraft must be extremely secure *and* reliable.' – JPL Forum

Inter-craft Beaconing

Spacecraft can use a CW tone to communicate with other craft in the network, once communications are established 16 CW tones (like DTMF) are sent between the compatible spacecraft. These simple tones will be added to all other receiving crafts downlink status to let ground control know that all is ok (or not) on the other craft in range.

Autonomous

The spacecraft do not have constant communications; there are a lot more spacecraft than dishes available. Science data & commands are stored in the CPU memory and only updated and read when scheduled. This means good planning and up-time is needed across the Deep Space Network. Other nations have a similar network (Russia, India, & Japan for examples) and there have been instances when facility sharing has been requested at critical times.

More Information

There is plenty of information on the Internet and at the 'Canberra Space Centre' visitor building.
73's for now.
de David Rolfe VK3JL

References: *NASA, Juno Telecommunications – Design and Performance Summary, Article 16, 2012*
http://www.cdscc.nasa.gov
https://www.nasa.gov/mission_pages/juno/
https://www.nasa.gov/mission_pages/voyager/index.html

MPAS Gallery

Right - Comet V2 Johnson with Galaxy NGC5566 taken at the MPAS Briars site on the 17th June 2017

Telescope ED80 with TSFLAT2 field flatter @ F/7.5

Canon 5Dmk3 full frame
Lights: 41x30s @ 3200 iso
Darks: 17
Flats: 4
Processed with Deep Sky Stacker.
By Andrew Nilsson

Right - NGC2070
The Tarantula Nebula

Paul Albers came home to a nice surprise, with one of his images published overseas again.

"I recently made the jump to CCD imaging. This was taken at the Briars National Park. One would always like to obtain more data, but given the total for this was 114 minutes, I was quiet pleased."
Paul Albers

Equipment - QHY9 mono CCD camera, William Optics FLT 110 DDG triplet APO refractor.

Right - Trifid M20 & Lagoon Nebula's M8 taken from my backyard at home using.

Williams Optic Megrez 90 Scope, with SBIG STL11000m camera, using an Astrodon 6nm Ha filter.

Taken using a Skywatcher AZ-EQ6 mount.

Stack of 6 – 30 minute subs, with darks and flats applied.

Taken from my backyard in Aspendale Gardens

Friday the 15th of June 2017
By Jamie Pole

SOCIETY INFORMATION

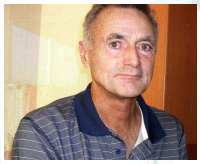
Dave Rolfe

Peter Lowe

Peter Skilton

Jamie Pole

Trevor Hand



Tony Nightingale

Fred Crump

Greg Walton

OFFICE BEARERS OF THE MORNINGTON PENINSULA ASTRONOMICAL SOCIETY

President: Dave Rolfe
Vice President: Peter Lowe
Committee: Trevor Hand, Fiona Murray, Fred Crump
Tony Nightingale & Greg Walton
Phone Contact: Peter Skilton

Secretary: Peter Skilton
Treasurer: Jamie Pole
Web master: Dave Rolfe
Scorpius editor: Greg Walton
Library: Fiona Murray

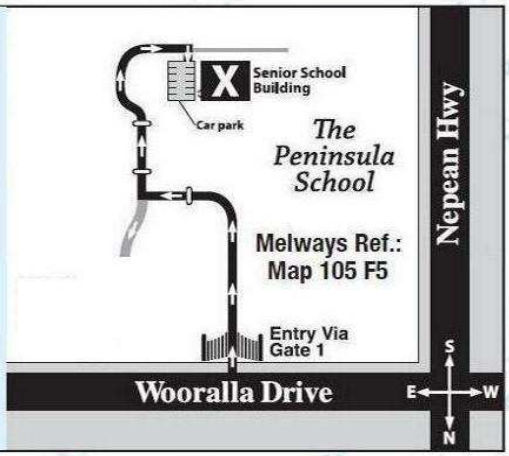
facebook **MPAS** - https://www.facebook.com/mpas0/

SOCIETY MEETINGS

Meeting Venue: The Peninsula School, Wooralla Drive, Mt Eliza, (Melways ref. 105/F5) in the Senior School at 8pm on the third Wednesday of the month (*except December*).
Entry is via the main gate, off Wooralla Drive. (See map).

For addition details:
Internet: www.mpas.asn.au
email: welcome@mpas.asn.au

Phone: 0419 253 252
Mail: PO Box 596, Frankston 3199, Victoria, Australia



facebook **MPAS members** - https://www.facebook.com/groups/MPAS1/

LIBRARY

Fiona Murray

The Society also has books & videos for loan from it's library, made available on most public & members nights at The Briars site, contact Fiona Murray.

E-SCORPIUS NEWSGROUP

M.P.A.S. main line of communication is the online newsgroup called E-Scorpius. Here you will be kept up to date with the latest M.P.A.S. news & events information as well as being able to join in discussions & ask questions with other members.

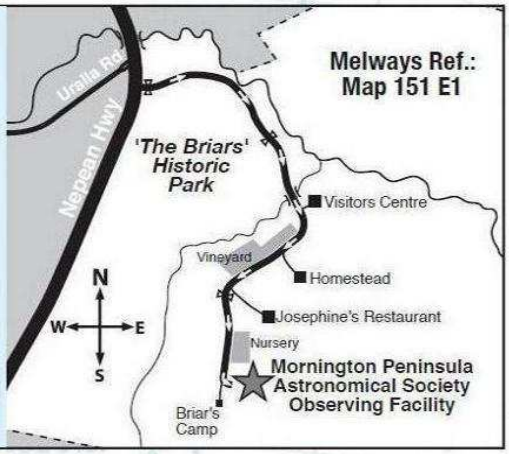
To join, to go: www.groups.yahoo.com/e-scorpius and sign up to Yahoo groups - you are required to sign up to Yahoo groups to join E-Scorpius. Once you have signed up at Yahoo groups, email welcome@mpas.asn.au say that you want to join E-Scorpius & you will be added to the E-Scorpius list.
Member forum : http://www.mpas.asn.au/members_forum.html

VIEWING NIGHTS - MEMBERS ONLY

Viewing Night - Members only
Any night, at The Briars, Nepean Hwy, Mt Martha, starting at dusk.
Members visiting The Briars for the first time must contact Greg Walton on 9776 2074 or 0415172503 if they need help getting to The Briars site. Upon arrival at the site, remember to sign the attendance book in the observatory building.

For additional details:
Internet: www.mpas.asn.au
email: welcome@mpas.asn.au

Phone: 0419 253 252
Mail: PO Box 596, Frankston 3199, Victoria, Australia



Members please write a story about your astronomy experiences and add some pictures.
Send them to: Greg Walton gwmpas@gmail.com

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