November 2008
Volume 13 Issue 11

Inside this Issue

Secretary's Column	3
Royal Stars	5
Monthly Binocular Object	7
Skytools 3 Review	8
Star Hopping to Messiers	11
Black Holes Ain't Holes	15
Backyard Observing	16

MAS Committee

President
John Rombi

Vice President
Daniel Ross

Secretary
Roger Powell

Treasurer
Dick Everett

Merchandising Officer
Stuart Grainger

Webmaster
Chris Malikoff

Committee Members
Lloyd Wright
Stuart Grainger
Ivan Fox

MAS Postal Address

P.O. Box 17
MINTO NSW 2566

Web: www.macastro.org.au

Prime Focus Editor
Kate Johnston
cyberpiggy@optusnet.com.au

Presidents Report

John Rombi

Welcome to all members and guests to our November meeting, the last one of the year!!

I would like to thank Dr Lisa – Harvey Smith (October) for her presentation on **"Massive Stars: Live Fast & Die Young"**

After the meeting Lisa expressed her thanks for the very inquisitive and well read audience and indicated that she would be very happy to make a return in the future.

Observing Nights

Have again been few and far between because of the weather.

The Stargard session had a full compliment of members with Mohammed Baddah taking a magnificent wide field image of the Milky Way.

It was so good that it was taken up by the local newspapers as a promotion for M.A.S, Thanks, Moh!!

The Forest weekend was greeted by a heavy overcast sky, so unfortunately any planned astronomy was cancelled.

The four brave souls that did make the trip enjoyed a weekend of DVD's and good social banter, so it shows that a clear sky is not always needed for a good time.

This months observing schedule

Will be held on Nov 22nd at Stargard and Nov 29th at The Forest.

The Forest weekend will include our **Christmas Party**, remember it's B.Y.O.E

Lets finish the year with a *"Big Bang"*
(I hope you'll pardon the pun)

M.A.S Shirts

Have been a runaway success!!

We are now up to our second order!!
We will also keep in stock approx 20 shirts of mixed colour, style and size.

So if you would like to compliment the shirt you already have or would like to spread the word by giving one away as a Christmas present, please contact our Merchandising Officer Stewart Grainger.

Observing Dates

November
17/11/08 General Meeting
22/11/08 Stargard
29/11/08 The Forest
Xmas Party

December
20/12/08 Stargard
27/12/08 The Forest

He may be reached by P.M (private message) through the website or in person at a meeting.

Remember, they are $30 each, regardless of size, colour or style.

Public Nights

There will NOT be any public nights held in December, due to ***The International Year of Astronomy*** in 2009; we have postponed all public activities until then.

IYA 2009

The committee is in the process of putting together a series of events for next year's celebrations.

Over the next couple of months these events will be brought to your attention.
I would like all members to be able to make themselves available for these events to be able to raise the profile of Astronomy and M.A.S in the greater community.
Please watch this space (and the website) for information.

End of 2008

As we approach the end of 2008, I would like to thank, YOU, the members of M.A.S for your enthusiasm, friendship and hard work.These strong attributes makes M.A.S the successful society that it is.

Christmas 2008

On behalf of my family to yours, I would like to wish you all a very Holy and Merry Christmas and a Prosperous 2009.

Tonight

Our speaker will be Dr Greg Madsen (Syd Uni) his presentation will be on **"How does our Galaxy work?"** I would like to thank Greg for making the trip to M.A.S.

For the latest news, remember login to the website www.macastro.org.au See you there!
Cheers, John Rombi.

Secretary's Column

Roger Powell

This is the final *Prime Focus* for 2008 and the meeting on 17th November will be our last until 19th January. However, observing nights will continue at Stargard and The Forest as usual.

The committee is now gearing up for a very busy 2009. If you have not already noticed, next year has been declared by the United Nations as *International Year of Astronomy (IYA2009).* It marks the four-hundredth anniversary of Galileo using a telescope to view the night sky for the first time.

A number of organisations world-wide will be involved with *IYA2009*, including NASA, CSIRO, Astronomical Society of Australia, National Trust and others. Even the Royal Mint is 'cashing in' by issuing a set of commemorative coins and no doubt there will be special postage stamps and plenty more besides.

IYA2009 provides our Society with a unique opportunity to improve the awareness of our universe amongst members of the local community.

It's time to tell them the difference between astronomy and astrology, between science and pseudo-science; it's time to tell them why we look at comets and nebulae not UFOs and horoscopes; and it's time to tell them what a fantastic Universe there is out there to see, if only they would stop once in a while, gaze up and start asking questions about it.

In line with this, it is expected that 2009 will see the Society: holding considerably more public observing nights than usual; participating again at the Campbelltown Show in April; helping the local Historical Society with an astronomy event sponsored by National Trust; entering Fisher's Ghost parade for the first time in November; and maybe a public lecture or two. Your further ideas would be most welcome. Just talk to a committee member.

Taking part in the Fisher's Ghost Parade for the first time intrigues me. I can see it now - sixty plus members, marching in tight formation along Queen Street next November, all smartly dressed in their MAS caps, MAS tee-shirts & MAS socks, carrying their telescopes over their shoulders. This would be closely followed by the MAS float carrying an observatory dome or two; and Bob Bee perched on top, dressed as Fred Fisher, using a loud hailer to tell everyone in the crowd how easy it is to star hop to Messier 51 in Canes Venatici. (☺!).

Speaking of domes, John will no doubt report to the meeting that the Society is supporting Campbelltown Rotary, who are rightly concerned that the Rotary Observatory on the UWS campus has not been providing a public outreach programme as was originally intended. The reasons for this are complex but should not be insurmountable.

I recently attended a meeting with Rotary leaders, along with John and Bob (who, coincidentally was the after dinner speaker at Rotary that evening). As a result of this meeting, Rotary intend to approach UWS directly, to try and reach an agreement to open up the Observatory for visits by school students and the general public, probably on a monthly basis. They will do this

reinforced by a commitment they have from MAS to participate in public education at the Observatory, if granted the opportunity to do so by UWS and Rotary.

I note that some enterprising local tourist organisations are advertising the Rotary Observatory as a tourist attraction - open once a month for visitors – something that has not happened in its eight year history. I hope that Rotary and UWS, with our support, can somehow begin to make this happen.

What a great shame it would be if we can't focus Macarthur's *IYA2009* contribution on the $200K observatory that is sitting right on our doorstep, hardly used and gathering cobwebs.

The committee has decided to begin to phase out the printing of *Prime Focus* to save cost, effort and trees. We are asking members to go on line before each meeting to read it, rather than take a printed copy from the meeting. If you want a printed copy, there is nothing to stop you downloading it to your own printer (or the office printer!). Each Prime Focus for 2008 is available at www.macastro.org.au , just go to the 'Articles' drop down menu. I urge everyone to get into this new habit of reading it online, because sometime soon no printed copies will be provided at meetings.

We are also reviewing our *Prime Focus* mail-out service. Currently, for an annual fee of only $5.00 you can receive your printed copy by mail if you did not attend the meeting. Now that *Prime Focus* is available electronically, this service may be no longer necessary. As such, it may be discontinued or provided at an increased cost. We are seeking members' comments on this, so please make your views known to a committee member as soon as you can.

10

That's the number of members who have now registered their laser pointer with the Society. It's a voluntary listing but it may be useful to you one day. So if you have not yet registered yours either see me or download a form from the Macastro website.

20

That's about the least number of times the Solar System is thought to have traveled a full orbit around the Milky Way Galaxy, (maybe as many as 25). Located about 25,000 light years from the galactic centre, it completes one orbit every 225,000 to 250,000 years at a velocity of 220 km/sec in the direction of Hercules. How the Milky works is the interesting topic of this month's address by Dr Greg Madsen.

MAS CHRISTMAS PARTY

Join us at the Forest

Saturday 29th November

B.Y.O.E

Royal Stars

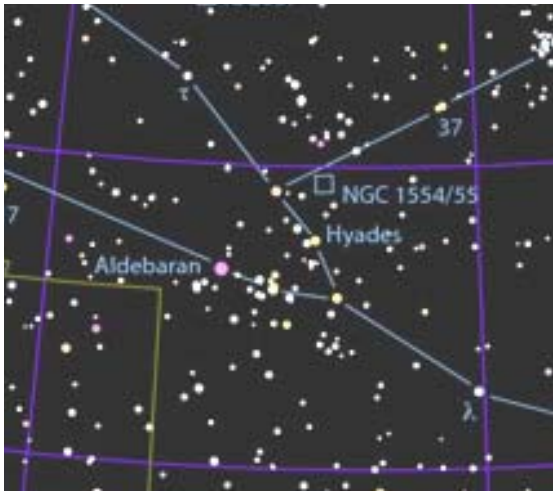
Ian Cook

The final of our **ROYAL STARS** or ***Four Guardians of Heaven*** rounds out the year for us with:-

***The Watcher of the EAST. ALDEBARAN (Alpha Tauri*)** marking the Ancient Spring Equinox.

As soon as the ancients saw the Pleiades alongside their mythological half-sisters the Hyades with the orange-red star **Al deb aran** in the sky, they knew that the busy time of crop planting and the balmy evenings of summer were not far away. Now culminating at midnight the end of November, it is nearer to the Winter solstice for northerners, and the **Summer Solstice** for us. Look up tonight; it is there right now!

Pronounced **Al - debaran**, the ancient Arabic name means "the Follower," as the star seems to follow the Pleiades or Seven Sisters star cluster across the sky. The star is a binary system with magnitude 0.85 and 13.6 red components.



Hyades Star Cluster

TheHyades star cluster which makes up the face of Taurus the Bull is 160 light years away, however **Al debaran** is positioned in front of the cluster at only 65 light years.

By far the brightest, and therefore the alpha star of the constellation, **Al debaran** appears as the celestial Bull's eye in most drawings of the constellation. Other names for the star are - the Bull's Heart, and ***Stella Dominatrix***, meaning, driving the Pleiades before it.

Eastern cultures linked it with," the Creator Spirit" that caused deluge, rain and growth.
It was thought to bring rain and if the rains did not come with its' first rising then chances were it would be a barren year. Ptolemy called it "the Torch Bearer", and traditional astrology claimed it brought riches and honour

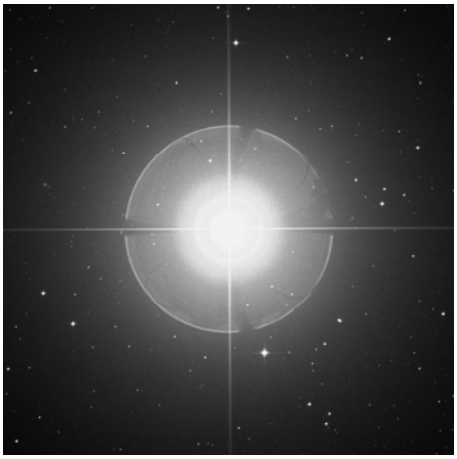
As part of the zodiac **Al debaran** lies close to the Sun's path. It is also a "lunar star" because it is regularly covered, or occulted, by the Moon. It therefore had great importance in ancient navigation.

In November the Taurid meteor shower radiates from a point North West of Al debaran. The Comet Encke's dust trail gives birth to meteors that are slow and sometimes burst into bright fireballs.

Al debaran A is an orange-red giant star of spectral and luminosity type K5 III. It has a temperature of just under 4000 degrees Kelvin, compared to the Sun's 5800 degrees. Hipparcos measured its' distance at 65 light years, moving away from our solar system at approx 50 km/second.

The red giant is in an advanced stage of evolution. Most of its' interior hydrogen fuel has been converted to helium which is now being fused into carbon, on its way to becoming a supergiant and eventually a planetary nebula. Before the star evolved into a red giant, it may have been a spectral type A dwarf, 350 times brighter than the Sun with a temperature of 8500 K.

Al debaran A is estimated to have 47 to 100 percent more heavy elements or metallicity (i.e. heavier than hydrogen) than our own Sun.



Al debaran DSS pic

This large star is an extremely slow rotator, taking almost two years to make a full spin. It has a mass between one to two and a half times our Sun, but its' size has expanded to a radius about 40 to 52 times solar.

This has enabled astronomers to measure its small angular diameter of only 0.021 seconds of arc, which would be the apparent size of an A$2 coin seen at a distance of 50 kilometres.

If placed at the position of the Sun, Al debaran would extend halfway to the planet Mercury and would appear almost as big as the moon in our sky, making life on Earth quite impossible.

This 13th brightest star in the sky is a low level irregular variable that fluctuates erratically and undetectably to our eye, by about two-tenths of a magnitude.

Alpha Tauri System

Star "B" is a red dwarf of spectral and luminosity type M2 V. It appears to have 15 percent of Sol's mass, 36 percent of its diameter, and less than 1 percent of its luminosity.

Two 11-13th magnitude stars two arc minutes away, were once considered to be component C and D, of the Al debaran system but are now known to be a separate binary system

New data has led some to think that Al debaran may have **its own "solar system".** A cooler shell of gas and dust surrounding **Al debaran A**, has been known for many years; however recent observations show that the star may be slightly shifting back and forth in response to a small body.

These new but unconfirmed observations point to an object with at least 11 times the diameter of Earth but with a mass eleven times that of Jupiter. If it exists, companion B appears to move around Aldebaran A with an average separation of 1.35 AU and a period of almost 654 days, or 1.8 years.

However, because the method of detection relies on radial velocities (the Doppler technique), which only determines the object's minimum mass, companion B may actually be a brown dwarf; ie. a failed star that is too small to support thermonuclear reactions in its core.

The Hyades with debaran from Australia

We do not know if the companion body is a massive planet, a low-mass "brown dwarf," or even perhaps a long-term natural oscillation of the star.

Interestingly, at one time in the past people thought Aldebaran A was a spectroscopic binary star.

The Watcher of the East is being watched as never before to see if 'the creator spirit' has left a surprise this spring/summer

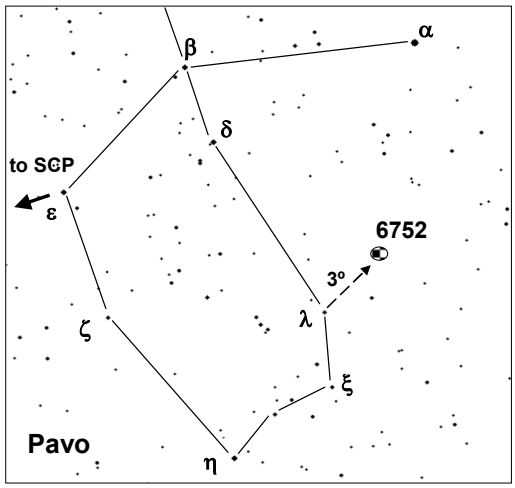
So, did you get to look at each of **The Four Royal Stars** this year?

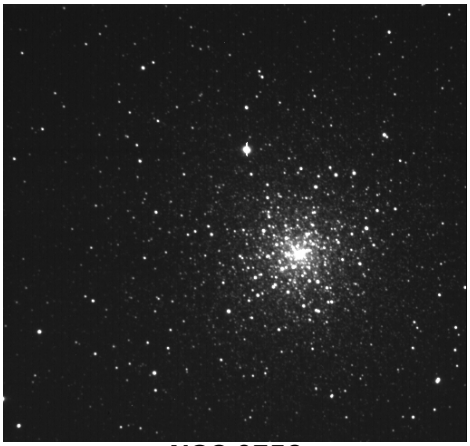
If not, they will appear in order again in a few months from now and repeat every year. They may not be as significant in our agricultural calendar or daily personal life as in past ages, but they are important for their own intrinsic natures and what they can teach us about the cosmos we live in.

IC Stars

Binocular Object of the Month - NGC 6752 in Pavo

Bob Bee





NGC 6752
(Note the 'bright' star at the top left of image.)

The binocular object of interest in Pavo (The Peacock) is a magnificent one, the Globular Cluster **NGC6752**. If this had been visible from France, it certainly would have a Messier number. Arguably the third largest (in apparent size, about ½ a Moon diameter) of the globulars, and at 5th magnitude, the 7th brightest in the sky.

Only 15,000 light years away, it is a treat for binoculars. It has a fairly concentrated centre with an even distribution of outer stars, with a 'bright' foreground 7th mag. star on its outer fringe.

As per the shape in the chart above, locate the constellation Pavo (it lies roughly midway between Ara and Grus). On a clear dark night the glob should show up in your binoculars fairly easily, so a rough guide would be to form an 'equilateral' triangle with α and β. NGC 6752 should be very close to the third point of the triangle. Alternatively, identify the two 4th mag. stars λ and ξ from the chart. 6752 lies in the binocular field of view only 3º away from λ as shown.

Happy viewing.

Review of SkyTools 3

Geoff Young

An early piece of advice I received when I joined Macarthur Astronomical Society was "plan your observations before each night. Make a list of what you are going to look at. Record these observations". On reflection, I realise that this was good advice, but, as a beginner, I was not sure where to start constructing such a list.

I spent a lot of time researching before each observing session – what is up tonight, when is it up, when would be the best time to view it (that night and during the year), can I see it with my setup? I ended up with a lot of hand-written pages and spent too much time shuffling them around instead of actually observing. Then recording – more lists, notes, sketches. More time not observing. The amount of paper involved was increasing exponentially. Then there were the problems experienced using these pages outside with my telescope – wind and dew (some pages became too wet and illegible).

I decided to start looking at software that would help me with these tasks and problems. Leaving aside task-specific software (eg, guiding, imaging), I found that astronomy software fell into one of three categories: planetariums (a "realistic" night sky on your monitor), computer atlases and planner-loggers (giant databases that help you generate lists of objects to observe).

SkyTools (http://www.skyhound.com/st3.html), written by Greg Crinklaw, is in the last category. It does have parts of the other two – it can do charts and draw the night sky, but it is essentially a big database, packed full of planning, searching and logging features. An added bonus for GoTo and PushTo mounts is a Real Time function which connects to the mount and directs the mount to the object to be observed.

A new version, SkyTools 3 is due for release early December 2008. This version has an incredible number of features, some of which are listed below:

- Visual Detection Model -- SkyTools 3 draws on scientific models of sky brightness, atmospheric conditions, and detection contrast to predict how difficult an object is to detect visually. Objects are categorized from obvious to very challenging based on your telescope and observing conditions.
- Double Star Pair Split Model
- Science-Based Realistic Sky Simulation
- Nightly Observing List Generator
- Observing Synopses
- The Premiere Double Star Database
- More Accurate Stellar Database
- More Accurate Galaxy Database
- Larger, more accurate Nebula Database
- Data Sync between different computers
- Organized Data
- Jupiter Great Red Spot Events
- Create an Observing List from any text file

Then there is the Pro Edition for the astronomical imager or any serious observer who wants even more features. This edition has a much larger stellar database, with stars down to 20th magnitude as well as

- Imaging Session Planner
- Exposure Calculator
- GPS Location Tool
- Minor Planets and Comets database search

These are the major features that make observing / imaging that much easier. Both programs also have a host of other features such as night-vision mode, printing and copying charts, ordering lists for optimum viewing times, using existing lists or creating your own personalised ones.

The logging function is incredibly easy to use. A bit of initial setting up once and that is all that is needed to create very quick logs of your observations. Each log entry notes the

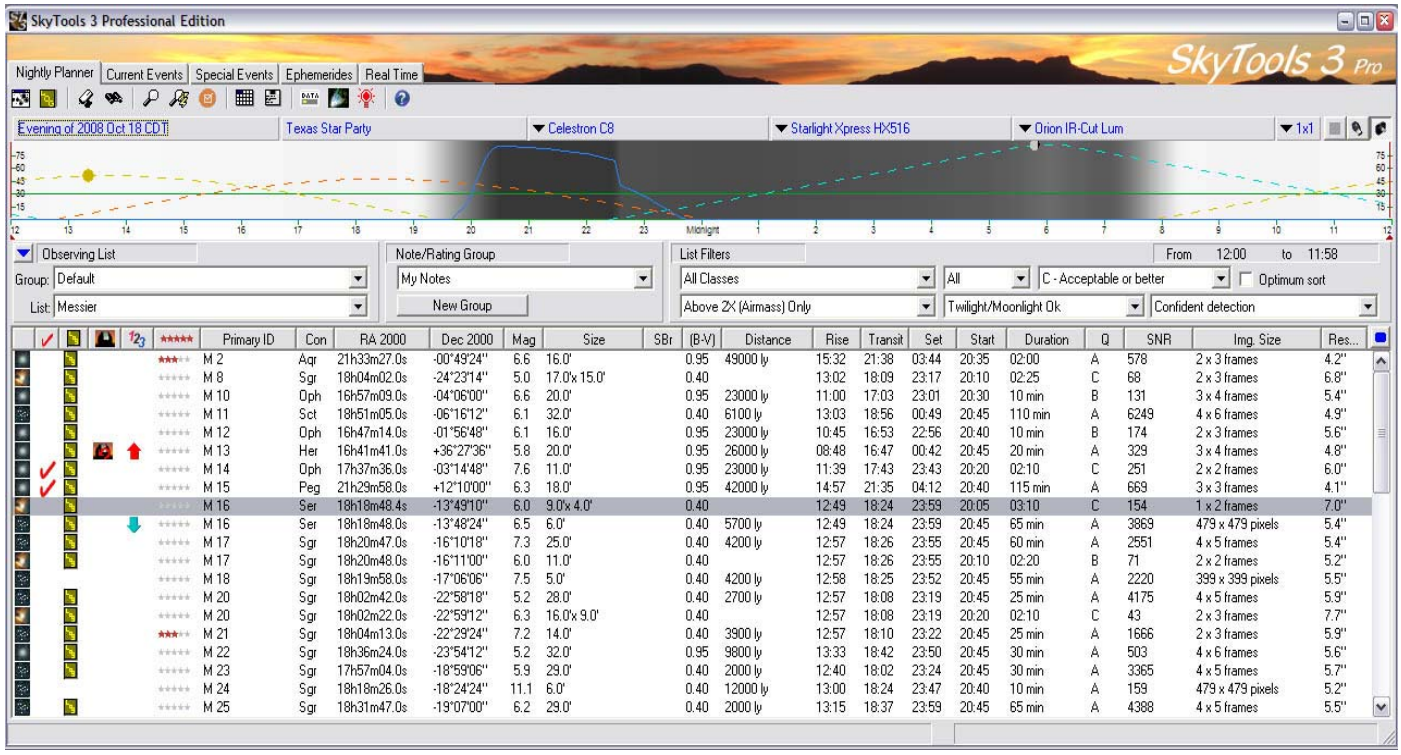
- feature
- location, date and time
- observing conditions
- instrument
- eyepiece
- RA and dec

plus space for your notes about the feature. When planning/observing, an icon indicates which features in the list have already been viewed.

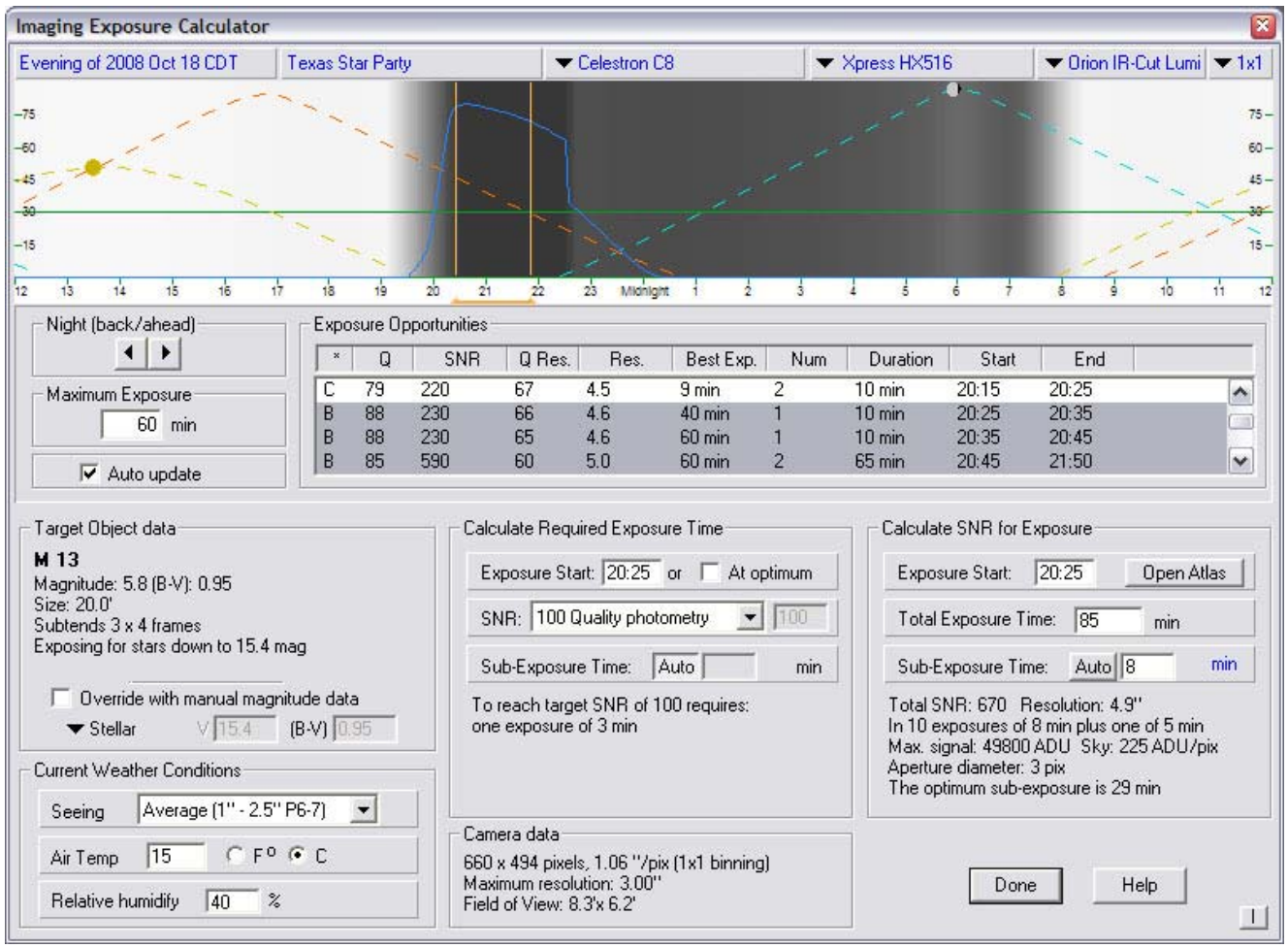
Since using this program, I have greatly reduced my problems with soggy paper and losing pages whenever a breeze comes up. The program automatically prompts for backups, but, as it is an incredibly stable program, I have not had to make use of these backups.

The recommended system requirements for SkyTools 3 are a Pentium 4 with 512MB of RAM or better, 650 MB of hard drive space is required for maximum install (so the CD is not required), but can be run with a Pentium II 233. A cd/dvd drive is necessary for loading the program and database.

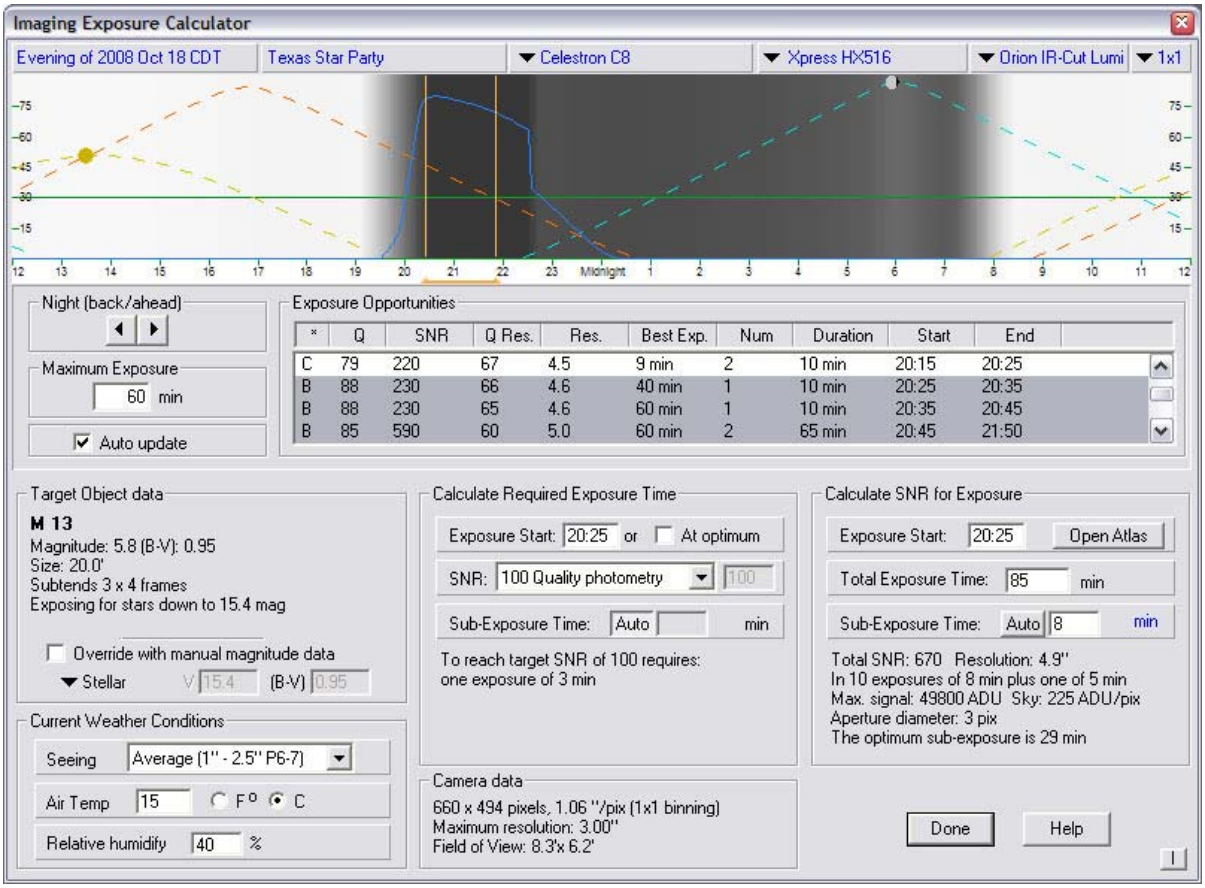
The picture below shows the main interface screen. The bar in the upper part of the screen shows sun, moon and object rise and set times, plus hours of total darkness.



This screen is the image exposure screen



This last screen is a part of the Database Power Search tool

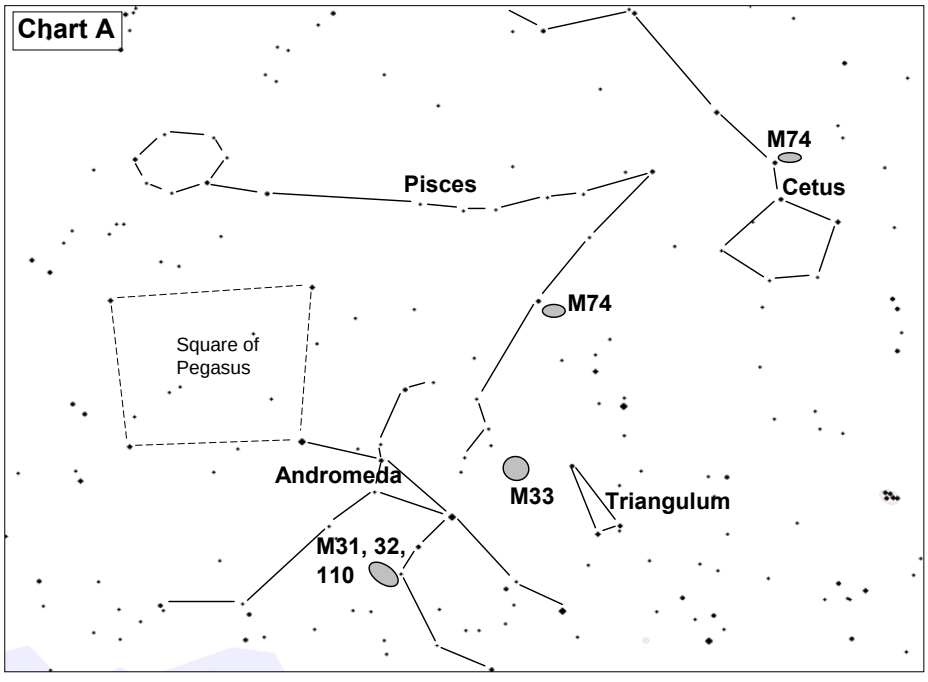


Star Hopping to Messiers #9

Andromeda (M31, 32 & 110), Pisces (M74), Cetus (M77) and Triangulum (M33)

Bob Bee

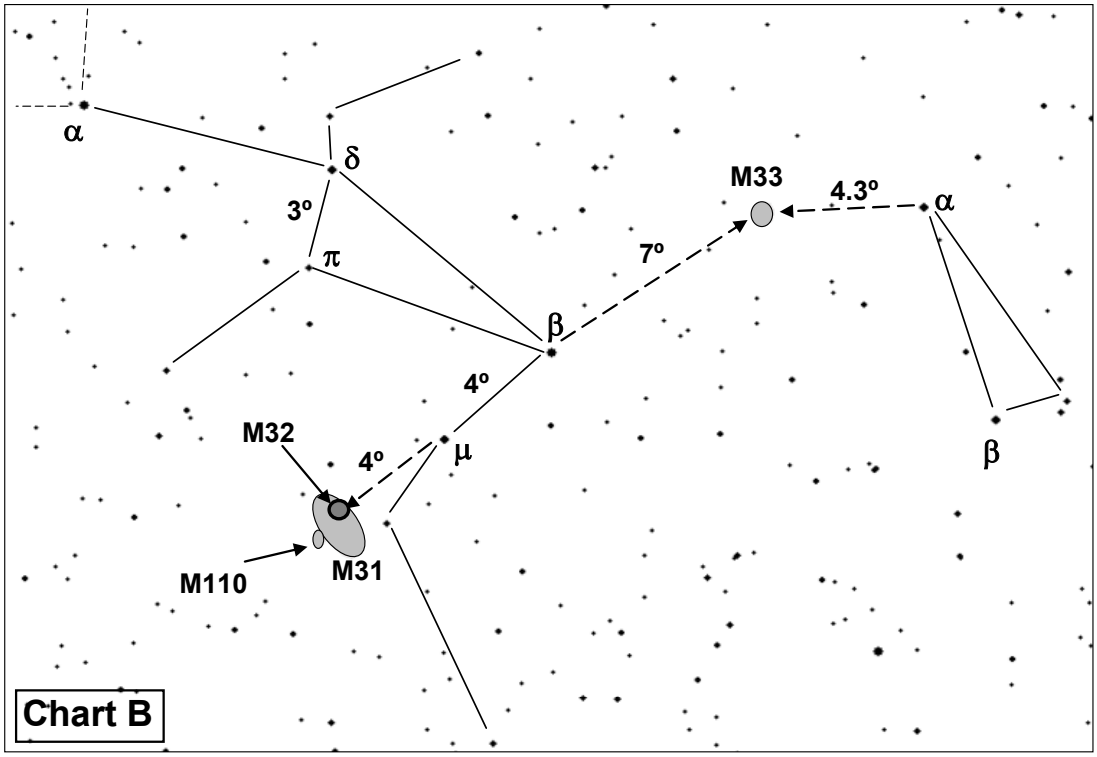
The four constellations are close together in the same area of sky as shown in Chart A below.



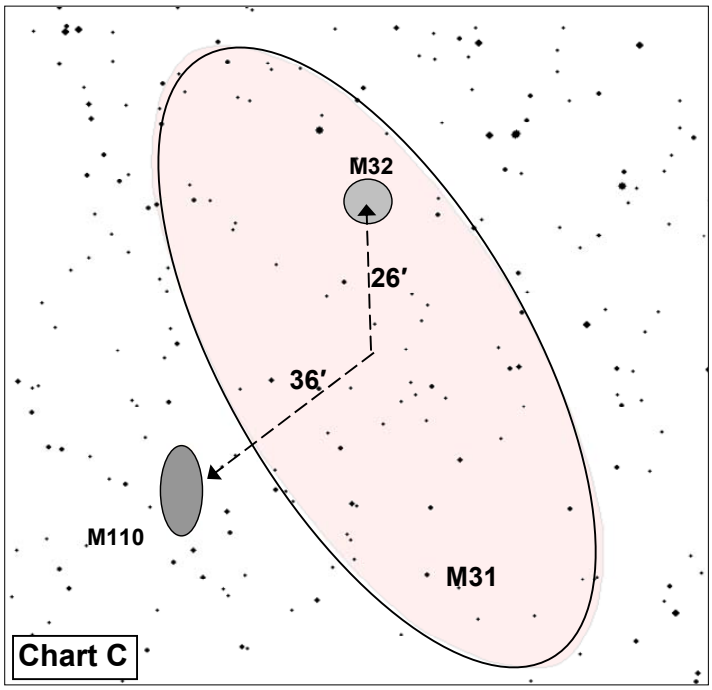
Andromeda - M31, M32 & M110:

Let's start with the biggest Messier, **M31 in Andromeda**. In any decent non light-polluted sky, M31, the Andromeda galaxy, should stand out like the Magellanic Clouds, a distinctive fuzzy patch in the sky. Even with moderate light pollution, you can still see the galaxy's core in binoculars or a finder scope. So if you can, improve your chances by getting away from the city and suburban light glow.

The path to Andromeda is via Pegasus. That is, find the Square of Pegasus (easy), then Andromeda starts from the square's bottom right star. With the help of Chart A and Chart B (below), identify the stars β (mag.2.1) and μ (mag 3.9). If not immediately obvious, work from α And. (the bottom right star of the Square), move down and east by 7º to find the two stars δ and π (3º apart). Then move a further 7º down and east to locate β and μ. Now these two are 4º apart. If you extend this line by the same distance, it should land right on M31. (You'll see there is another mag. 4.5 star between μ and M31. Got it?



Now for M32 and M110, its satellite galaxies. They will look like this (except they may be inverted in your eyepiece.



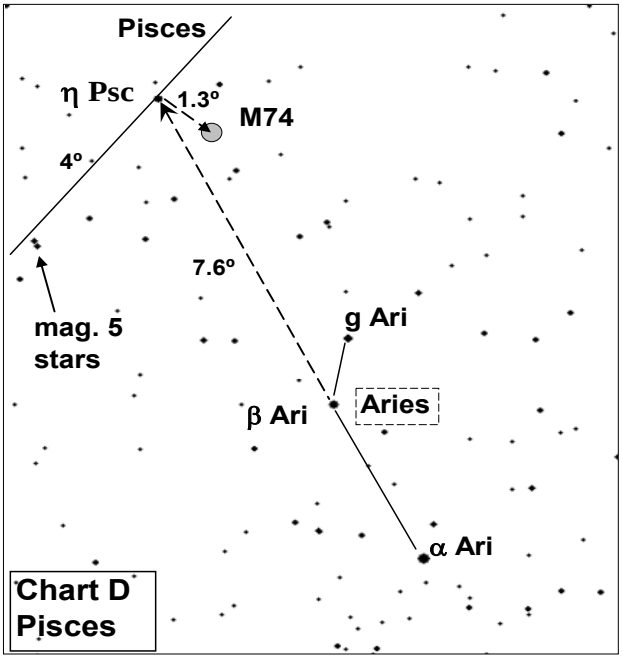
M31, M32 (top left) & M110 (lower centre).

As you can see from Chart C, M32 is imbedded within the halo of M31 as a bright fuzzy ball. If you can estimate the 'centre' of M31's disc, **M32** is located 26′ above that point. From the same 'centre' point, **M110** is a long (17.4′) ovalish smudge 36′ from it in the '7 o'clock' position.

Trianglum - M33:
Now refer back to Chart B to locate **M33**. It is a face on spiral galaxy covering an area of sky twice the diameter of our full Moon, spreading out its light. For this reason, it is not prominent and is best seen in binoculars or on your lowest power eye piece to enhance contrast. It also helps if you have a good dark night.

If you can locate the faint 3rd and 4th mag. stars of the thin triangle, it's easy. Put your f/s edge on the top star, α Tri, and M33 will be 4.3º (inside your f/s FoV) to its west. Alternatively, find μ and β And. as before, then extend the line between them by about double their distance (7º) and you should land on M33.

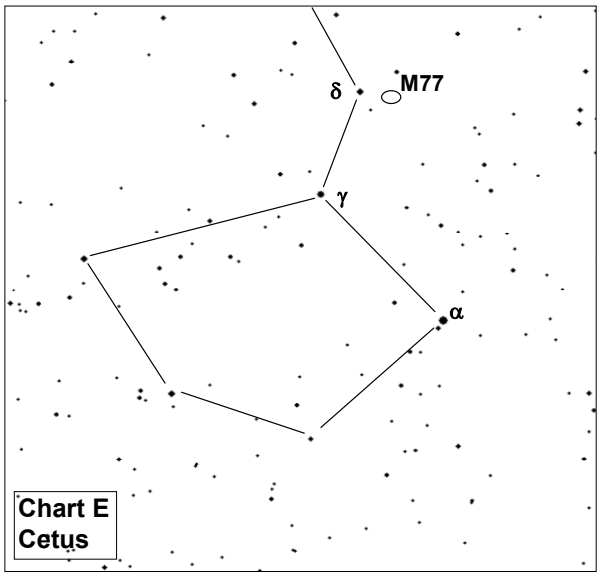
Pisces – M74:
M74 is another face-on spiral galaxy only 10.2′ diameter (much smaller than M33) and mag. 9.2 (too faint to see in your f/s).
You need to locate the mag. 3.6 star η Psc (see the general location from Chart A.) This can be found by first locating Aries, then extending the line from α to β Ari. by 7.6º – this will land right on η Psc. When you find η, locate the two close mag. 5 stars below and to its west. This will give you a 4º long base line to work from.



Place the two mag 5 stars and η Psc in your f/s FoV. Move away from η at right angles to the base line by 1.3º back towards Aries. This should land you right on M74. The 4º x 1.3º triangle should fit nicely in your f/s FoV.

Cetus – M77:

Refer again to Chart A for the general location and shape of Cetus. You only need to find its head at the lower east. M77 is only 6.9′ across and is mag. 8.8 but finding it from the guide stars is quite simple.



Look at Chart E above, showing more detail of the monster's head.

3º above γ Cet.(mag 3.5) is the 4th mag. δ. Find that first. Now move east at right angles to the γ – δ line by a mere 52′. That lands you on **M77**. The γ – δ - M77 triangle will all fit in the FoV of your f/s.

Good hunting.

Black Holes Ain't Holes – Part 5

An essay on the problems perceived with the concept of black holes

Robert Zindler

(Editors Note: Robert Zindler has kindly offered the readers of Prime Focus sections of an essay he producing. Each month you will find the next extract from this essay.)

Cosmologist' s descriptions of a black hole and its core singularity

More can perhaps be gleaned about black holes from their descriptions by a few authorities. Their notes describe the conventional cosmological views of black holes, even though there may be some inconsistencies within their own publications or between the authors.

Brian Greene, *The Fabric of the Cosmos*

Brian Greene, (*The Fabric of the Cosmos,* Penguin Books, 2004) writes:
"The centre of a black hole, in which an entire star has been crushed by its own weight to a miniscule point, and the big bang, in which the entire observable universe is imagined to have been compressed to a nugget far smaller than a single atom …(p 17)."
"According to general relativity, all the matter that makes up a black hole is crushed together at a single miniscule point at the black hole's centre (p 337)."
"For physicists … the existence of a realm in which the known laws of physics break down – no matter how esoteric the realm might seem – throws up red flags (p 337)."
"After all, the universe works; … the universe does not break down. The correct theory of the universe should, at the very least, meet the same standard (p 337)."

And Brian Greene, *The Elegant Universe*

Brian Greene, (*The Elegant Universe,* Vintage, 2000) writes:
"John Wheeler (made) the statement 'black holes have no hair.' By this Wheeler meant that except for a small number of distinguishing features, all black holes appear to be alike. The distinguishing features? One of course, is the black hole mass. What are the others?"
"…they are the electric and certain other force charges a black hole can carry, as well as the rate at which it spins (p 321)."
"…according to Einstein's theory, there is no minimum mass for a black hole (p 321)."
"When – according to Andrew Strominger in 1995, the three-dimensional sphere has collapsed to a pinched point, the corresponding black hole…is mass-less." and "…what in the world is a mass-less black hole… (p 331)?"
"In 1970, Jacob Berkenstein, then a graduate student of John Wheeler…made an audacious suggestion. He put forward the remarkable idea that black holes `might have entropy and a huge amount of it." This was based on the "…well-tested second law of thermodynamics, which declares that the entropy of a system always increases. Everything tends toward greater disorder (p 334)."
The "…total area of the event horizon of a black hole always increases (p 335)."
"…the more massive the (black) holes, the greater the entropy (p 338)."
"But disorder of what (p 338)?"
"…the mystery remained unsolved (p 338)."
"…the enormous inward force of gravity (p 339)."
"…this results in a cataclysmic implosion of the star's enormous mass; it violently collapses under its own tremendous weight, forming a black hole (p 339)."
"…all of the matter that has crossed the event horizon is inexorably drawn to the centre of the black hole, and since once there the matter has no future, time itself comes to an end at the heart of a black hole (p 344).

Observing From My Backyard

Ian Cook

Last week I was observing with binoculars from my backyard which is sheltered from bright street lights at the front of my neighbor's place.

I had been sweeping the northern and southern skies just trying to identify locations where I knew I would be looking for double stars on another night with my telescope. I heard aircraft jet engines and as I usually do I glanced up to watch an aircraft approaching Sydney with its' landing lights flaring out ahead in the slight cloud over head.

Suddenly my heart thumped as a very bright light appeared just to the left of the aircraft and flew in a straight line keeping pace with it. I lifted my binoculars but couldn't get it in view.

Quickly putting them down I moved slightly to the left to keep the sight from disappearing behind the roof line, when to my amazement nine or more bright lights sprang into view flying in formation with the original one, alongside the aircraft. I wondered what these could be? Could the pilot of the aircraft see them, and what did he think of them tracking him across the sky?

I stared as the lights flashed across the sky and kept perfect formation. I turned to keep them in view when they just disappeared. They did not slowly fade away as if they flew behind a cloud. But one moment they were there, the next they were gone. Had I seen a UFO?

As I pondered this thought I looked up again and there they were again! All nine or ten of the UFOs, were back. Still flying in that perfect formation. In much the same spot!

I shifted my weight to my right foot and the lights flashed forward. I shifted to my left and they went backwards. Then I noticed I was actually looking through my TV antennae, and the UFOs were points of light from the street light out front reflected off the antennae extensions. Want to see some UFOs come to my place I can produce them on demand.

Goes to show it's not always the seeing that's believing, but the understanding!

Prime Focus Article Submission

Deadline for article submissions for the January edition of Prime Focus is

Monday 12th January 2009

All Articles can be submitted via email
cyberpiggy@optusnet.com.au
Or via snail mail to the MAS Postal address

Thanks to all the Prime Focus contributors for 2008

John Rombi
Roger Powell
Bob Bee
Ian Cook
Daniel Ross
Geoff Young
Robert Zindler
Stuart Cant
Dick Everett
David Jones
Ursula Braatz
Lloyd Wright
Henry Swierk
Noel Sharpe
David Hall