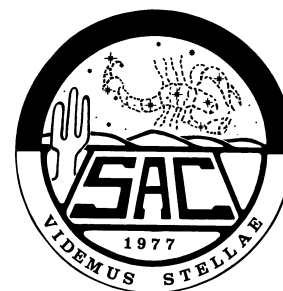


Saguaro Astronomy Club

Metro Phoenix, Arizona

SACNEWS



January 1995 — Issue #216

v12.22

The Great Moon Race: The Finish Line

by Andrew J. LePage

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I still remember that hot summer evening twenty-five years ago this month. My parents let me stay up well past my bedtime to watch the earliest historical event that I can remember. I clearly recall watching the television with the image of Mission Control fixed on the screen and listening to Walter Cronkite of CBS-TV News trying to explain to the audience the significance of the cryptic conversations taking place. For what seemed like an eternity I waited; something that any seven year-old finds difficult to do. I had watched the landing that afternoon and knew what was about to happen would be a first. However, having grown up in the Space Age with its steady diet of celestial firsts—and being only seven—I did not fully appreciate the upcoming event's significance.

Finally, just before eleven P.M. Eastern Daylight Time (EDT), the image on the TV changed and a puzzling, ghostly image appeared. At first I could not decipher what I was looking at. Then a faint human figure appeared on the screen. I quickly realized that it was an astronaut making his way down the Lunar Module (LM) ladder - but the image was upside down! After a few moments the picture righted itself. Just minutes before eleven (10:56:20 p.m. EDT, to be exact), a traveler from the planet Earth named Neil Armstrong stepped off the LM foot pad and touched the face of the Moon for the first time.

It was not too long after that I succumbed to the inevitable and fell asleep, missing the events that would fol-

Quick Calendar

SAC Meeting

Speaker: Kim Poor

7:30 PM, Friday, January 13

SAC Deep Sky Meeting

Last 22 of the 110 Best NGC

7:30, Thursday, January 19

SAC Star Party

Buckeye Hills Recreation Area

Saturday, January 28

Membership Renewals Are Due

Renewals: 47 of 105 — Have you renewed?

See Member Services Form on the back page.

low: A second human named Edwin "Buzz" Aldrin coming down the ladder, the planting of the American flag, the gathering of lunar samples, and more. The United States had won what some at the time believed was a one-sided race to the Moon.

What happened exactly the next day I do not remember. It was just part of the now blurry mosaic of typical events in the life of any kid during a summer vacation in the late Nineteen Sixties in an ordinary New England mill town: Playing with my friends Kevin and Mike, running under the sprinkler to stay cool, building forts in the woods, staying clear of my sister's friend Diane who obviously wanted to kiss me, and occasionally wondering what third grade with Sister Bertha would be like.

Most of the estimated one billion people who watched the previous evening's events, including myself, were un-

SAC Officers

President	Bob Gardner	274-5046
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Public Events	Rich Walker	997-0711

aware of what was then taking place at a different mission control center deep inside the Soviet Union. A large automated spacecraft of unproven design was attempting to make its way to the lunar surface from orbit. The crash of LUNA 15 that afternoon would be just the latest in a string of failures that ultimately denied the Soviet Union their winning a significant piece of the race to the Moon.

It would be several years before I would learn of the events of that day. It would be even more years before I read about the little-known and then mostly rumored string of failures that preceded it. Only with the advent of Perestroika and the subsequent breakup of the Soviet Union in the early 1990s would the bits and pieces of the real story finally start to trickle out from behind the crum-

bled Iron Curtain. Although many pieces are still missing, we in the West now know that there was indeed a race to the Moon and how the Soviets tried to either win parts of that race or at the very least upstage the American effort.

The Grand Plan

During the last year that lead up to the APOLLO 11 mission in 1969, the Soviet Union was working frantically on a three-pronged assault on the Moon. The first part of this effort was a program to send a man on a looping trajectory that would make a simple pass by the Moon and return him to Earth. The spacecraft that would perform this mission, known as the L-1, was a six-ton (5,600-kilogram) vehicle based on the SOYUZ design, whose de-

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.

Jan. 13
Feb. 10
Mar. 17
Apr. 14
May 12
Jun. 9
Jul. 14
Aug. 4
Sep. 8
Oct. 6
Nov. 3
Dec. 9 Party

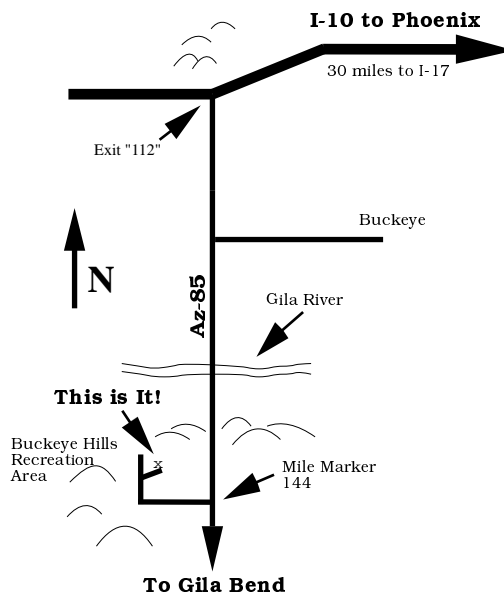
Date	Sunset	Moonrise
Jan. 28	5:56pm	5:15am
Feb. 25	6:22pm	4:00am
Mar. 25	6:41pm	2:50am
Apr. 22	7:05pm	1:30am
May 20	7:26pm	12:10am
Jun. 24	7:42pm	3:00am
Jul. 22	7:36pm	1:40am
Aug. 19	7:11pm	12:20am
Sep. 23	6:24pm	5:15am
Nov. 18	5:25pm	2:40am
Dec. 16	5:23pm	1:25am

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.



scendant is still used today to ferry crews to and from Russia's MIR Earth-orbiting space station.

From the outside, the L-1 looked like the three-part SOYUZ but lacked its spherical orbital module. Other major differences were less obvious, including a modified propulsion system, a beefed up heat shield, long-distance communication systems, and more. The spacecraft was well-suited for its simple mission to carry a lone cosmonaut on a week-long circumlunar mission. A successful mission before the American Moon landing would allow the Soviets to claim that they were the first to send a human to the Moon.

Previous tests of the L-1 were less than successful. First they were plagued by failures of the then-new PROTON launch vehicle. The first mission to make it beyond Earth parking orbit, ZOND 4, was launched in early March of 1968. To avoid unnecessary complications, ZOND 4 was aimed directly away from the trajectory-distorting influences of the Moon and its rather lumpy gravitational field. The mission was simply to test the L-1 spacecraft at lunar distances, especially the all-important communications system.

During the six days following launch, cosmonauts in a bunker on Earth spoke to mission controllers through a relay transmitter on board the spacecraft to test these systems. Upon return from cislunar space, ZOND 4 was to make a relatively low-G, double-skip entry and land in Soviet territory. Then, just before this complicated maneuver, the probe's astro-orientation system failed, forc-

ing the descent module to make a simple ballistic entry into Earth's atmosphere. With the quickly descending probe coming down over the Gulf of Guinea off the coast of Africa, far from any Soviet recovery ship, the spacecraft was deliberately blown up to prevent it from falling into the hands of American intelligence.

The next attempt to test the L-1 was scheduled for July 21, 1968. With the American manned lunar program on the verge of shifting into overdrive, Soviet officials needed to launch this L-1 towards the Moon in a full

...By this time, the CIA had informed NASA decision makers of the Soviet Union's intent to fly a manned circumlunar mission soon.

test of the circumlunar mission. On board were a number of biological specimens to assess the effects of exposure to the near-lunar environment, a photographic system to take high-quality images of the lunar surface as the spacecraft passed the Moon, and, like ZOND 4, equipment to perform long-distance voice communication tests. Before the launch, a crack was discovered in the Block D escape stage of the PROTON, forcing the removal of the launch vehicle from the pad for repairs. Two months later, ZOND 5 was finally launched on September 15 and successfully sent towards the Moon.

Comet Comments

by Don Machholz

(916) 346-8963 CC197.TXT December 7, 1994

Two returning comets have been recovered recently. Only Periodic Comet Borrelly remains visible in our skies.

The year 1995 should present several periodic comets. Periodic Comet Borrelly opens the year at magnitude nine, fading rapidly. During the summer months we can expect to see Periodic Comet Clark and Periodic Comet d'Arrest, the latter at magnitude seven. Periodic Comet Jackson-Neujmin will reach magnitude 11. As the year ends, Periodic Comet Honda-Mrkos-Pajdusakove should become a binocular object. In addition to these returning objects, there may be other comets, one never knows when a new one will come along.

Periodic Comet Kopff (1994s): S. Larson used the 1.5-m reflector at Catalina Station and a CCD to record images of this comet on Nov. 30. The object was stellar and faint at magnitude 22.8. It orbits the sun in 6.45 years, it will again be closest the sun (1.57 AU) in 18 months.

Periodic Comet Clark (1994t): This comet was recovered on Dec. 5 by A. Nakamura of Japan. He used a

0.6-m telescope with a CCD. Then at magnitude 17.5 the comet, which takes 5.5 years to orbit the sun, will brighten to perhaps magnitude 11 by early next summer.

Periodic	Comet	Borrelly	(1994I)		
Date	RA-2000-Dec	Elong	Sky	Mag	
12-19	09h33.5m	+50° 51'	129°	M	8.0
12-24	09h41.1m	+54° 20'	130°	M	8.2
12-29	09h47.0m	+57° 30'	131°	M	8.4
01-03	09h51.0m	+60° 18'	132°	M	8.5
01-08	09h52.9m	+62° 44'	132°	M	8.7
01-13	09h52.4m	+64° 46'	131°	E	9.0
01-18	09h49.6m	+66° 24'	131°	E	9.3
01-23	09h45.1m	+67° 38'	130°	E	9.6
01-28	09h39.1m	+68° 28'	129°	E	9.9
02-02	09h32.3m	+68° 56'	128°	E	10.2
02-07	09h25.5m	+69° 03'	126°	E	10.5

Orbital Elements

	1994I
Perihelion	1.3651 AU
Perihelion Date	Nov. 01.492, 1994
Argument of Perihelion	353.359°(2000)
Ascending Node	075.424°(2000)
Inclination	030.271°(2000)
Eccentricity	0.6228036
Period	6.88 years
Source of 2000 Elements	MPC 18259

What's Up

by Steve Coe

January 1995

Auriga

The Northern part of the Winter Milky Way is at its best in Auriga, the Charioteer. Spend some time with a pair of binoculars or a small scope with a wide field eyepiece and you will see a wide variety of chains of stars and nebulae zoom past the eyepiece. So, let's stop and observe a few of these goodies at a more leisurely pace. If you are looking to take on the Messier list, here is a constellation that will provide you with three Messier clusters.

NGC 1857 is a bright and rich cluster that is located at 5 hr 20.2 min and +16 deg 42 min. Very nice at 165X, an 8th mag yellow star with several nice star chains radiating out from it. 45 members were counted using the 13" scope within 12 minutes of cluster size.

IC 410 Without UHC filter it is faint, large and irregular. Using the UHC, it is pretty bright and obvious at 100X. In either case this nebula surrounds the cluster NGC 1893 and is more easily spotted on the south and west sides. Its position is 5 hr 22.6 min and +33deg 31min.

NGC 1907 is pretty bright, pretty small, much compressed and resolved at 165X. This cluster is at 5 hr 28 min and +35 deg 19 min. Just seen in the 11X80 finder, I counted 22 stars in 13". This cluster has a dark lane down the middle. It is near M 38 and reminds me of M 35 and NGC 2158 somewhat.

NGC 1912 (M 38) Bright, large, not compressed, seen in finder. The stars are arranged in the Greek letter "Pi". 50 stars counted at 100X. It is located at 5 hr 28.7 min and +35 deg 50 min.

NGC 1931 Bright, pretty large and somewhat elongated. Looks like a small comet at very low powers. There is a triple star in the center, it is resolved at 200X. It is positioned at: 5 hr 31.4 min and +34 deg 15 min. Try high power on this small emission nebula.

NGC 1960 (M 36) Bright, large, rich and round. Easy in finder, several double stars are involved, they are all split at 135X. This excellent cluster is at 5 hr 36.1 min and +34 deg 08 min.

NGC 2099 (M 37) Very Bright, large, very rich. Naked eye at my best sites in the mountains of Arizona, it is obvious in the finder. This cluster has always seemed a winter version of M 11 to me for several reasons: it is triangular in shape, there is a bright, yellow-orange star involved and both clusters are cut into sections by dark lanes. M 37 is in a very rich section of winter Milky Way and at 135X in the 13" I have estimated 200 members by counting 50 in one quadrant. This is one of my favorite clusters in the sky. It is located at 5 hr 52.4 min and +32 deg 33 min.

B 34 is an easy dark nebula at 60X in a surplus 38mm Erfle with gives the 13" a one degree field. The dark area is about 1/2 degree in size and is roundish with several dark lanes winding out of the field to the west. Raising the magnification does not help the view. This field of dark lanes is at 5 hr 43.5 min and +32 deg 39 min.

IC 2149 Pretty bright, small, little elongated. The central star comes and goes with the seeing at 270X. The planetary is a greenish dot elongated 1.5 to 1 east-west. 5 hr 56.3 min and +46 deg 07 min is the position of this lovely, light green dot afloat in a rich Winter Milky Way field of stars.

UV Aur is a carbon star paired with a B type giant, the ultimate red-blue pair. It is a pretty faint pair, but well worth it. At 165X in the 13" this pair is a gorgeous burnt orange and blue, it exhibits some of the best color I have ever seen in a double star even though the stars are not bright. 5 hr 21.8 min and +32 deg 31 min.

Three days after launch, ZOND 5 made its single close pass of the Moon at a minimum distance of 1,210 miles (1,950 kilometers). Its precisely tailored trajectory then allowed the spacecraft to return to Earth without any major propulsive maneuvers. Unfortunately, failure struck just before entry into Earth's atmosphere. Again the astro-orientation system ceased to function properly and the descent module was forced to make a punishing high-G ballistic entry. This time, however, a Soviet tracking ship named the VASILY GOLOVIN was stationed under the path of ZOND 5 and was able to recover the wayward spacecraft after its splashdown in the Indian Ocean.

By this time, the Central Intelligence Agency (CIA) had informed NASA decision makers of the Soviet Union's intent to fly a manned circumlunar mission soon. With the successful Earth orbit mission of APOLLO 7 in October, the APOLLO Command and Service Modules (CSM)

were deemed ready for a lunar mission. However, with the ground testing of the LM months behind schedule, there was no way for the Americans to mount a previously planned lunar orbit test of the LM to beat the Soviets. Instead, it was decided that only the CSM would be launched on a lunar orbit mission in late December. The race to be first **around** the Moon, if not actually landing on it yet, was on.

With the L-1 yet to perform successfully, Soviet engineers knew they needed at least one good end-to-end test of their circumlunar spacecraft before committing to a manned flight. The memory of the failure of SOYUZ 1 in 1967 with its then less-than-proven design and the loss of its pilot Vladimir Komarov was still fresh in the minds of everyone involved. Another test, ZOND 6, was launched on November 10. This would be the last chance to test the L-1 on its circumlunar mission and still mount a manned

L-1 mission before the Americans launched APOLLO 8.

The mission of ZOND 6 was virtually identical to its predecessor. Three days after launch, the probe swung to within 1,500 miles (2,420 kilometers) of the lunar surface and began its long fall back towards Earth. Unlike the previous pair of tests, the L-1 astro-orientation system functioned properly and ZOND 6 successfully executed a double-skip entry, thus assuring a landing in Soviet territory. But the return to Earth would prove to be less than perfect. The parachute deployed prematurely and the landing capsule crashed. If it had been manned, ZOND's occupant would have been killed. While the Soviets publicly hailed the mission as a success, it was yet another blow to their lunar program.

As the December 7 launch window was approaching, a heated debate was taking place whether to commit a man to the next L-1 launch. The cosmonauts training

**...the program schedule was
pushed to the limit in hopes
that the American APOLLO
program might somehow falter...**

for the mission wrote to the Politburo, stating that they were prepared to take the risk and argued that the mission would have a better chance at success with a man on board to take over in case of another automated system failure. It is rumored that a crew was chosen and that a cosmonaut would fly on this last mission before the upcoming launch of the American APOLLO 8.

After the PROTON with its L-1 was rolled out onto the pad, a series of problems with the launch vehicle arose. Before the problems could be fixed, the launch window closed and the Soviets' last chance to be first to the Moon was lost. The mission of APOLLO 8, which entered lunar orbit on Christmas Eve of 1968 with three Americans on board, was a success. American astronauts, not a Soviet cosmonaut, were the first to visit the Moon.

The following month, the now repaired launch vehicle was rolled out onto the pad for another unmanned test of the L-1. A human passenger would not be risked this time, since there was not a space first at stake any longer. The spacecraft was launched unmanned. During ascent to Earth parking orbit, the launch vehicle exploded upon ignition of the PROTON's second stage. The fact that the launch escape system also failed to operate must have sent a chill through the ranks of the cosmonauts training for the L-1 mission. If a cosmonaut was on board, he would have surely perished. While work on the L-1 circumlunar missions continued, it was realized that its passengers would not be the first to the Moon. Still, these flights would be valuable in support of the second prong of the Soviet Union's lunar assault.

Received in the mail:

Greetings From Prude Ranch!!

Once again **Prude Guest Ranch** will be hosting the **Annual Texas Star Party** in Spring 1995.

The dates this year will
be **May 21-29, 1995.**

Beginning January 3, 1995, Prude Ranch will be taking reservations for that week. Upon receiving your reservation you will be sent a Ranch Confirmation. Reservations will need to be made for tent camping, RV camping and all rooms.

You will not receive any rooming forms in your TSP Packet, so **PLEASE DO NOT DELAY!!**

**Please call the Ranch
Office at (915) 426-3202.**

I look forward to another star filled week with all of you.

Carol Prude

The Long Shot

The second prong of the Soviet assault on the Moon was an actual manned landing on the lunar surface. During 1968, it became clear to Soviet leaders that a manned landing by a Russian cosmonaut would not occur until 1970 or 1971 at the earliest. Delays in the development of the Soviet Moon rocket, the N-1, made an earlier date unlikely. Delays in the design and testing of the Lunar Orbiter Cabin (LOK), and especially the Lunar Cabin (LK) that would make the descent to the surface, made it impossible. Nonetheless, the program schedule was pushed to the limit in hopes that the American APOLLO program might somehow falter, affording the Soviets the opportunity to overtake them in the next year or so.

The first and largest component ready for testing would be the N-1 Moon rocket itself. On November 25, 1967, a mockup of the N-1 was installed on launch pad Number 1 for seventeen days of electrical tests. The first flight-ready launch vehicle was erected on the same pad on May 7, 1968, in preparation for a test launch. The booster had to be returned to the assembly building, however, after cracks were found in the first stage structure, possibly caused by the attachment of the payload.

After months of assessment and repairs, this vehicle was again placed on the launch pad in November, only to be replaced with another mockup for further tests and launch team training. Finally, in mid-January of 1969, N-1 Number 3L was erected on the pad with its payload for its first test flight. The test would be risky since, to save time and money, the large cluster of first-stage engines was never tested as a group.

Since neither the LOK nor LK were ready for a test

flight at that time, the Soviets used a modified L-1 known as the L-1S as the vehicle's primary payload. The N-1 would place the L-1S and a dummy LK on a trajectory towards the Moon. Once there, the L-1S alone would en-

...only a failure of the APOLLO 11 mission and a successful N-1 test would leave the Soviets with any chance of landing a man on the Moon first

ter lunar orbit to take high-resolution photographs of proposed landing sites and then return to Earth with the exposed film. For the mission, an Orientation Engine Module (DOK) would be attached to the front of the basic L-1. The DOK would slow the L-1S enough to place it into lunar orbit, after which it would be jettisoned. The

L-1S would then use its own propulsion system, located in the Instrument Module, to accelerate out of lunar orbit for the return to Earth. The spacecraft would perform a double-skip entry as in previous L-1 flights as a test of the nearly identical LOK Descent Module.

After 28 days of on-pad preparations and an additional one-day weather delay, the first N-1 lifted off into clear skies on February 21, 1969. Seconds after launch trouble began. Two of the first stage's thirty NK-33 engines shut down due to a problem with the KORD control system which guided the mammoth rocket. The launch vehicle was designed to operate with as many as four first-stage engines shut down, so the flight continued with the other engines compensating for the loss. Twenty-five seconds after launch, the engines were throttled back as programmed as the N-1 passed through maximum dynamic pressure, or max-q.

About 65 seconds into the flight, the engines were throttled back up to full power. At this point the lack of adequate testing of this Space Age leviathan became

Universal Time and Date of Total Lunar Occultations for Phoenix (33.5° Lat., 112.0°W Long.)

Date	Time ¹	Time ²	Mag	Star Information	PH	PA ¹	PA ²	PS	Elong	MAL	MAZ	SAL	SAZ	
01/18	04:04:17	04:03:53	4.3	ZC1341 (α Cnc)	RD	325	329	90	197	25	92	-41	271	
01/23	10:01:50	10:01:16	1.2	ZC1925 (α Vir)	DB	125	138	58	256	32	132	-55	76	
01/23	11:17:11	11:16:48	1.2	ZC1925 (α Vir)	RD	290	276	57	257	41	151	-40	88	
01/26		13:45:15	4.6	ZC2353	RD		275	34	298	32	151	-9	107	
02/09	07:05:59	06:58:34	3.6	ZC0668 (ε Tau)	DD	020	039	62	111	31	274	-69	332	A
04/08		08:01:10	3.7	ZC1106 (λ Gem)	DD		98	52	94	6	287	-49	12	
04/15	10:06:56	10:06:37	1.2	ZC1925 (α Vir)	DD	144	149	99	180	31	229	-33	49	
04/15	11:02:20	11:02:57	1.2	ZC1925 (α Vir)	RB	251	250	99	181	22	240	-23	60	
05/14	06:18:41	06:18:10	2.9	ZC2118 (α2 Lib)	DD	49	66	97	175	40	170	-36	341	
05/14	07:09:36	07:09:05	2.9	ZC2118 (α2 Lib)	RB	346	333	98	176	41	185	-38	356	
06/09	07:03:59	06:56:47	1.2	ZC1925 (α Vir)	DD	180	189	72	130	27	235	-33	353	B
06/09	07:23:47	07:09:47	1.2	ZC1925 (α Vir)	RB	214	209	72	130	24	238	-34	357	B
07/08	01:28:06	01:27:15	2.9	ZC2118 (α2 Lib)	DD	120	133	67	121	35	148	13	288	
07/08	02:46:12	02:45:51	2.9	ZC2118 (α2 Lib)	RB	280	269	68	122	41	170	-2	299	
07/13	11:20:54	11:23:07	3.3	ZC2969 (β2 Cap)	RD	278	294	90	198	27	228	-12	53	
08/20	12:03:30	12:01:50	4.7	ZC0832 (119 Tau)	RD	195	213	37	294	47	98	-10	67	C
09/05	03:52:24	03:51:53	4.0	ZC2826 (ρ Sgr)	DD	105	98	72	129	39	180	-25	298	
09/06	04:16:35	04:10:23	3.3	ZC2969 (β2 Cap)	DD	23	10	79	142	41	169	-29	302	D
10/16	07:01:27		3.7	ZC1106 (λ Gem)	RD	271		50	270	8	75	-65	353	
11/09	02:35:02		3.9	ZC0648 (δ Tau)	RD	259		86	204	9	74	-26	267	
11/09	02:59:41	02:59:52	4.8	ZC0653 (64 Tau)	RD	221	231	86	205	14	78	-32	270	
12/18	11:42:51	11:42:10	4.6	ZC2053 (λ Vir)	RD	248	233	28	309	14	116	-33	98	

NOTES:

- A = Graze N limit in S Arizona, No A&B factors for N.M. Std. Station.
- B = Graze S limit N,W of Phoenix, No A&B factors at either station.
- C = Graze S limit S,E of Phoenix, No A&B factors for N.M. Std. Station.
- D = No A&B factors listed for L.A. Std. Station.

Subtract 7 hours for correct Mountain Standard Time and Day.

Time¹ = Hrs:Min:Sec (Std Sta NM)

Time² = Hrs:Min:Sec (Std Sta LA)

PH = Phenomenon, i.e. RD = (R)eappearance on (D)ark Limb

PA¹ = Position Angle of star from north point of moon (90=East) (NM Std Sta)

PA² = Position Angle of star from north point of moon (90=East) (LA Std Sta)

PS = Percent Sunlit

Elong = Elongation of moon from sun (180 = full; 270 = 3rd Qtr)

MAL = Moon Altitude in degrees (90 = directly overhead)

MAZ = Moon Azimuth (90 = East)

SAL; SAZ = Sun Altitude; Azimuth

Blanks = Not Listed at Standard Station

Compiled by Brian K. Vorndam, for more info call him at 602-344-9841.

Summary of Lunar Missions: Second Half 1968 to 1969

Name	Launch Date	Country	Weight lbs (kg)	Launch Vehicle	Comments
ZOND 5	Sep 14, 1968	USSR	12,300 (5600)?	PROTON	Partially successful unmanned L-1 circumlunar test
ZOND 6	Nov 10, 1968	USSR	12,300 (5600)?	PROTON	Partially successful unmanned L-1 circumlunar test
APOLLO 8	Dec 21, 1968	US	63,631 (28,897)	SATURN V	First manned lunar orbiter
Unannounced	Jan 19, 1969?	USSR	12,300 (5600)?	PROTON	Possible launch failure of unmanned L-1 circumlunar test
Unannounced	Feb 21, 1969	USSR	15,000 (7000)?	N-1	Unsuccessful test of N-1 carrying L-1S photographic lunar orbiter
Unannounced	Apr 15, 1969	USSR	12,600 (5700)?	PROTON	Launch failure of sample return attempt
APOLLO 10	May 18, 1969	US	94,325 (42,836)	SATURN V	Second manned lunar orbiter and test of LM
Unannounced	Jun 14, 1969	USSR	12,600 (5700)?	PROTON	Launch failure of sample return attempt
Unannounced	Jul 3, 1969	USSR	15,000 (7000)?	N-1	Unsuccessful test of N-1 carrying L-1S photographic lunar orbiter
LUNA 15	Jul 13, 1969	USSR	12,600 (5700)?	PROTON	Unsuccessful lunar sample return attempt
APOLLO 11	Jul 16, 1969	US	96,584 (43,862)	SATURN V	First manned lunar landing
ZOND 7	Aug 7, 1969	USSR	12,300 (5600)?	PROTON	Unmanned L-1 circumlunar test
KOSMOS 300	Sep 23, 1969	USSR	12,600 (5700)?	PROTON	Unsuccessful lunar sample return attempt
KOSMOS 305	Oct 22, 1969	USSR	12,600 (5700)?	PROTON	Unsuccessful lunar sample return attempt
APOLLO 12	Nov 14, 1969	US	96,681 (43,906)	SATURN V	Second manned lunar landing

apparent. The engines throttled up more quickly than expected, causing stronger than planned vibrations. A liquid oxygen pipeline burst and started a fire in the engine compartment before the KORD could shut down the affected engine. The surrounding engines and turbopumps quickly overheated and exploded.

After seventy seconds of flight, the KORD finally shut down all engines and the launch escape system was activated. The L-1S capsule was recovered 20 to 22 miles (32 to 35 kilometers) downrange. The now powerless N-1 slammed into the Kazhak steppes and exploded some 30 miles (48 kilometers) from its launch pad.

Undeterred by this first failure, a second N-1 was modified and prepared for launch. With the successful tests of the American LM in Earth orbit during the APOLLO 9 mission in March and the test in lunar orbit by APOLLO 10 in May, only a failure of the APOLLO 11 mission and a successful N-1 test would leave the Soviets with any chance of landing a man on the Moon first.

By mid-1969, the second N-1 launch pad was ready and a mockup installed for fitting and electrical tests. Finally, on July 3, the second N-1, Number 5L, took off from pad Number 1 with another L-1S as its primary payload. It immediately encountered problems when debris in the oxidizer tank was ingested by one of the first-stage engines, causing its turbopump to explode. This explosion caused a second engine to fail, which in turn caused a chain reaction, eliminating several neighboring engines as well as damaging the KORD's electrical control system.

The launch escape system was automatically activated, pulling yet another L-1S descent module away from an N-1. The capsule came down about one-half mile (one kilometer) from the pad, while the fully fueled N-1 crashed into its launch pad eighteen seconds after launch. The impact destroyed the rocket, pad Number 1, and heavily damaged the newly completed pad Number 2.

The N-1 was in desperate need of modification. Al-

most two years of launch pad reconstruction would be needed before the Moon rocket could be flown again. With their hopes to beat the Americans to a manned Moon landing surely dashed, the Soviets had only one last card to play.

The Ace in the Hole

The last prong of the Soviets' plan to beat the Americans to the Moon did not involve a manned spacecraft at all. As part of a long-term plan to explore the Moon, designers at the Babakin Design Bureau had come up with plans for unmanned lunar landers, rovers, and orbiters somewhat similar in size and mission to the long-abandoned American PROSPECTOR program. The exact origin and original mission for this family of spacecraft is still unknown, but it was likely meant to be used as a manned mission pathfinder.

At this point in history, though, one of the proposed missions could have been to undermine the scientific justification for the manned APOLLO missions. By March of 1969, the Soviets publicly admitted to planning an unmanned lunar sample return mission. The major selling point of this program was that an unmanned spacecraft could return samples of the lunar surface for a fraction of the cost of a manned mission and at no risk to a human crew. It would be a major coup if the Soviets could do this before an American manned landing and could totally undermine political support in America for any manned lunar mission if one of the early APOLLO test missions or the first manned landing attempt had failed.

With the real possibility of stealing some of APOLLO's thunder, the first launch of this six-ton (5,700-kilogram) sample return spacecraft took place on April 15, 1969. It never got far since its PROTON booster was rumored to have exploded on the launch pad. A second attempt on June 14 made it as far as the ignition of the PROTON's second-stage, at which point it exploded.

Since March, tensions between the Soviets and Chinese had erupted almost to the point of war, with several skirmishes taking place along their common border. During this time an unusually large number of Soviet photoreconnaissance satellites were launched to observe Chinese troop movements. With this heightened sense of alert, one cannot help but wonder if such 'unimportant' flights as a lunar mission got the short end of the stick when it came to obtaining resources for launch preparations.

There was only one last chance to beat the Americans and get samples of the Moon back to Earth before the APOLLO 11 mission. On July 13, 1969, just three days before the launch of APOLLO 11, LUNA 15 went into a trajectory towards the Moon. After a trajectory correction maneuver the day after launch, LUNA 15 fired its rockets again on July 17, entering a 34 by 126-mile (55 by 203-kilometer) lunar orbit with APOLLO 11 just two days behind it. On the day APOLLO 11 entered lunar orbit, LUNA 15 altered its orbit to 5.6 by 137 miles (9 by 203 kilometers), inclined 126 degrees to the lunar equator. At this point there were worries in the U.S. that LUNA 15 would somehow interfere with the manned APOLLO mission. Assurances were quickly given by the Soviets that this would not be the case and both missions continued.

On July 20, only hours before the scheduled landing of APOLLO 11, LUNA 15 made yet another orbital change, resulting in a 10 by 68-mile (16 by 110-kilometer) orbit inclined 127 degrees. It was not until the next day, after astronauts Neil Armstrong and Edwin Aldrin had already landed their Lunar Module named EAGLE on Mare Tranquilitas—the Sea of Tranquility—and walked on the Moon, that LUNA 15 made its last retrorocket burn and began its descent to the lunar surface. Unfortunately, the lander crashed at a speed of 300 miles per hour (480 kilometers per hour) at 17 degrees north, 60 degrees east in Mare Crisium, the Sea of Crises. The Soviets simply announced that LUNA 15 had completed its mission and left it at that. It would be almost twenty years before it was officially admitted that LUNA 15 was a failed sample return attempt.

Even if LUNA 15 had succeeded at this landing attempt, it would not have returned until the day after the return of APOLLO 11 on July 24. This mission did spend one day longer in lunar orbit than was typical of later sample missions, making it possible that there were some problems with the spacecraft or tracking it or accurately predicting its orbit. If LUNA 15 had made it down in three days instead of four, or if the APOLLO 11 mission had failed to return samples, the Soviets would have had their space first. Instead, the Soviets had several tons of wreckage on the lunar surface and at best a brief blurb in Western newspapers buried several pages behind the news of the successful mission of APOLLO 11.

Postscript

Even after the failure to beat the Americans to the Moon, the Soviets continued through 1969 with their lunar missions. On August 8, 1969, the Soviets successfully

launched an L-1 spacecraft on another unmanned circumlunar flight. ZOND 7 flew by the Moon, coming to within 1,200 miles (2,000 kilometers) of the surface three days after launch. On August 14 the latest L-1's descent module executed a perfect entry and landing, making it the first totally successful flight of the L-1 design.

Plans at that time called for another unmanned flight in December. The first manned L-1 circumlunar flight would then be launched in April of 1970 to coincide with the one hundredth anniversary of the birth of Vladimir Ilyich Lenin (1870-1924), the leader of the Russian Revolution in 1917. Electrical tests of the last unmanned L-1 spacecraft took place between September and November of 1969, but the L-1 manned program was postponed and finally scrapped, possibly because of the success of the second American lunar landing, APOLLO 12, in November.

Sample return mission attempts also continued in 1969, but with less success. A mission launched on September 23 got stranded in its Earth parking orbit when the PROTON's Block D escape stage failed to operate properly. This attempt received the generic Soviet moniker of KOSMOS 300. Another attempt launched on October 22 suffered a similar fate and was designated KOSMOS 305 after it failed to leave Earth orbit. Unlike the L-1 program, however, the Soviets would continue with their unmanned lunar program into 1970 and beyond, advertising it as the preferred, cheaper, and safer means to explore the Moon. It was hoped that 1970 would be luckier for the Soviets than the previous two years.

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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 pro-

gram for over one dozen years. Andrew's Internet address is: lepage@bur.visidyne.com

Bits and Pieces

Coming Events

Star Parties

Quartzsite	Mar. 3-5
Messier Marathon	Apr. 1
Sentinel	Apr. 29
Texas Star Party	May 21-29
RTMC	May 27-29
Grand Canyon	Jun. 17-24

The 1995 Arizona Messier Marathon

April 1, 1995

The Messier Marathon is a test of an observer's observing skill. In spite of the date this year, this is a real event, not an April Fools prank. For a lot of observers this is one night to work through the entire Messier catalogue. Those who take the time to write down their observations can complete their club's Messier Observing award in just one night, or at least get most of it done. Other observers might just be trying to better their count from the previous year. And yet still others may want to just come out and do their own observing programs or watch the people doing the marathon.

Regardless of why they do this, the mission of the marathon is still to view as many Messier objects as the evening, weather, and observing skills permit. The date chosen for this year's event allows the possibility of 109 to all 110 objects being seen.

After the event, awards will be given in recognition of observing efforts. Certificates are awarded to those observing 50 or more objects. Last year, a special certificate was awarded to those observing 100 or more objects since so many people reach that point. Those reaching the highest total will receive a small plaque, suitable for mounting on a telescope, for first, second and third places. Duplicate awards are presented in case of ties.

The marathon held at a site near Arizona City, which is nearly halfway between Phoenix and Tucson. A map will be provided in the February and March newsletters on how to get to the site. More details will also appear in the newsletter. The observing list available at SAC meeting possibly as early as the January meeting. The observing list will also be available at the site at the start of the event.

Spending the whole night doing the entire marathon means you have to plan ahead. Remember to bring those warm clothes and late night snacks. During the night you can spend a couple of hours just waiting for more objects to rise. During this time of inactivity, the cold will really get to you, making the night uncomfortable. If you bring extra layers of clothing, you can add layers as you feel colder, rather than going home.

Invitations were sent to all Arizona Astronomy Clubs that are known. We hope for a large turn-out. So plan on being there early to see old friends and make new ones. Last year, the weather in Phoenix was cloudy and many people decide not to attend, but south of Arizona City, the sky was nearly clear with only an occasional cloud.

Results of the Marathon will be sent to all Arizona Astronomy Clubs as well as popular Astronomy periodicals.

The Messier Marathon is being coordinated by A.J. Crayon, the chairman of the Saguaro Astronomy Club's Deep Sky Subgroup. You can contact him at: 13819 N. 37th Avenue, Phoenix, AZ 85023. By phone: (602) 938-3277. Via E-Mail: a.crayon@az05.bull.com.

Quartzsite Star Party

March 3–5, 1995

Event Sign-Up By January 15, 1995

The town of Quartzsite cordially invites astronomy clubs of Arizona and eastern California to Quartzsite's First Annual Star Party. This event is sponsored by the Quartzsite Chamber of Commerce.

This is an opportunity for clubs to mentor beginners and amateurs to help form a rural Arizona astronomy club. So they will be trying

to attract the interest of winter residents as well as their local residents.

There will be camping (RV or tenting), campfire and entertainment (away from star gazers), a Saturday morning pancake breakfast, and a day hike to Palm Canyon. The sky will have a young crescent moon (2–3 days old) that will set early.

Quartzsite is 135 miles west of Phoenix on I-10, and approximately 90 miles north of Yuma on SR 95.

Please contact

Quartzsite Chamber of Commerce

P.O. Box 85, Quartzsite, AZ 85346

(602) 927-5600

Minutes of the November Meeting

The President opened the meeting by asking for first time visitors to identify themselves.

Nominations were opened for next years officers. No new names advanced, so the nominations were closed. A motion to accept the officers by acclamation was made and passed. So the officers for 1995 are:

President	—	Bob Gardner
Vice President	—	Susan Pritchard
Treasurer	—	Adam Sunshine
Secretary	—	AJ Crayon
Properties	—	Pierre Schwaar

Adam Sunshine gave the treasurers report.

Rich Walker spoke about two upcoming Public Star Parties for elementary schools and requested assistance from club members.

AJ Crayon spoke about the Deep Sky Meeting and the 1995 Messier Marathon which will be on April 1st [and that's no joke].

Leroy Paller agreed to have the Christmas Party at his house.

Gerry Rattley spoke about the upcoming Lunar Grazing occultation.

At the break there was a low of 28 people in attendance.

After the break it was announced the our speaker decided to stay in Flagstaff due to bad weather. (Looks like some club members did the same.)

To recover from speaker's absence; Pierre Schwaar and Paul Lind took center stage to talk about their trip to Peru to observe a Solar Eclipse. They were introduced by their Peruvian friend Pablo! In addition Dick Jacobsen and Gayle Lind also made the trip. Members enjoyed seeing the slides and video. The next, reasonably close eclipse, is February 1998 some where in the Caribbean Sea.

—A.J. Crayon, SAC Secretary

1995 Observer's Handbooks

The **1995 Observer's Handbooks** are now available for **\$10** each. Contact Adam Sunshine at the next SAC meetings.

Deep Sky Meeting

The Deep Sky Group is a Special Interest Group made up of people who like to discuss observing and observing techniques. They particularly like to observe objects out past the Orrt Cloud that's why they're called the Deep Sky Group. The type of objects include stars, nebula and galaxies.

If you are interested in sharing your observations, or are interested in observing techniques, then by all means come join in. The meetings are held at John McGrath's house every other month; directions are elsewhere in this Newsletter.

The group doesn't extend invitations to this meeting. It is not a closed meeting. It is OPEN to all SAC members. All you have to do is have the interest and follow the directions to the McGrath's.

Our study of the 110 Best NGC objects will complete with the next session; January 19, 1995 at 7:30 P.M. The constellations and object are: Auriga 1907 and 1931; Camelopardalis 1501, 2403 and 2655; Centaurus 5128 and 5139; Canis Major 2359; Corvus 4361; Gemini 2158 and 2392; Hydra 3242; Monoceros 2244 and 2261; Orion 1788, 1973, 2024, 2022 and 2194; and Puppis 2438, 2440 and 2539.

The next project will be to observe the What's Up Column by Steve Coe. His column appears monthly and the meeting once every two months. That will give you about ten to fifteen deep sky objects and double stars to discuss. We will discuss the previous two months articles; for example, the March Deep Sky Meeting will discuss the objects appearing in the January and February columns.

January 1995

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
New Year's Day New Moon 3:56 A.M. 1	2	Quadrantid Meteors Peak: 4 P.M. Z.H.R. 85 3	4	PAS Meeting Brophy Prep. Physics Lab 5	TAAA Meeting (Tucson) 6	7
First Quarter Moon 8:46 A.M. 8	9	10	EVAC Meeting (SCC: Rm. PS172) 11	12	SAC Meeting Grand Canyon University, Fleming Rm. 105 13	14
15	Full Moon 1:26 P.M. 16	17	18	SAC Deep Sky Meeting 7:30 P.M. 19	20	21
22	Last Quarter Moon 9:58 P.M. 23	24	25	26	27	SAC Star Party Buckeye Hills (members&guests) 28
29	New Moon 3:48 P.M. 30	31	All Times are Mountain Standard Time			

Great Holiday Party

by Steve Coe

With a crowd of approximately 40 SAC members on hand, the Holiday party was a big success. There was plenty of food and cheerful folks on hand to celebrate in style.

Pierre Schwaar showed up with several video tapes in hand to give everyone a chance to observe his excellent shots of the solar eclipse from Peru, a total lunar eclipse from the club site at Buckeye and the crash of Comet Shoemaker-Levy 9 hitting Jupiter.

A walk around the room found people talking about a wide variety of subjects including: computer bulletin

boards, eclipse chasing, occultation results, meteor showers and a wide variety of non-astronomical subjects.

All this with the view of the city lights in the background, as seen from Palo Verde house. As always, a BIG Thank You to Leroy and Faye Paller as gracious guests for the end of the year celebration.

Newsletter Deadline

Mail items for Such-a-Deal at least two weeks before the end of the month. Articles that need to be published in a timely fashion must be submitted or the newsletter editor notified of the article at least 6 weeks before month they are published. Items arriving too late for an issue will be included in the next newsletter.

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:
Adam Sunshine
SAC Treasurer
20401 N 30th Drive,
Phoenix AZ 85027



SACNEWS

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

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