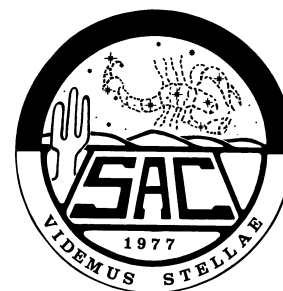


# Saguaro Astronomy Club

Metro Phoenix, Arizona

## SACNEWS



December 1993 — Issue #203

v12.1

## The Great Moon Race: The Final Lap

by Andrew J. LePage

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*This article from the November, 1993 (Volume 5, Number 4) issue of the Electronic Journal of the Astronomical Society of the Atlantic (EJASA) of the Astronomical Society of the Atlantic (ASA).*

As the year 1967 began, the Soviet Union's unmanned probe LUNA 13 had just fallen silent on the surface of the Moon. LUNA 12 would still be operational for another nineteen days, continuing to gather data from lunar orbit.

The Americans also had their share of functioning lunar spacecraft. LUNAR ORBITER 2, with its photographic mission completed, continued to orbit the Moon, gathering information on the newly discovered mascons, the radiation environment, and micrometeoroids. Within one week, SURVEYOR 1 would be revived one last time in order to gather Doppler tracking data for refining scientists' knowledge of the Moon's orbit around Earth.

In the United States, the last three LUNAR ORBITERS and five SURVEYORS were in various states of readiness. All were scheduled for launch in 1967 to round out America's unmanned lunar exploration effort. Once their missions were completed, emphasis would shift to the manned APOLLO program.

In the Soviet Union, things were progressing differently. The political need for further lunar flights evaporated with the success of the LUNA spacecraft launched in 1966. A few surplus second generation spacecraft buses remained and would be modified as needed to support the needs of the Soviet manned lunar program. With the death of Sergei Korolev one year earlier, the design and construction of Soviet unmanned lunar spacecraft was moved from the Korolev Design Bureau to the Babakin

### Quick Calendar

**SAC Star Party**  
Buckeye Hills Recreation Area  
Saturday, December 11

**SAC Party**  
7:30, Saturday, December 18

**SAC Star Party**  
Buckeye Hills Recreation Area  
Saturday, January 8

**SAC Meeting**  
7:30, Friday, January 28

### Membership Renewals Are Due

**Renewals: 32 of 114 — Have you renewed?**  
See Member Services Form on the back page.

### 1994 SAC Officers

President	Bob Gardner
Treasurer	Carol Lee
Secretary	A.J. Crayon
Properties	Pierre Schwaar

Design Bureau. Here they were busy designing and testing the Soviets' third generation of unmanned lunar explorers. Elsewhere, preparations were being made to start unmanned tests of the L-1 circum-lunar spacecraft.

### LUNAR ORBITER 3

On February 5, 1967, the year's first new lunar probe was launched. LUNAR ORBITER 3 lifted off from Pad 13 at Cape Kennedy with a mission to complete the mapping

### SAC Officers

President	Bob Dahl	582-5526
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Treasurer	Carol Lee	946-9206
Secretary	Susan Morse	934-7496
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SACNEWS Editor	Paul Dickson	841-7044
Public Events	Piet Burggraaf	995-1964

of potential APOLLO Lunar Module landing sites. After 37.7 hours of flight, a short 4.3-second course correction burn was performed. At the launch plus 54.9 hour mark, the main engine flared to life once more for 542.5 seconds, easing the Moon's latest visitor into a 124 by 1,150-mile (200 by 1,850-kilometer) orbit, inclined 21 degrees to the lunar equator. Four days later, a trim maneuver lowered the perilune to 30 miles (48 kilometers). On February 15, LUNAR ORBITER 3 began its photographic survey of the Moon.

By February 23, LUNAR ORBITER 3 had exposed 211 frames, including views of one dozen potential APOLLO and SURVEYOR landing sites. Unfortunately, only 182 of those frames were returned back to Earth when the stalled film winding motor burned out on March 2, making further transmission impossible. Despite this failure, LUNAR ORBITER 3 had completed the program's objective of mapping equatorial lunar landing sites. The last two orbiters would be free to pursue more scientific objectives from polar orbit.

Meanwhile, LUNAR ORBITER 3, like its predecessors, continued on in lunar orbit after the completion of its photographic mission. On April 12, the orbit was altered to avoid prolonged periods of darkness during the April 24 eclipse of the Sun by Earth. A 125.5-second burn on August 30 dropped the spacecraft's apolune from 1,133 miles (1,823 kilometers) down to 196 miles (315 kilometers). With the perilune unchanged at about 89 miles (143 kilometers), this orbit simulated APOLLO's 100-mile (160-kilometer) high lunar parking orbit. A final 32-second burn on October 9 decreased LUNAR ORBITER's speed by 118 miles per hour (53 meters per second), deliberately crashing the probe at 14.6 degrees north, 91.7 degrees west.

### SURVEYOR 3

The first SURVEYOR flight of 1967 would be the first of the series to carry a scientific instrument other than a television camera. Towards the end of 1965, six instruments for the advanced SURVEYOR mission had been chosen for development. Two of these, the television camera and touchdown dynamics system, were already being flown. The other four experiments chosen for further development included a micrometeorite detector, a seismometer, a device to assess the chemical makeup of the surface, and a surface digger. With the cancellation of the advanced SURVEYOR flights, ways were sought to speed up development and incorporate some of these instruments on the remaining five "engineering" missions. It was the digger, officially known as the Soil Mechanics Surface Sampler (SMSS), that would be carried on SURVEYOR 3.

The SMSS was a simple extendible tubular aluminum pantograph with a small steel-tipped bucket on the end. It was mounted on the bracket that once held the never-used descent camera. To simplify the SMSS interface with the lander, this new experiment was modified to make use of the camera's existing wire harness and command lines. The SMSS used four reversible electric motors to move. One motor controlled the extension of the device, which could reach from 23 to 58 inches (0.6 to 1.5 meters) in front of the lander on level ground. The second motor controlled the azimuth. The maximum clear range was 112 degrees of arc starting from Landing Pad 2. The third motor, connected with a clutch, controlled the elevation of the bucket, which could be varied from forty inches (one meter) above to 18 inches (0.45 meter) below the surface. Finally, the fourth motor opened and closed the door of the five-inch (thirteen-centimeter) long, two-

## SAC and SAC Meetings

Saguaro Astronomy Club (SAC) was formed in 1977 to promote fellowship and the exchange of scientific information among its members — amateur astronomers. SAC meets monthly for both general meetings and star parties, and regularly conducts and supports public programs on astronomy.

SAC meetings are usually held on the Friday nearest the full moon. This means that over the course of the year, meetings are not held on same week of the month. The same is true of the club's star parties. Star parties at Buckeye Hills are mostly held on the Saturday of the third quarter moon.

### 1993 SAC Meetings

Dec. 18 Party  
 — 1994 —  
 Jan. 28  
 Feb. 25  
 Mar. 25  
 Apr. 22  
 May 27  
 Jun. 24  
 Jul. 22  
 Aug. 19  
 Sep. 16

### 1993 SAC Star Parties

Date	Sunset	Moonrise
Dec. 11	5:22pm	6:35am
— 1994 —		
Jan. 8	5:38pm	5:22am
Feb. 5	6:05pm	4:11am
Mar. 5	6:29pm	2:58am
Apr. 9	6:55pm	5:42am
May 7	7:16pm	4:17am
Jun. 4	7:34pm	2:52am
Jul. 2	7:42pm	1:27am
Aug. 6	7:24pm	6:09am
Sep. 3	6:51pm	4:56am

inch (five-centimeter) wide bucket. These motors, upon command from Earth, would operate in bursts of either 0.1 or 2.0 seconds.

Originally the SMSS was also to be instrumented with position sensors, two strain gauges, and an accelerometer on the bucket. Due to the limitations of development time and the limited number of existing telemetry channels, scientist would have to content themselves with readings of motor current and temperature for one motor at a time. Still, combined with television images, this would be enough to roughly characterize the properties of the lunar surface.

On April 17, 1967, SURVEYOR 3 finally lifted off on ATLAS-CENTAUR 12 into a 103.5-mile (166.5-kilometer) high Earth parking orbit, the first SURVEYOR ever to do so. After a 22-minute, 9-second coast, CENTAUR successfully reignited and sent the new SURVEYOR on its way to the Moon.

In addition to the SMSS, the lander was also equipped with a pair of small mirrors mounted on the frame. This would allow controllers to peek below the lander once on the surface to see what, if any, effect landing had on the

ground beneath. A mid-course maneuver performed 21 hours, 41 minutes after launch fine-tuned the aim to a point 230 miles (370 kilometers) south of the rayed crater Copernicus in Oceanus Procellarum.

Two days later, SURVEYOR 3 was 47 miles (76 kilometers) above the lunar surface, traveling at 5,874 miles per hour (2,625 meters per second), 25 degrees to the local vertical. The solid retrorocket ignited and was jettisoned forty seconds later, leaving the three vernier engines to further slow SURVEYOR's 312 mile per hour (139 meter per second) descent. Seconds before the vernier engines were to shut down 14 feet (4.3 meters) above the surface, the descent radar lost its lock on the surface and the lander switched to inertial guidance. Essentially flying blind, the verniers continued firing until touchdown at a speed of 4.8 miles per hour (2.1 meters per second), the slowest touchdown in the series.

SURVEYOR 3 was not quite down yet. The lander rebounded at a ten degree angle with the verniers still firing. The hapless lander bounced up 35 feet (11 meters) and landed again about 66 feet (20 meters) away. This was followed by another 11-foot (3.3-meter) high, 36-foot

# Comet Comments

by Don Machholz

(916) 346-8963

November 10, 1993

Four comets are now visible in our skies, two more were recovered.

Comet	Mueller		(1993a)		
Date	RA-2000-Dec	Elong	Sky	Mag	
11-29	20h31.8m	+46° 30'	89°	E	8.8
12-04	20h41.5m	+41° 54'	85°	E	8.8
12-09	20h50.2m	+37° 39'	81°	E	8.9
12-14	20h58.3m	+33° 46'	76°	E	8.9
12-19	21h05.7m	+30° 15'	72°	E	9.0
12-24	21h12.8m	+27° 04'	67°	E	9.0
12-29	21h19.5m	+24° 13'	63°	E	9.1
01-03	21h25.9m	+21° 40'	58°	E	9.2
01-08	21h32.0m	+19° 23'	53°	E	8.2

Comet	Mueller		(1993p)		
Date	RA-2000-Dec	Elong	Sky	Mag	
11-29	22h54.4m	+10° 49'	101°	E	10.8
12-04	22h52.4m	+07° 41'	95°	E	10.7
12-09	22h51.3m	+04° 45'	89°	E	10.6
12-14	22h51.0m	+02° 01'	83°	E	10.5
12-19	22h51.6m	-00° 30'	77°	E	10.5
12-24	22h52.8m	-02° 50'	71°	E	10.4
12-29	22h54.7m	-05° 00'	66°	E	10.2
01-03	22h57.1m	-07° 02'	60°	E	10.1
01-08	23h00.1m	-08° 55'	55°	E	10.0

**Periodic Comet Urata-Nijima (1993q):** Recovered by Jim Scotti of Kitt Peak, this comet will remain faint. The orbital period is 6.6 years.

**Periodic Comet Spitaler (1993r):** Jim Scotti first thought that this was a discovery of a new comet. However, upon his suggestion, this is now proven to be Periodic Comet Spitaler, lost since discovery in 1890. Its 7.1 year orbit has brought it to perihelion 13 times since then. It is expected to remain faint.

Periodic	Comet		Encke		
Date	RA-2000-Dec	Elong	Sky	Mag	
11-29	22h40.4m	+07° 29'	97°	E	10.9
12-04	22h36.3m	+06° 36'	91°	E	10.8
12-09	22h33.3m	+05° 51'	85°	E	10.6
12-14	22h31.3m	+05° 12'	80°	E	10.4
12-19	22h30.2m	+04° 38'	74°	E	10.2
12-24	22h29.6m	+04° 08'	69°	E	9.9
12-29	22h29.5m	+03° 40'	64°	E	9.6
01-03	22h29.4m	+03° 12'	59°	E	9.3
01-08	22h29.0m	+02° 38'	53°	E	8.9

Periodic	Comet Schwassmann-Wachmann 2				
Date	RA-2000-Dec	Elong	Sky	Mag	
11-29	08h34.3m	+16° 28'	120°	M	11.6
12-04	08h37.5m	+16° 22'	124°	M	11.5
12-09	08h40.1m	+16° 20'	129°	M	11.4
12-14	08h41.8m	+16° 21'	134°	M	11.4
12-19	08h42.8m	+16° 26'	138°	M	11.3
12-24	08h43.0m	+16° 35'	144°	M	11.2
12-29	08h42.4m	+16° 48'	149°	M	11.1
01-03	08h41.1m	+17° 05'	154°	M	11.1
01-08	08h39.1m	+17° 26'	160°	M	11.0

(11-meter) long hop. On ground command, the verniers were finally shut down 34 seconds after first contact and part way through the second hop. With its engines off, SURVEYOR 3 skidded sideways another foot (thirty centimeters) and finally came to a stop. SURVEYOR had come down at 2.97 degrees north, 23.34 degrees west longitude, less than one mile (1.6 kilometers) from its aim point.

Finally down, controllers checked to make sure that the batteries had a sufficient charge after the unscheduled power demands of the probe's landing. Satisfied with the condition of the batteries and other systems, SURVEYOR 3 returned its first image of the surface 58 minutes after arriving. Much dust had been kicked up by the rough landing and this had its effect on the camera. Dust partially coated the television camera's scan mirror, reducing the quality of the images. Dust had also worked its way into the gears, making it difficult to point the camera. Despite the problems, the images returned showed that the spacecraft had come to rest on the inside slope of a degraded 650-foot (200-meter) diameter, 50-foot (15-meter) deep crater strewn with blocks up to thirteen feet (four meters) long. All in all, the terrain looked similar to that observed by SURVEYOR 1 less than one year earlier.

The day after landing, a pyrotechnic pin was fired to release the SMSS. There was some concern that the arm would not operate. Due to an apparent shortage of power caused by the longer-than-normal landing and indications that the power-hungry descent systems had not shut down properly, the SMSS electric motor heaters were shut down to conserve power. After it had been determined that the power shortage did not in fact exist, the heaters were turned back on. As it turned out, the SMSS suffered no damage from its cold soak and worked properly. During the days that followed, the device operated for a total of 18.3 hours, receiving a total of 5,879 commands; over one-tenth of the 57,848 commands SURVEYOR 3 responded to during its first day of operation.

During testing it was found that the arm's motor current telemetry was too noisy to be of much use. Possibly because of dust in the gears, the SMSS could only apply one-third of the expected force during trenching operations. Despite the minor problems, the SMSS performed seven bearing tests, thirteen impact tests, and dug four trenches. The results of these tests indicated that the lunar soil behaved similarly to fine-grained terrestrial soils and was firm enough to support a manned spacecraft. A small rock was also picked up after much effort. Up to one hundred pounds per square inch (eight bars) was applied, but the bucket failed to crush the stone.

By the end of its first day on the Moon, SURVEYOR 3 had returned a total of 6,326 images. Unfortunately, the lander did not survive the long, cold lunar night (equivalent to fourteen Earth days) and could not be raised by ground controllers the following lunar dawn.

This would not be the last of SURVEYOR 3, however. On November 19, 1969, 942 terran days or almost 32

lunar days after landing, the second manned lunar landing mission, APOLLO 12, landed on the rim of what became known as Surveyor Crater only 510 feet (155 meters) from the long-silent lander. Astronauts Pete Conrad and Alan Bean removed the television camera, SMSS bucket, and a sample of aluminum tubing and wire harness. They returned them to Earth to determine the effects of long exposure to the lunar environment.

Aside from the discoloring of the white paint and a coating of lunar dust, these components survived in good shape. According to one test, a bacterium (*Streptococcus mitis*) in the camera survived through the spacecraft's vacuum testing and 31 months on the lunar surface. It is possible that the bacterium was deposited during the journey back to Earth, but similar tests performed on a portion of the wire harness showed no signs of bacteria or other organisms.

### **The Second Round**

The next mission on deck was LUNAR ORBITER 4. This would be the first of the series to assume a polar orbit around the Moon. From this vantage point, LUNAR ORBITER would be able to view virtually the entire lunar surface, including the previously poorly-imaged lunar poles. In order to take advantage of this opportunity, the photographic system was loaded with an extra sixty feet (eighteen meters) of film. This orbit would also expose the probe to much higher thermal loads. The problem was solved by placing more than five hundred quartz mirrors on the Sun-facing underside of the equipment deck. On May 4, an ATLAS-AGENA D placed LUNAR ORBITER 4 on a trajectory towards the Moon.

The day after launch, a 53.8-second burn of the velocity control engine fine-tuned the aim. Three days later, this engine came to life again for 501.7 seconds, cutting 1,474 miles per hour (659 meters per second) off of LUNAR ORBITER's speed, allowing it to slip into a 1,681 by 3,750-mile (2,705 by 6,034-kilometer) orbit inclined 85.48 degrees to the Moon's equator. Once mapping began, the orbiter performed two hundred camera pointing maneuvers to view the many scattered targets of interest. This was much more than the fifty performed by its predecessor.

Unfortunately the new thermal control measures were not fully up to the task. The photographic system experienced higher-than-normal temperatures and some images were lost to fogging. Still, by June 1, 163 usable frames were received that showed 99 percent of the Moon's near side, as well as the first clear images of the lunar south polar region.

Two orbit trim maneuvers on June 5 and 8 altered the orbit height to 48 by 2,451 miles (77 by 3,943 kilometers). From this vantage, LUNAR ORBITER 4 could map the lumpy lunar gravitational field at higher latitudes. This knowledge was needed to support the last LUNAR ORBITER mission, which would fly in this lower orbit. Contact was unexpectedly lost on July 17 and LUNAR ORBITER 4 is thought to have crashed in late October of

1967 somewhere on the Moon.

*To be continued next month.*

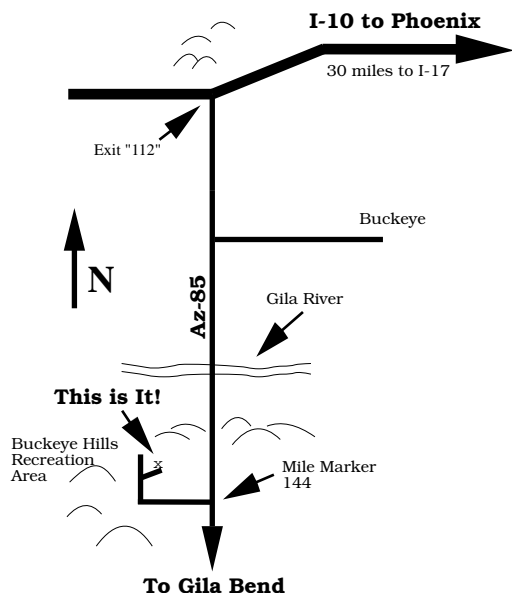
### About the Author

Andrew J. LePage is a scientist at a small R&D company in the Boston, Massachusetts area involved in space science image and data analysis. He has written many articles on the history of spaceflight and astronomy over the past few years that have been published in many magazines throughout North America and Europe. Andrew has been a serious observer of the Soviet/CIS space program for over one dozen years. Andrew's Internet address is: [lepage@bur.visidyne.com](mailto:lepage@bur.visidyne.com).

## Directions to SAC Events

**SAC General Meetings** 7:30 PM at Grand Canyon University, Fleming Building, Room 105 — 1 mile west of Interstate 17 on Camelback Rd., north on 33rd Ave., second building on the right.

**SAC Star Parties** at Buckeye Hills Recreation Area



Interstate 10 west to Exit 112 (30 miles west of Interstate 17), then south for 10.5 miles, right at entrance to recreation area, one-half mile, on the right. No water and only pit toilets. Please arrive before sunset; allow one hour from central Phoenix.

**SAC Deep Sky Subgroup Meeting** at John & Tom McGrath's, 11239 N. 75th St., Scottsdale, 998-4661 — Scottsdale Rd. north, Cholla St. east to 75th St., southeast corner.

## Newsletter Deadline

Mail items at least two weeks before the end of the month. Items arriving too late for an issue will be included in the next newsletter.

# Bits and Pieces

## Deep Sky Meeting

The Deep Sky Group is made up of people that like to observe celestial bodies out past the far reaches of our Solar System. These bodies include stars, nebula and galaxies. If you are interested in sharing your observations, or knowing what they look like in telescopes — then by all means come join us at the next meeting. We will discuss Deep Sky objects in Gemini and Lupus. The meeting will be held at John McGrath's house; directions are here in the newsletter.

You don't need to RSVP, we don't extend special invitations to anyone — ourselves included. If you are interested show up, we'd love to have you.

The Deep Sky meeting will take place on Thursday, February 3 at 7:30pm.

## Minutes of the October Meeting

The October meeting opened at 7:35 PM with President Bob Dahl giving a welcome to guests and new members asking them to sign the guest book to receive the SAC newsletter. Paul Dickson reminded members about the upcoming casting party scheduled in mid-December [Now scheduled for the first week of January. -ed.] to be held at the University of Arizona's Mirror Laboratory in Tucson — more information will be in the newsletter. Rich Walker reported that at the public star party at Thunderbird Park, there were at least fifteen scopes and no one had to wait in long lines for viewing. The All-Arizona Star Party had good conditions for Friday, but clouds cleared most everyone out by Saturday evening.

Piet Burggraaf asked for telescope support at the Desert Valley School for Wednesday, November 17. A.J. Crayon reported that the Deep Sky Meeting will be on November 4 at the McGrath house; the constellation will be Pisces. He also presented the Messier Catalog award to Bob Gardner and explained about the new award of 1000+. This is for those observers who have completed the Messier, the Best 110 NGC, and the Herschel 400, and gave the first award and plaque to Steve Coe for his completion.

Carol Lee gave the Treasurer's Report and mentioned that there was a change in the group rate for Astronomy magazine — now \$18/year. Subscription and membership renewals are now due. Steve Coe still has the deep sky database disk available for members. Stan Student said that the club's library also has a copy. Pierre Schwaar was featured on Channel 3's news in connection with the Space Shuttle's dawn appearance. Although, Pierre was not able to see it, several other club members reported good sightings.

The Club's annual Christmas Party is scheduled for Saturday, December 18, 1993, and currently we need a

volunteer to host the gathering. Please contact Bob Dahl if you can help.

November is the annual election month, and President Bob Dahl opened the offices for nominations. Tentatively, the slate of officers is as follows: President — Tom Polakis, Vice-President — Tim Lee, Secretary — A.J. Crayon, Properties — Pierre Schwaar, and Public Relations — *open*. Carol Lee has agreed to continue as Treasurer for the coming year. All members are encouraged to nominate other members or themselves for the elections at next month's meeting on November 19, 1993.

There was no scheduled program and the meeting adjourned at 8:10 PM.

Respectfully submitted, —*Susan V. Morse, SAC Secretary*

## Minutes of the November Meeting

President Bob Dahl opened the meeting at 7:35 PM mentioning the elections. He reminded members about the upcoming lunar eclipse on the last Sunday (November 28). It starts around 9:30 with maximum coverage around 11:30 PM. All members are required to renew their memberships and subscriptions.

Leroy Paller will host the annual holiday party at his house on December 18, from 7:00 PM until dawn. There are flyers on the table with details, including the food requirements (BYOB). All members are invited to see his observatory and join in the festivities. Carol Lee gave the Treasurer's Report and will gladly collect any dues or subscription renewals.

Paul Dickson announced that the mirror spin casting party at the Stewart Observatory Mirror Lab at the University of Tucson will be held sometime in early January. More will follow later in the newsletter.

The President then opened the meeting for the nomination of officers. The following names were nominated for the opened positions: President — Bob Gardner; Vice-President in charge of programming — *open*; Secretary — A.J. Crayon; Treasurer — Carol Lee; Properties — Pierre Schwaar; Public Events — Rich Walker. After much discussion and suggestions, no name was submitted for Vice-President. A motion was made by Paul Dickson that the officers elected for the current year have their membership dues extended. Bob Dahl said that particular topic had arisen before, but it was felt that no compensation was necessary for the officers who were elected. A motion was made by Gerry Rattley to accept the slate of candidates as presented. It was seconded by Paul Dickson and passed. It was suggested that at the annual holiday party, other members would be asked to fill the still open position of Vice-President.

Rich Walker then talked about his recent visit to a school where he demonstrated his telescope for students. He has also spoken to other groups such as Cub Scout packs and urged the members to consider doing similar community service presentations.

No regular program was scheduled and the meeting adjourned.

Respectfully submitted, —*Susan V. Morse, SAC Secretary*

## Letters

*This letter arrived several months ago from the author of the July newsletter article.*

Paul,

Thanks for the copy of my article sent to me. I would be interested to know what the reaction to it is if any feedback comes in.

Writing that article and my current work in astro history has rekindled my interest in Astronomy. Until about ten years ago I was a very active observer but due to career, family and other pressures I slowly drifted away. I would not like to get back into Astronomy, since things have changed over the last ten years I would appreciate some advice.

Looking at scopes: a 8 or 10 inch SCT seems a good compromise between size, portability and price. The two makes that are widely advertised are Celestron and Meade. Do you have any suggestion as to which is better, is there a difference?

An 8 or 10 inch, for one man setup and dismount is the 10 inch to heavy/cumbersome for this?

The additionally coatings offered, are they effective?

Hope this is not too much to ask. There is no real urgency about this so pls do not feel compelled to answer right away. Any advice you could offer would be appreciated. One final point — my area of interest is deep sky objects. I have not yet gotten around to a detailed examination of the Mag clouds (visible only for the south, sorry) this will be one of my first project with my new scope.

Thanks again.

Ian Bacon, P.O. Box 166  
Scarborough, Australia, 6019  
phone: +61 (09) 380 2165  
[ibacon@uniwa.uwa.edu.au](mailto:ibacon@uniwa.uwa.edu.au)

Could someone like to respond to this letter? If you do, please also send a copy to the newsletter editor.

# December 1993

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
All Times are Mountain Standard Time			<b>EVAC Meeting</b> Directions: Joe Murray 482-2918			
			1	2	3	4
5	Last Quarter Moon 8:49 a.m.	7	8	9	Jupiter 4°N of Moon 1 a.m.	11
Mercury 5°N of Antares at dawn	New Moon 2:27 a.m.	Geminid meteor shower	15	16	17	18
12	13	14	15	16	17	18
19	First Quarter Moon 3:26 p.m.	Winter Solstice 1:26 p.m.	22	23	24	25
26	27	28	29	30	31	31
		Full Moon 4:05 p.m.				

## Magazines & Discounts

Club members may subscribe to astronomical magazines at reduced rates through the club Treasurer. See the Member Services Form on the back page of this newsletter. Furthermore, club members are encouraged to align their subscriptions with the Jan.-Dec. calendar year. This eases the burden both on the Treasurer and the Publisher by permitting a single Group Renewal to be placed in the autumn for the upcoming calendar year.

Those members who experience problems with their subscriptions to *Astronomy* magazine may call Kalmbach Publishing Customer Service at (800) 446-5489.

Those members who experience problems with their subscriptions to *Sky & Telescope* magazine may call Sky

Publishing at (800) 253-0245.

Besides the club discount on *Sky & Telescope* magazine, Sky Publishing offers club members a 10% discount on all other Sky publications. This means books, star atlases, observing aids, Spotlight prints, videos, globes, computer software, and more.

Club members who subscribe to *Sky & Telescope* through the Club Discount Plan may order Sky publications directly, at the above toll-free number, without going through the club Treasurer. Simply mention the Club Discount Plan and give the Saguaro Astronomy Club name to receive the discount. Sky Publishing will check their records to verify that you are eligible to receive the discount.

# Saguaro Astronomy Club Member Services Form

## Membership

Memberships are for the calendar year and are pro-rated as follows: Jan - Mar 100%, Apr - Jun 75%, Jul - Sep 50%, Oct - Dec 25%.

- \$20.....Individual Membership
- \$30.....Family Membership (one newsletter)
- \$100.....Business Membership (includes advertising)
- \$4.....Nametag for members
- \$10.....Newsletter Only

## Subscriptions

The following magazines are available to members. Subscribe or renew by paying the club treasurer. You will receive the discounted club rate only by allowing the treasurer to renew your subscription.

Sky & Telescope.....\$20.00 for one year

Astronomy.....\$18.00 for one year

Write your name, address, and phone number in the space below.

Make checks payable to SAC.  
Mail the completed form to:

Carol Lee  
SAC Treasurer  
3314 N 68th Street, #205-W  
Scottsdale AZ 85251



## SACNEWS

c/o Paul Dickson  
7714 N 36th Avenue  
Phoenix AZ 85051

Stamp

First Class Mail