

# Star Stuff



## THE FORD AMATEUR ASTRONOMY CLUB NEWSLETTER

Volume 6, Number 12

December 1997

### MARS PATHFINDER MISSION WINDS DOWN

From Jet Propulsion Laboratory (<http://www.jpl.nasa.gov>)

After operating on the surface of Mars three times longer than expected and returning a tremendous amount of new information about the red planet, NASA's Mars Pathfinder mission is winding down. Flight operators at NASA's Jet Propulsion Laboratory, made the announcement after attempting to reestablish communications with the spacecraft over the last month. With depletion of the spacecraft's main battery and no success in contacting Mars cannot command the spacecraft or the small rover named Sojourner that had been roving about the landing site and studying rocks.

"We concede that the likelihood of hearing from the spacecraft again diminishes with each day," said Pathfinder Project Manager Brian Muirhead. "We will scale back our efforts to reestablish contact but not give up entirely. Given that, and the fact that Pathfinder is the first of several missions to Mars, we'll say 'see you later' instead of saying goodbye," he said. "I want to thank the many talented men and women at NASA for making the mission such a phenomenal success. It embodies the spirit of NASA, and serves as a model for future missions that are faster, better and cheaper. Today, NASA's Pathfinder team should take a bow, because America is giving them a standing ovation for a stellar performance," said NASA Administrator Daniel S. Goldin.

Since its landing on July 4, 1997, Mars Pathfinder has returned 2.6 billion bits of information, including more than 16,000 images from the lander and 550 images from the rover, as well as more than 15 chemical analyses of rocks and extensive data on winds and other weather factors. The only remaining objective was to complete the high-resolution 360-degree image of the landing site called the "Super Pan," of which 83 percent has already been received and is being processed. The last successful data transmission cycle from Pathfinder was completed at 3:23 a.m. PDT on Sept. 27, which was Sol 83 of the mission.

"This mission has advanced our knowledge of Mars tremendously and will surely be a beacon of success for upcoming missions to the red planet," added Dr. David Baltimore, president of the California Institute of Technology, which manages JPL for NASA. "Done quickly and within a very limited budget, Pathfinder sets a standard for 21st century space exploration."

The Mars Pathfinder team first began having communications problems with the spacecraft on Saturday, Sept. 27. After three days of attempting to reestablish contact, they were able to lock on to a carrier signal from the spacecraft's auxiliary transmitter on Oct. 1, which meant that the spacecraft was still operational. They locked on to the same carrier signal again on Oct. 6, but were not able to acquire data on the condition of the lander. At that time, the team surmised that the intermittent communications were most likely related to depletion of the spacecraft's battery and a drop in the spacecraft's operating temperatures due to the loss of the battery, which kept the lander functioning at warmer temperatures.

Over the last month the operations team has been working through all credible problem scenarios and taking a variety of actions to try to recover the link with Pathfinder. With all of the most plausible possibilities exhausted, the team plans to continue sending commands and listening for a spacecraft signal on a less frequent basis. "Basically we are shifting to a contingency strategy of sending commands to the lander only periodically, perhaps once a week or once per month," said Mission Manager Richard Cook. "Normal mission operations are over, but there is still a small chance of reestablishing a link, so we'll keep trying at a very low level."

Although the true cause of the loss of lander communications may never be known, recent events are consistent with predictions made at the beginning of the extended mission in early August, Muirhead said. When asked about the life expectancy of the lander, project team members predicted that the first thing that would fail on the lander would be the battery; this apparently happened after the last successful transmission September 27.

After that, the lander would begin getting colder at night and go through much deeper day-night thermal cycles. Eventually, the cold or the cycling would probably render the lander inoperable. According to Muirhead, it appears that this sequence of events has probably taken place. The health and status of the rover is also unknown, but since initiating its onboard backup operations plan a month ago, the rover is probably circling the vicinity of the lander, attempting to communicate with it.

The rover, which went into a contingency mode on Oct. 6, or Sol 92 of the mission, had completed an alpha proton X-ray spectrometer study of a rock nicknamed Chimp, to the left of the Rock Garden, when it was last heard from. The rover team had planned to send the rover on its longest journey yet — a 50-meter (165-foot) clockwise stroll around the lander — to perform a series of technology experiments and hazard avoidance exercises when the communications outage occurred. That excursion was never initiated once the rover's contingency software began operating.

Now known as the Sagan Memorial Station, the Mars Pathfinder lander was designed primarily to demonstrate a low-cost way of delivering a set of science instruments and a free-ranging rover to the surface of the red planet. Landers and rovers of the future will share the heritage of spacecraft designs and technologies first tested in this "pathfinding" mission.

Part of NASA's Discovery program of low-cost planetary missions, the spacecraft used an innovative method of directly entering the Martian atmosphere. Assisted by an 11-meter-diameter (36-foot) parachute, the spacecraft descended to the surface of Mars on July 4 and landed, using airbags to cushion the impact. The spacecraft's novel entry was successful. Scientific highlights of the Mars Pathfinder mission are:

- Martian dust includes magnetic, composite particles, with a mean size of one micron.
- Rock chemistry at the landing site may be different from Martian meteorites found on Earth, and could be of basaltic andesite composition.
- The soil chemistry of Ares Vallis appears to be similar to that of the Viking 1 and 2 landing sites.
- The observed atmospheric clarity is higher than was expected from Earth-based microwave measurements and Hubble Telescope observations.
- Dust is confirmed as the dominant absorber of solar radiation in Mars' atmosphere, which has important consequences for the transport of energy in the atmosphere and its circulation.
- Frequent "dust devils" were found with an unmistakable temperature, wind and pressure signature, and morning turbulence; at least one may have contained dust (on Sol 62), suggesting that these gusts are a mechanism for mixing dust into the atmosphere.
- Evidence of wind abrasion of rocks and dune-shaped deposits was found, indicating the presence of sand.
- Morning atmospheric obscurations are due to clouds, not ground fog; Viking could not distinguish between these two possibilities.

(continued on page 2)

REMEMBER, 1998 F.A.A.C. MEMBERSHIP DUES MUST BE PAID TO RAY FOWLER (RFOWLER4) BY JANUARY 1ST.

(continued from page 1)

- The weather was similar to the weather encountered by Viking 1; there were rapid pressure and temperature variations, downslope winds at night and light winds in general. Temperatures were about 10 degrees warmer than those measured by Viking 1.
- Diversity of albedos, or variations in the brightness of the Martian surface, was similar to other observations, but there was no evidence for the types of crystalline hematite or pyroxene absorption features detected in other locations on Mars.
- The atmospheric experiment package recorded a temperature profile different than expected from microwave measurements and Hubble observations.
- Rock size distribution was consistent with a flood-related deposit.
- The moment of inertia of Mars was refined to a corresponding core radius of between 1,300 kilometers and 2,000 kilometers (807 miles and 1,242 miles).
- The possible identification of rounded pebbles and cobbles on the ground, and sockets and pebbles in some rocks, suggests conglomerates that formed in running water, during a warmer past in which liquid water was stable.

Engineering milestones of the mission included demonstrating a new way of delivering a spacecraft to the surface of Mars by way of direct entry into the Martian atmosphere. In addition, Mars Pathfinder demonstrated for the first time the ability of engineers to deliver a semi-autonomous roving vehicle capable of conducting science experiments to the surface of another planet. ☆

## EVEN ODDS FOR LIFE ON MARS

From University of Arizona News Services

Did life exist on Mars or not? According to Timothy D. Swindle, it's not an either/or question. Swindle, an associate professor in the Lunar and Planetary Laboratory at The University of Arizona in Tucson, conducted a survey of his colleagues at the 28th annual Lunar and Planetary Science Conference in Houston in March. He asked respondents to assess two things: the possibility that life existed on Mars and the likelihood that Mars meteorite ALH84001 contains evidential features of martian life.

A group of NASA scientists announced on Aug. 7, 1996, that the meteorite ALH84001 contains what might be evidence for past life on Mars. Found in the Allan Hills ice fields of Antarctica in 1984, this meteorite has stirred up a lot of controversy. As part of a neutral team, Swindle took part in the initial presentation of ALH84001 at the Division of Planetary Science Meeting last year in Tucson. It was at this meeting that Swindle first started thinking about the question of life on Mars in the context of the controversy. He realized that the answer, for the present anyway, would not be so neatly black-and-white. The controversy over the meteorite and the lack of conclusive evidence for life on Mars made the question difficult to answer. "I conducted the survey because the yes or no question was too restrictive," Swindle said.

Of all the 125 respondents to the survey, the median response was a 56 percent chance that life has existed at some point on Mars. In response to the second question, of whether the features of ALH84001 provide evidence of martian life, the likelihood was much lower: the median response was a mere 20 percent chance. Swindle is quick to point out, however, that the survey has a few limitations. Only one-tenth of the scientists at the Houston Conference responded, which is not a scientific majority. And of the 125 respondents, only 19 had published something regarding the origin or early evolution of life.

According to Swindle, it is also important to realize that science is not a democracy. "The process of acceptance or rejection of an idea is driven by experiments, models, and theories, and is seldom instantaneous," Swindle said. Despite these limitations, the survey reveals that the current scientific attitude toward life on Mars is more complicated than most people believe. The issue has not been conclusively settled: it may take ten to twenty years to know conclusively whether life existed on Mars. While those surveyed may believe there is more than a 50 percent chance that life existed at some point on Mars, they don't believe that ALH84001 provides convincing evidence for that claim. The survey also reveals that, in general, those who studied Mars gave higher estimates than those who studied meteorites.

Swindle hopes to conduct the survey again in a few years because he wants to know how scientific attitudes change. The big change in attitude, he predicts, will come when we actually bring rocks back from Mars. Until a space expedition actually returns with this evidence, Swindle will examine meteorites on Earth. On November 3, he leaves for a six week expedition among the mountains of Antarctica to search for meteorites — some of which may from Mars and be more decisive evidence than ALH84001. ☆

### STAR STUFF

Monthly Publication of the Ford Amateur Astronomy Club

Star Stuff Newsletter

P.O. Box 7527

Dearborn, Michigan 48121-7527

### 1997 CLUB OFFICERS

President:	Bob MacFarland	313-33-79754
Vice President:	George Korody	248-349-1930
Secretary:	Harry Kindt	313-835-1831
Treasurer:	Ray Fowler	313-8292182 (pager)

### GENERAL MEETINGS

The Ford Amateur Astronomy Club holds regular general meetings open to the public on the fourth Thursday of the month at 5:00 PM. Meetings are held in conference room 100 in the Ford Worldwide Web & Internet Applications (WWW&I) building, at 555 Republic Drive in the Fairlane Business Park in Dearborn.

### OBSERVING SITE

The Ford Amateur Astronomy Club has an established observing site, by permit, at the Spring Mill Pond area of the Island Lake Recreational Area in Brighton, Michigan located near the intersections of I-96 and US-23. Members are responsible for opening and closing the gate after the parks 10:00pm closing time. The combination for the lock should be available on our hotline number. Always close the gate behind you after 10:00pm whether entering or leaving the park.

### OBSERVING HOTLINE NUMBER - (313) 39-05456

On Friday and Saturday nights, or nights before holidays, you can call the hotline number up to 2 hours before sunset to find out if we will be observing that night. Assume that any clear Friday or Saturday night is a candidate observing night unless something else is going on or none of the club officers are able to make it.

### WWW PAGE

Computers inside the Ford network or on the Internet can access the F.A.A.C. web page at one of the following addresses:

Ford Intranet: <http://bc0084.bc.ford.com/fh/faac>  
Internet: <http://kode.net/~dougbock/faac/>

### MEMBERSHIP AND DUES

Membership to the Ford Amateur Astronomy Club is open to both Ford and Non-Ford Motor Company employees. The general public is also welcome to join. The dues structure is as follows:

Annual Individual/Family	\$20.00
Lifetime Membership	\$100.00

Membership benefits include a subscription to the Star Stuff newsletter, discounts on subscriptions to Astronomy and/or Sky & Telescope magazine(s), after hour use of the observing site at Island Lake, and discounts at selected area astronomical equipment retailers.

### NEWSLETTER STAFF

Editor:  
Inter-company Mail:  
E-mail:





### NEWSLETTER SUBSCRIPTION

A yearly subscription at a rate of \$12.00 is available to those who are not members of the Ford Amateur Astronomy Club. Subscriptions are free to other astronomy clubs wishing to participate in a newsletter exchange.

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## DECEMBER 1997

SUN	MON	TUE	WED	THU	FRI	SAT
	1	2	3	4 FAAC Meeting	5	6
7 	8	9	10	11	12	13 
14	15	16	17	18	19	20
21 	22	23	24	25	26	27
28	29 	30	31			

- Dec 01 Asteroid 3200 Phaethon Near-Earth Flyby (0.309 AU)  
 Dec 03 Comet C/1997 D1 Mueller Closest Approach to Earth (1.416 AU)  
 Dec 03 Asteroid 532 Herculina Occults SAO 189113 (9.0 Magnitude Star)  
 Dec 05 Comet Pons-Gambart Perihelion (0.820 AU)  
 Dec 07 **First Quarter Moon (1:11 am)**  
 Dec 07 Asteroid 349 Dembowska Occults SAO 76598 (8.7 Magnitude Star)  
 Dec 09 Moon Occults Saturn, Visible From North America  
 Dec 09 Venus Passes 2.5 Degrees From Neptune  
 Dec 09 Asteroid 23 Thalia at Opposition (9.2 Magnitude)  
 Dec 09 Asteroid 356 Liguria at Opposition (10.6 Magnitude)  
 Dec 10 Comet C/1997 T1 (Utsunomiya) Perihelion (1.34933 AU)  
 Dec 10 Asteroid 5870 Baltimore Closest Approach to Earth (0.896 AU)  
 Dec 11 Venus at Greatest Brilliancy (-4.7 Magnitude)  
 Dec 12 Comet Taylor at Perihelion (1.948 AU)  
 Dec 13 **Full Moon (9:38 pm)**  
 Dec 13 Moon Occults Aldebaran  
 Dec 13 Geminids Meteor Shower Peak  
 Dec 14 Comet Gehrels 2, Closest Approach to Earth (1.3119 AU)  
 Dec 14 Comet P/1996 R2 (Lagerkvist) Closest Approach to Earth (2.216 AU)  
 Dec 15 Asteroid 5184 Cavaillie-Coll Closest Approach to Earth (1.167 AU)  
 Dec 16 Mars Passes 1.6 Degrees South of Neptune  
 Dec 18 Asteroid 5634 (1978 VT6) Closest Approach to Earth (1.324 AU)  
 Dec 19 Asteroid 27 Euterpe at Opposition (8.4 Magnitude)  
 Dec 20 Asteroid 1992 BF Near-Earth Flyby (0.1721 AU)  
 Dec 20 Comet C/1997 J1 (Mueller) Closest Approach to Earth (2.479 AU)  
 Dec 21 **Last Quarter Moon (4:45 pm)**  
 Dec 21 Winter Solstice (20:07 UT)  
 Dec 21 Asteroid 2102 Tantalus Near-Earth Flyby (0.1379 AU)  
 Dec 21 Asteroid 1994 LX Near-Earth Flyby (0.315 AU)  
 Dec 22 Comet Hartley 2 Perihelion (1.032 AU)  
 Dec 22 Venus Passes 1.1 Degrees North of Mars  
 Dec 22 Ursids Meteor Shower Peak  
 Dec 23 Venus Passes 3 Degrees West of Uranus  
 Dec 24 Asteroid 3688 Navajo Closest Approach to Earth (1.355 AU)  
 Dec 25 Asteroid 2952 Lilliputia Closest Approach to Earth (1.073 AU)  
 Dec 27 Comet Hale-Bopp at Opposition  
 Dec 27 Mars Passes 0.6 Degrees From Uranus  
 Dec 29 **New Moon (11:58 am)**  
 Dec 30 Asteroid 12 Victoria at Opposition (11.0 Magnitude) ☆

## MEETING ANNOUNCEMENT

The Ford Amateur Astronomy Club (FAAC) holds regular general meetings on the fourth Thursday of each month, except November and December. Our next meeting will be Thursday, January 22, at 5:00.

The FAAC meets in conference room 100 in the Ford WorldWide Web & Internet Applications (WWW&IA) building, at 555 Republic Drive in the Fairlane Business Park in Dearborn. The find the building take the Southfield Freeway to Rotunda Drive. Go east on Rotunda and take the first right into the Fairlane Business Park (there is a sign). The WWW&IA building is the first building on the left. Park on the south or east side of the building and come to the south door (there is a big "425" over the door). The WWW&IA building is secured with a card entry system. If no one is at the door to let you in, then dial 18388 on the lobby phone and we will send someone. When you enter the building, turn left and follow along the windows to the conference room. ☆

## ~~10/23/97~~ FAAC MEETING MINUTES

by Harry Kindt, Sec'y FAAC.

*This is where the minutes were supposed to go, but Harry did such a great job on them they wouldn't fit. They're on the next page.*

*None of my cartoons would fit here either, so this little space sort of went to waste. So it goes.*

-GB

## DECEMBER SPACE HISTORY

The following December events come from the 10/25/97 edition of "Space Calendar." This calendar is compiled and maintained by Ron Baalke (baalke@kelvin.jpl.nasa.gov).

- Dec 02 5th Anniversary (1992), STS-53 Launch (Discovery), DOD Mission  
 Dec 07 25th Anniversary (1972), Apollo 17 Launch  
 Dec 08 5th Anniversary (1992), Galileo, 2nd Earth Flyby  
 Dec 10 20th Anniversary (1977), Soyuz 26 Launch (USSR)  
 Dec 13 30th Anniversary (1967), Pioneer 8 Launch  
 Dec 13 35th Anniversary (1962), Relay 1 Launch  
 Dec 14 35th Anniversary (1962), Mariner 2 Venus Flyby  
 Dec 17 40th Anniversary (1957), 1st Successful Atlas Launch  
 Dec 23 325th Anniversary (1672), Cassini's Discovery of Saturn Moon Rhea  
 Dec 29 20th Anniversary (1977), Discovery of Mars Meteorite ☆

## DECEMBER 1997 SPACE EVENTS

The following December 1997 events come from the 10/25/97 edition of "Space Calendar." This calendar is compiled and maintained by Ron Baalke (baalke@kelvin.jpl.nasa.gov). Note that launch dates are subject to change.

- Dec ?? Chinastar-1 Long March 3B Launch (China)  
 Dec ?? Clark LMLV-1 Launch  
 Dec 04 Globalstar-1 Delta 2 Launch  
 Dec 04 GeoSat-FO-1 Taurus 2 Launch  
 Dec 08 Galileo Europa Mission Begins  
 Dec 08 Galaxy-Bi Atlas 2AS Launch  
 Dec 12 Galileo, Europa 12 Flyby  
 Dec 13 Galileo, Orbital Trim Maneuver #38 (OTM-38)  
 Dec 13 DSCS Atlas AC-109 Launch  
 Dec 13 SNOE/BATSAT Pegasus XL Launch  
 Dec 13 30th Anniversary (1967), Pioneer 8 Launch  
 Dec 13 35th Anniversary (1962), Relay 1 Launch  
 Dec 16 Iridium-6 Delta 2 Launch  
 Dec 17 CRSS-1 LMLV-2 Launch  
 Dec 18 Intelsat 804 Ariane 4 Launch  
 Dec 20 Galileo, Orbital Trim Maneuver #39 (OTM-39)  
 Dec 27 Progress M-37 Launch (Russia) ☆

## F.A.A.C. Meeting Minutes for 12/4/97

The meeting was called to order by our President, Bob MacFarland at 5:00 o'clock PM. There were 29 members, guests and visitors present.

Two new books are being made available through Naturegraph Publishers; "Welcome to the Moon" by Robert Bruce Kelsey and "Sundial" by Sam Muller. Bob passed out copies of these books to two of our members for evaluation. Look for the results of their evaluation of these books in future editions of the newsletter.

Don Klaser reported on the plans for the Annual Ice Days Festival at Lake Erie Metropark scheduled for January 17-18. The club is scheduled to participate in this event on Saturday, the 18th of January. Club members will be giving presentations on the various aspects of our hobby. All members are encouraged to attend and to bring along your 'scopes. Weather permitting, we will also make ourselves available for a public viewing session after the presentations.

Keep in mind that we are holding our annual election of club officers on January 22, 1998. All positions are open and we are still looking for nominees. Remember that the nominees for the positions of the President and Treasurer must be Ford Motor Company employees. Doug Bock and Jack Kennedy both suggested that we consider the idea of creating 1st and 2nd vice-president positions. The 1st V.P. would assume the responsibility of arranging the speaker/program for our monthly meetings. The 2nd V.P. would assume the responsibility of co-ordinating and scheduling the various star party events that are held throughout the year. The executive committee will be discussing this proposal at our next meeting and you will be notified of the results prior to election night.

George Korody reported on the 2nd Annual F.A.A.C. dinner party. The party is scheduled for February 28, 1998, at Pappa Romano's Headquarters Building in Plymouth, Michigan. The doors will open at 6:30 PM and dinner will be at 7:00 PM. All members are invited to this gala event. The cost, per person, (yet to be determined) will be between \$14.00-\$16.00. The exact cost and directions to the party will be available in the January newsletter. *(Those of us who attended last year's party had a great time and would encourage your attendance at this year's event --ed.)*

Bob MacFarland reported that plans are in the works for a second GLAAC (Great Lakes Amateur Astronomy Clubs) star party tentatively scheduled for May 1-2, 1998 at Kensington Metropark. More on this event will appear in future newsletters as the plans are finalized.

The Treasurer's report was read and accepted. Ray Fowler also reported that the forms were available for the F.A.A.C. Science Scholarship Award Program. As stated in the award guidelines, "this program is available to graduating high school seniors residing in the six Detroit metropolitan counties of Wayne, Oakland, Macomb, Washtenaw, Livingston, and Monroe." If you would like to obtain copies of the guidelines/registration forms, please contact one of the executive board members. We would also like you to obtain copies to post on the bulletin boards of your local high school.

Dale Ochalek reported that he and Chuck Boren will be assuming the responsibility of keeping the Intranet pages alive and well in the absence of Paul Mrozek. Paul, by the way, was applauded for the fine work he had done on the Intranet/Internet web pages. Thanks again Paul.

Doug Bock reported that his web page was once again up and running after about a week of problems with his ISP. Included in his web page is a new bulletin board service where individuals can post messages of interest to amateur astronomers. Doug's page also includes a link to E.M.U.'s light pollution site.

The editorial ship of the club's newsletter has yet to be determined. We have, at this time, three individuals who have expressed an interest in taking over as editor of the paper, Jack Kennedy, Chris Housner and Brian Gossiaux. Regardless of the final selection for editor, the newsletter is always looking for input from our general membership. So, if you would like to see your own ideas, articles, questions, etc. included in the newsletter, please feel free to contact one of the club officials and we will see that it is included in future editions.

Over our usual pizza and pop, those present had the opportunity to introduce themselves and to briefly describe their viewing experiences since our last meeting.

Our featured speaker for the evening was Mike Best who discussed his involvement with the SETI (Search for ExtraTerrestrial Intelligence) project. A question and answer period followed Mike's talk. The club then expressed its thanks to Mike for his presentation.

The meeting was adjourned at 6:50 PM.

Submitted 12/7/97  
Harry Kindt  
Sec'y FAAC

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Hmm...

Perhaps you have noticed a certain lack of "crispness" in the format of this month's STAR STUFF. This is due to the departure of our illustrious editor, Paul Mrozek, who has done such a fine job with this newsletter over the last couple of years. But for Paul's dedication to the timely publication of STAR STUFF, there probably wouldn't even BE a December issue. In keeping with his consistency and reliability, Paul prepared most of this issue before he left, and I had only to cut 'n' paste in the minutes from the Nov/Dec meeting to complete it. You can see the hack job that resulted; Paul, we will miss you. Good luck in your future endeavors, and please keep in touch.

With luck, production of STAR STUFF will be taken over by either Jack, Brian, Chris, or some combination for the coming year. Our club has consistently published one of the best newsletters going; hopefully that tradition will continue.

Merry Christmas and Happy New Year!

Greg Burnett

# STATISTICALLY SPEAKING

Location (Dearborn, MI): 42°19'12" N, 83°10'48" W, 180 meters elevation  
Local Time = Universal Time - 5 hours (Eastern Standard Time)

Abbreviations used in reports:

FM Full Moon FQ First Qtr Moon LQ Last Qtr Moon NM New Moon  
MR Moon Rise MS Moon Set SR Sun Rise SS Sun Set

## Calendar Report for December 1997

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
	SR: 7:42	SR: 7:43	SR: 7:44	SR: 7:45	SR: 7:46	SR: 7:47
	SS: 17:01	SS: 17:01	SS: 17:01	SS: 17:01	SS: 17:00	SS: 17:00
	MR: 8:52	MR: 9:46	MR: 10:35	MR: 11:20	MR: 12:01	MR: 12:38
	MS: 18:49	MS: 19:46	MS: 20:48	MS: 21:53	MS: 23:01	MS: None
7	8	9	10	11	12	13
SR: 7:48	SR: 7:49	SR: 7:50	SR: 7:51	SR: 7:52	SR: 7:53	SR: 7:53
SS: 17:00	SS: 17:00	SS: 17:00	SS: 17:00	SS: 17:00	SS: 17:00	SS: 17:01
MR: 13:13	MR: 13:48	MR: 14:22	MR: 14:59	MR: 15:39	MR: 16:22	MR: 17:10
MS: 0:09	MS: 1:18	MS: 2:28	MS: 3:38	MS: 4:48	MS: 5:56	MS: 7:02
14	15	16	17	18	19	20
SR: 7:54	SR: 7:55	SR: 7:56	SR: 7:56	SR: 7:57	SR: 7:57	SR: 7:58
SS: 17:01	SS: 17:01	SS: 17:01	SS: 17:02	SS: 17:02	SS: 17:02	SS: 17:03
MR: 18:03	MR: 18:59	MR: 19:58	MR: 20:57	MR: 21:56	MR: 22:54	MR: 23:51
MS: 8:02	MS: 8:57	MS: 9:45	MS: 10:26	MS: 11:03	MS: 11:35	MS: 12:05
21	22	23	24	25	26	27
SR: 7:59	SR: 7:59	SR: 8:00	SR: 8:00	SR: 8:00	SR: 8:01	SR: 8:01
SS: 17:03	SS: 17:04	SS: 17:04	SS: 17:05	SS: 17:06	SS: 17:06	SS: 17:07
MR: None	MR: 0:48	MR: 1:45	MR: 2:42	MR: 3:41	MR: 4:41	MR: 5:41
MS: 12:33	MS: 13:01	MS: 13:29	MS: 13:59	MS: 14:32	MS: 15:09	MS: 15:51
28	29	30	31	Lunar Events		
SR: 8:01	SR: 8:01	SR: 8:02	SR: 8:02	Nov 07	FQ: 1:11	
SS: 17:08	SS: 17:09	SS: 17:09	SS: 17:10	Nov 13	FM: 21:38	
MR: 6:40	MR: 7:37	MR: 8:30	MR: 9:18	Nov 21	LQ: 16:45	
MS: 16:39	MS: 17:35	MS: 18:36	MS: 19:42	Nov 29	NM: 11:58	

## Planet View Info Report for December 1997

Mercury	Rise	Set	RA	Dec	Elongation	Ill Fr	DISI(AU)
12/ 3/1997	9:30	18:14	18h07m29s	-25°21'12"	20°55'28"	0.494	0.91657
12/10/1997	8:57	17:55	18h12m38s	-23°49'25"	14°56'01"	0.198	0.75883
12/17/1997	7:47	17:04	17h42m11s	-21°32'15"	1°59'27"	0.003	0.67756
12/24/1997	6:42	16:13	17h09m19s	-19°53'20"	14°26'22"	0.170	0.73727
12/31/1997	6:18	15:46	17h08m36s	-20°44'30"	21°33'17"	0.449	0.87761
Venus	Rise	Set	RA	Dec	Elongation	Ill Fr	DISI(AU)
12/ 3/1997	11:03	20:01	19h47m24s	-23°59'32"	43°36'59"	0.330	0.46791
12/10/1997	10:46	19:58	20h05m44s	-22°26'32"	40°55'19"	0.275	0.41952
12/17/1997	10:23	19:49	20h18m25s	-20°46'35"	37°00'54"	0.215	0.37440
12/24/1997	9:54	19:34	20h24m09s	-19°07'09"	31°33'57"	0.150	0.33421
12/31/1997	9:17	19:09	20h21m50s	-17°35'51"	24°38'41"	0.087	0.30113
Mars	Rise	Set	RA	Dec	Elongation	Ill Fr	DISI(AU)
12/ 3/1997	10:33	19:35	19h19m17s	-23°26'59"	37°17'35"	0.952	2.03974
12/10/1997	10:25	19:35	19h42m35s	-22°36'18"	35°36'43"	0.955	2.06370
12/17/1997	10:16	19:35	20h05m40s	-21°33'09"	33°56'57"	0.959	2.08724
12/24/1997	10:05	19:36	20h28m30s	-20°38'12"	32°18'01"	0.962	2.11046
12/31/1997	9:54	19:37	20h51m02s	-18°52'17"	30°39'49"	0.966	2.13337
Jupiter	Rise	Set	RA	Dec	Elongation	Ill Fr	DISI(AU)
12/ 3/1997	12:01	22:01	21h18m44s	-16°36'17"	66°05'49"	0.992	5.34226
12/10/1997	11:37	21:39	21h23m21s	-16°41'30"	60°09'21"	0.993	5.43935
12/17/1997	11:13	21:19	21h28m19s	-15°50'40"	54°47'53"	0.994	5.53086
12/24/1997	10:49	20:58	21h33m35s	-15°24'55"	48°30'47"	0.995	5.61597
12/31/1997	10:25	20:38	21h39m08s	-14°57'20"	42°47'39"	0.996	5.69387
Saturn	Rise	Set	RA	Dec	Elongation	Ill Fr	DISI(AU)
12/ 3/1997	14:22	2:50	0h53m00s	2°48'49"	122°23'08"	0.998	8.82047
12/10/1997	13:54	2:22	0h52m31s	2°47'40"	115°30'10"	0.998	8.92212
12/17/1997	13:26	1:55	0h52m21s	2°48'37"	108°01'51"	0.998	9.02991
12/24/1997	12:59	1:27	0h52m31s	2°51'42"	100°58'12"	0.997	9.14219
12/31/1997	12:31	1:01	0h53m00s	2°56'51"	93°59'23"	0.997	9.25724
Uranus	Rise	Set	RA	Dec	Elongation	Ill Fr	DISI(AU)
12/ 3/1997	11:27	21:03	20h33m08s	-19°25'09"	54°54'05"	1.000	20.39194
12/10/1997	11:01	20:37	20h34m19s	-19°20'44"	48°05'08"	1.000	20.48670
12/17/1997	10:34	20:11	20h35m37s	-19°15'52"	41°17'18"	1.000	20.57202
12/24/1997	10:08	19:45	20h37m02s	-19°04'37"	34°30'21"	1.000	20.64681
12/31/1997	9:41	19:20	20h38m31s	-19°05'01"	27°44'12"	1.000	20.71002
Neptune	Rise	Set	RA	Dec	Elongation	Ill Fr	DISI(AU)
12/ 3/1997	10:58	20:26	20h00m03s	-20°11'37"	47°08'43"	1.000	30.80756
12/10/1997	10:31	20:00	20h00m55s	-20°09'17"	40°44'42"	1.000	30.89050
12/17/1997	10:04	19:34	20h01m51s	-20°06'43"	33°21'07"	1.000	30.96244
12/24/1997	9:37	19:07	20h02m50s	-20°03'57"	26°27'46"	1.000	31.02244
12/31/1997	9:11	18:41	20h03m53s	-20°01'01"	19°34'38"	1.000	31.06958
Pluto	Rise	Set	RA	Dec	Elongation	Ill Fr	DISI(AU)
12/ 3/1997	6:39	17:33	16h23m31s	-9°33'06"	12°56'00"	1.000	30.98259
12/10/1997	6:13	17:06	16h24m35s	-9°35'53"	16°49'14"	1.000	30.96557
12/17/1997	5:46	16:40	16h25m38s	-9°38'17"	22°09'56"	1.000	30.93494
12/24/1997	5:20	16:13	16h26m39s	-9°40'16"	28°09'46"	1.000	30.89112
12/31/1997	4:54	15:47	16h27m38s	-9°41'50"	34°29'05"	1.000	30.83462

## Planet Conjunction/Opposition/Apsides Report for December 1997

12/15/1997 Mercury @ Perihelion Distance from Sun: 0.31 AU  
12/17/1997 Mercury @ Inferior Conjunction Hour: 03

## Moon Apsides Report for December 1997

Date	Hour	Apsis	Distance (km)	Diameter
12/ 9/1997	12	Perigee	368883	0.5399°
12/21/1997	18	Apogee	404266	0.4926°

## Meteor Showers Report for December 1997

Date	Meteor Shower	ZHR	RA	DEC	Illum	Frac.	Longitude
12/ 8/1997	Puppids-Velids	15	9h00m	-48°	0.67		257°
12/13/1997	Geminids	75	7h28m	32°	1.00		262°
12/22/1997	Ursids	5	14h28m	78°	0.42		271°
12/25/1997	Puppids-Velids	15	9h20m	-65°	0.16		274°

## Twilight Report for December 1997

Date	Sun Rise	Sun Set	Astronomical Begin	Astronomical End	Nautical Begin	Nautical End	Civil Begin	Civil End
12/ 3/1997	7:44	17:01	5:59	18:46	6:33	18:12	7:08	17:37
12/10/1997	7:51	17:00	6:05	18:46	6:39	18:12	7:14	17:37
12/17/1997	7:56	17:02	6:10	18:48	6:44	18:14	7:19	17:39
12/24/1997	8:00	17:05	6:13	18:52	6:47	18:18	7:23	17:42
12/31/1997	8:02	17:10	6:16	18:56	6:50	18:22	7:25	17:47



# SKY & TELESCOPE NEWS BULLETINS

From the editors of Sky & Telescope magazine

## NEW MOONS FOR URANUS

Astronomers using the 5-meter telescope atop Palomar Mountain have turned up two new members of the solar system. Brett J. Gladman (University of Toronto) and his team imaged the region around Uranus on September 6th and 7th and discovered two objects — at 20th and 22nd magnitude — traveling along with the planet. The observations were confirmed in October using other telescopes. Thus, Uranus now has 17 known satellites. The five largest were discovered by ground-based observations. Voyager 2 found 10 more satellites during its flyby in 1986. Preliminary orbits reveal that the new satellites have highly eccentric and inclined orbits, taking them 6 and 8 million kilometers from the planet. This is more than 10 times as far away as the other moons. The objects are estimated to be 160 km and 80 km in diameter. These are the dimmest moons to be imaged from a ground-based telescope.

## GLOBAL SURVEYOR TO RESUME AEROBRAKING

NASA announced this week that the Mars Global Surveyor orbiter will resume aerobraking on November 7th. The spacecraft had been repeatedly brushing the Martian atmosphere to slow it and lower its orbit. But on October 6th a solar panel was pushed beyond its "locked" position. Engineers at the Jet Propulsion Laboratory raised the Global Surveyor's orbit to study the problem. It was decided that the mission will go forward but make shallower passes into the atmosphere. The spacecraft's final orbit will be slightly different than planned, but as project manager Glenn E. Cunningham, notes, it should not significantly affect the mission's science results.

## WHEN STARS COLLIDE

A decades-old puzzle about the ages of anomalous stars is seemingly solved. Within many globular star clusters are curiosities dubbed blue stragglers. These stars are hotter and brighter — and hence, at first glance, younger — than the bulk of their cluster cohabitants. Assuming all stars in a given globular were born simultaneously, such stars should not exist, as they would have evolved into red giants. However, results from the Hubble Space Telescope are clearing up the mystery. Observations targeting the center of cluster 47 Tucanae have identified one star that is nearly twice as massive as the Sun, but rotating 75 times faster. This result bolsters the view that blue stragglers are actually the products of mergers of two lower-mass stars. Smaller stars use up their hydrogen fuel more slowly than more massive ones. Thus while larger stars would have evolved, lower-mass stars stay largely unchanged — until one bumps into another one it the crowded core of the cluster and then sets out on a new evolutionary track. See page 19 of the October issue of SKY & TELESCOPE for details.

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# LOST MARS LANDER FOUND

Extracted from University of Western Ontario newspaper WESTERN NEWS.

## Geographer pinpoints location of lost Viking lander on Mars

By Reg Fendick, Western News, October 23, 1997

The search for a lost Viking is usually the stuff of the Anthropology department, but a Western geographer believes he has found the most lost Viking of all. Dr. Phil Stooke, who specializes in mapping asteroids, says he has pinpointed the location of the Viking 2 Martian lander, lost nearly 21 years ago on the Utopia Planitia area of the Red Planet. His finding, using a technique of his own devising, could lead to an earlier and more precise mapping of Mars. "People had basically given up because the task had seemed too hard in the past, but by bringing some new ideas to it, I was able to solve that problem and find the spacecraft."

In 1976, Viking 2 landed on Mars around the same time as Viking 1. The two craft and their orbiting counterparts fed data back to NASA for several years. Viking 1's location is well pinpointed, but the exact location of the Viking 2 lander has been a mystery since its touchdown on the flat, featureless plain of stones. Finding the craft is of more than academic interest. Stooke says that pinpointing its exact location will make the mapping of Mars quicker and more precise. NASA has plenty of photographs of the surface and a latitude/longitude grid for Mars, but the difficulty has been tying the grid and the features together in the absence of very specific reference points. The best reference points available in these cases are landed spacecraft.

"It's difficult, working on some remote world like this, making the grid and the craters line up properly," Stooke said. "But if we can find a location like this and see where it is on the surface and have an accurate measurement — from timing radio signals and things — of exactly where (the spacecraft) are on the surface, then we can tie the grid and the surface feature together. That's what this will be used for — to improve maps of Mars."

Viking 1 provided one precise point, but NASA scientists could only place Viking 2 within a 20-km range. Last summer, Stooke and an undergraduate student, Wallace Chu, decided that with some new image processing tricks, they could find the spacecraft. The usual method of mapping in cases like this is to take

panoramic photos from the lander and overhead shots from the orbiter and tie the images together. "Within that area, they could look down from an orbiting spacecraft and see craters and ridges and things on the surface. And the spacecraft that landed could look out and see craters and ridges on the horizon. So, with a little bit of detective work, people could eventually piece the two views together and find exactly where that spacecraft landed," Stooke said.

The challenge of Viking 2 was that the surface it landed on is huge and mostly featureless. Moreover, the pictures of Utopia from the Viking 2 orbiter are of poor quality. Using the available data, the best guess put the lander within a 20-km area. "It was a very, very flat site and there was hardly any relief on the horizon that they could try to tie in with these overhead pictures," Stooke said. "I was able to take advantage of some new techniques that we have now, plus this little trick of mine that exaggerates the features on the horizon and eventually I was able to find a location that worked for it."

For three years NASA has been experimenting with an imaging technique called super-resolution. In super-resolution, small features become more visible when several different pictures of the same area are combined. Stooke created his own version of the technique using the computer imaging standard software, Adobe Photoshop. He greatly enhanced the edges of the orbiter's image of Utopia. Molehills became mountains in the reworked photos. Then, he and Chu painstakingly counted the boulders on the horizon of the shots from the lander. By putting the two results together, they found Viking.

Over this summer, two new NASA missions to Mars arrived. As the world watched the first breathtaking images from the robot called Pathfinder, another probe sped on its way to the Red Planet. The orbiter Surveyor arrived in September and, over the next couple of years, will more precisely map Mars. One of the Surveyor camera crew's tasks is to look for Viking in the place where Stooke says it should be.

"Sometime over the next two years, they will attempt to photograph this area with their very high resolution camera and that will give us a test. They will probably see the lander and, with any luck, they will see it where I say it is, rather than off somewhere else," Stooke said with a laugh. The precision of the cameras on the satellite is a far cry from Viking 2. The Viking camera gave a resolution of one pixel for every 40 to 50 meters. Surveyor will be more like one pixel for every 1.5 meters.

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## Ford Amateur Astronomy Club

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