

National Aeronautics and Space Administration • Ames Research Center, Moffett Field, California

## Apollo 16 Ready for April 16 Launch

Apollo 16, scheduled for launch April 16 at 9:54 a.m. PST, will devote its 12-day duration to gathering additional knowledge about the environment on and around the Moon and about our own planet Earth. The lunar landing will take place April 20.

John W. Young is Apollo 16 commander, with Thomas K. Mattingly flying as command module pilot and Charles M. Duke, Jr. as lunar module pilot. Young is a US Navy captain, Mattingly a Navy lieutenant commander, and Duke a US Air Force lieutenant colonel.

During the three days two Apollo crewmen, Astronauts Young and Duke, spend on the lunar surface north of the crater Descartes, they will extend the exploration begun by Apollo 11 in the summer of 1969 and continued through Apollo 12, 14, and 15 lunar landing missions. In addition to gathering samples of lunar surface material for analysis on Earth, the crew will emplace a fourth automatic scientific station.

### EXPERIMENTS

An extensive array of scientific experiments in the orbiting command/service module will search out and record data on the physical properties of the Moon and near-lunar space and photographic images to further refine mapping tech-

nology. Additionally, the command module pilot will photograph astronomical phenomena in the distant reaches of space.

The Descartes landing site is a grooved, hilly region which appears to have undergone some modification by volcanic processes during formation. The Descartes region is in the southeast quadrant of the visible face of the Moon and will offer an opportunity to examine several young, bright-rayed craters created by impacts in the volcanic terrain.

Astronauts Young and Duke will climb down from the lunar module onto the lunar surface for three seven-hour periods of exploration and experimentation. A major part of the first EVA will be devoted to establishing the nuclear powered, automatic scientific station--Apollo Lunar Surface Experiment Package (ALSEP)--which will return scientific data to Earth for many months for correlation with data still being returned by the Apollo 12, 14 and 15 ALSEPS.

The second and third EVAs will be devoted primarily to geological exploration and sample gathering in selected areas in the vicinity of the landing site.

In lunar orbit, Mattingly will op-

(Continued on Page 2)



AMES EXPERIMENT ON APOLLO 16 . . . Two Ames projects, the Lunar Surface Magnetometer, (LSM, pictured at bottom right) and the Lunar Portable Magnetometer (LPM, pictured at bottom left) will be deployed on the Moon's surface during the Apollo 16 mission this month. Pictured above with the experiments are (l to r) Carle A. Privette, Experiment Manager for the LPM, Space Physics Branch; Dr. Palmer Dyal, Principal Investigator for both the LPM and the LSM, Space Physics Branch; Dr. Curtis W. Parkin, co-investigator for both experiments, Space Physics Branch; and John S. Keeler, Experiment Manager for the LSM, QUESTOL.

## Ames Projects on Apollo 16

Two Ames experiments, the Lunar Surface Magnetometer (LSM) and the Lunar Portable Magnetometer (LPM) will be aboard Apollo 16 when it is launched April 16. Similar instruments were included on three previous Apollo missions.

"Because the experiments have been so successful on past missions two Ames magnetometers and a subsatellite magnetometer will be included on Apollo 16", said Principal Investigator, Dr. Palmer Dyal, Space Physics Branch, during a recent interview. An LSM was emplaced on the lunar surface during each of the Apollo 12 and 15 missions, and an LPM was used during the Apollo 14 mission.

The instruments will measure two aspects of the Moon's magnetic field. The LSM, part of the Apollo Lunar Surface Experiments Package (ALSEP), will be left on the Moon's surface to measure variations in the Moon's magnetic field over a period of time.

The smaller, portable magnetometer, will be used by Mission Commander, John W. Young, to measure the strength of the Moon's magnetic field in four separate lo-

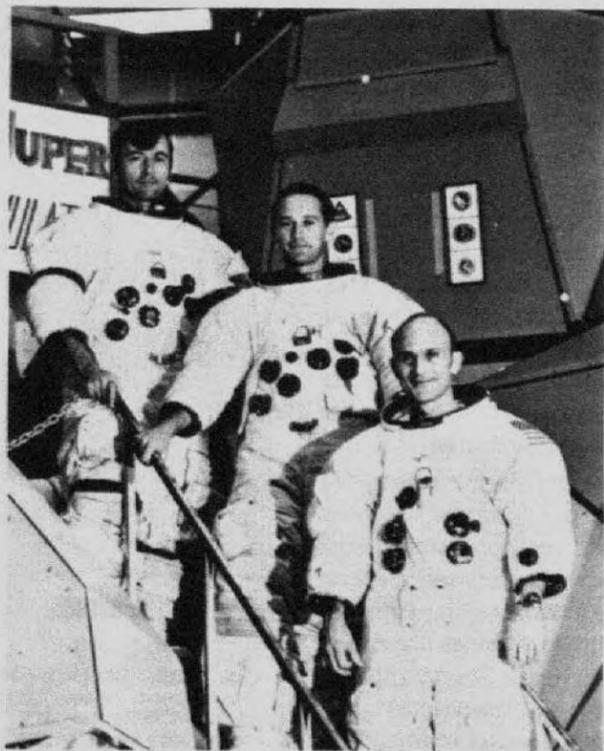
cations of the Moon's Descartes region, the Apollo 16 landing site.

The portable magnetometer was designed by Dr. Dyal and built at Ames. Carle A. Privette, Space Physics Branch, as Experiment Manager, was responsible for supervision of the instrument's construction and testing.

According to co-investigator, Dr. Curtis W. Parkin, Space Physics Branch, data returned by these instruments may ". . . shed light on the origin and evolution of the moon." With data from previous magnetometers and from the Apollo 16 instruments, scientists hope to determine the origin of lunar fossil magnetism, processes that have altered the magnetized state of the lunar surface, and their relationships to lunar evolutionary history.

Dr. Charles P. Sonett, Deputy Director of Aeronautics, is co-investigator for the Lunar Surface Magnetometer, with Dr. Parkin and Dr. David S. Colburn, Space Physics Branch. John S. Keeler, QUESTOL, was Experiment Manager for the

(Continued on Page 3)



APOLLO 16 CREW . . . ready for launch on April 16. Standing top to bottom on stairway are Mission Commander, John W. Young, Lunar Module Pilot Charles M. Duke, Jr., and Command Module Pilot Thomas K. Mattingly, II.

# Pioneer Flight Path Objectives Met

Primary objectives for the flight path of the Pioneer-Jupiter spacecraft appear to have been achieved precisely by the second mid-course correction made on March 24, according to project officials at Ames.

To determine the exact Pioneer 10 trajectory, specialists have analyzed more than ten days of radio tracking data since the mid-course change.

The primary flight path objectives are to provide optimum viewing of the planet and to get simultaneous data-return coverage by two Deep Space Network ground-tracking stations during the five hours of closest approach to Jupiter. This means Pioneer 10 will encounter the planet 14 degrees below its equator and pass just inside 87,000 miles from Jupiter's orange and blue striped cloud tops. In addition, accomplishment of the goal of flying the spacecraft behind Jupiter's moon, Io, now seems likely.

The second course change moved the Pioneer 10 fly-by point 7860 miles closer to the giant planet, and delayed arrival time by two hours and 36 minutes.

The spacecraft now is aimed precisely enough at the optimum Jupiter fly-by point that it is within the 800-mile area of uncertainty about the exact location of Jupiter and its moons.

One of the objectives of the Pioneer 10 mission is to locate Jupiter and its orbit more precisely.

Time of closest approach to Jupiter now is predicted at 6:33 p.m. P.S.T., December 3, 1973. This is seven minutes later than the estimated optimum time for passage behind the moon, Io. To pass behind Io, the spacecraft must arrive at Jupiter within a time period of 15 minutes.

However, arrival time now is within the area of uncertainty concerning effects on the flight path caused by the push of solar radiation pressure on the spacecraft. Fortunately, effects of solar radiation pressure go down very rapidly by the square of the distance away from the Sun. As a result, uncertainty caused by this solar radiation effect on the trajectory and flight time will be much less in a few weeks.

The second mid-course correction was so successful that any further velocity adjustment, if needed, would probably be only one or two inches per second. These thrusts will be made along the spacecraft-earth line, eliminating the compli-



A JOB WELL DONE... Above average performance in executing a variety of complex experimental procedures essential to the mission of his branch has resulted in a NASA Special Achievement Award for Benjamin B. Zeitman (left) of the Biochemical Endocrinology Branch. The techniques which he applied have resulted in the early fruition of research objective and publications within his organization. Dr. Stanley Ellis (center), chief of the branch, is pictured as he presented a letter of congratulations from the Director, Dr. Hans Mark, and a monetary award to Mr. Zeitman in the presence of Dr. J. Ken McDonald (right) and members of the Biomedical Research Division.

## AIAA Meeting APOLLO 16

(Continued from Page 1)

Dr. J. Edward Anderson, Professor of Mechanical Engineering at the University of Minnesota, will be the guest speaker at a dinner meeting of the San Francisco Section of the AIAA on April 20. His subject will be "Personal Rapid Transit."

The meeting will be held at Rickey's Hyatt House in Palo Alto beginning with a social hour at 6 p.m., dinner at 7 p.m., and Dr. Anderson's talk at 8:30. Advance reservations are required and may be made by calling Ames ext. 5887 prior to April 17.

ation of turning the spacecraft to a particular direction before making the thrust.

Controllers will continue to study estimates of Jupiter's exact position and effects of the pressure of solar radiation to determine what if any further changes in the spacecraft course, will be needed to hit the optimum arrival time.

Because of the near perfect launch to Jupiter, 170 meters per second of thrust remain, far more than the amount required for any anticipated course changes.

The current fly-by point will allow multiple studies of Jupiter's 30,000 mile long Great Red Spot, of the planet's turbulent belts, zones, and cloud currents, as well as of its magnetic field and radiation belt, plus return of pictures.

erate experiments in the scientific instrument module (SIM) bay for measuring such things as the lunar surface chemical composition, and the composition of the lunar atmosphere. A high-resolution camera and a mapping camera in the SIM bay will add to the imagery and photogrammetry gathered by similar cameras flown on Apollo 15. Mattingly will perform an inflight EVA during transearth coast to retrieve film cassettes from these camera.

Using hand-held cameras, Mattingly will photograph such phenomena in deep space as the Gegenschein, and looking earthward, photograph the ultraviolet spectra around Earth.

A second subsatellite, similar to the one flown on Apollo 15, will be ejected into lunar orbit to measure the effect of the Earth's magnetosphere upon the Moon and to investigate the solar wind and the lunar gravity field.

The landing crew will remain at Descartes for 73 hours before they return to lunar orbit and for rendezvous with the orbiting command module on April 23. Earth splash-down will occur on April 28 at 12:30 p.m. PST in the central Pacific just north of Christmas Island.

Communications call signs to be used during Apollo 16 are "Casper" for the command module and "Orion" for the lunar module.

# Telescope Studies for Ames' C-141

NASA is inviting the scientific community to submit proposals for use of an Airborne Infrared Observatory which will be available to experimenters in mid-1973.

The observatory, to be operated as a national facility by Ames Research Center, is the C-141 jet transport which will be fitted with a 36-inch aperture telescope. The aircraft will be able to carry the telescope to altitudes above 85 percent of the atmosphere and 99 percent of atmospheric water vapor which obscures Earth based observations in infrared wavelengths. The C-141 can fly at 39,000 feet for four hours.

Proposals for support beginning in July 1973 will be accepted until May of this year. Robert Cameron of the Ames Airborne Science Office has further information on the subject.

## Guy Ferry Honored by Toastmasters

Guy V. Ferry of the Ames Planology Branch has been recognized as a Distinguished Toastmaster by Toastmasters International for his participation in the organization's educational and community activities.

Distinguished Toastmaster recognition is the highest honor that can be earned by a member of the Toastmasters organization. It signifies accomplishments in the club's communication and leadership program, leadership experience as an elected and appointed club and district officer, and participation in Toastmasters community program.

In a letter from the Executive Director of Toastmasters International Mr. Ferry was cited for voluntarily investing his time and effort in the club's program, demonstrating a sincere desire to improve his communication and leadership abilities.

Toastmasters International has been in existence for 48 years and at present has 65,000 active members.

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# LPM Experiment Repeated

The Lunar Portable Magnetometer (LPM) an Ames in-house effort, was carried previously on the Apollo 14 mission and will be part of the Apollo 16 mission.

Two measurements were obtained with the instrument during the Apollo 14 mission. Both were startling. The first was about 103 gammas and the second was about 43 gammas. Gammas are a measurement of magnetic field intensity like candlepower is a measurement of light intensity.

These values were startling because they were much larger than expected, and the difference in the two values, 60 gamma, was equally surprising. Scientists had not expected such a large change to occur over a short distance.

In order to help understand the rapid change with distance, scientists are most anxious to obtain several measurements on Apollo 16.

Dr. Palmer Dyal, of the Space Physics Branch, designed and is Principal Investigator for both the Apollo 14 and 16 magnetometers. Other investigators for the Apollo 16 project are; Drs. Curtis W. Parkin, Space Physics Branch; Charles P. Sonett, Deputy Director of Astronautics; Gene Simmons, Massachusetts Institute of Technology; and Robert DuBois, Oklahoma University.

Carle A. Privette was Project Manager for both instruments. The



ONE OF AMES' MOST SUCCESSFUL . . . projects, the Lunar Portable Magnetometer (LPM) will measure the Moon's magnetic field this month during the Apollo 16 mission. Pictured above with the instrument is LPM Experiment Manager, Carle A. Privette, Space Physics Branch,

projects were handled entirely at Ames, including design, parts screening, construction and qualification and acceptance testing.

The project manager was assisted on both the Apollo 14 and 16 projects by Charles E. Duller and by Michael G. Dix, who was responsible for the electronic design.

Thermal design was provided by John Arvesen of the Thermal Protection Branch. Dave Englebert, Robert Davidson and Earl Menefee, all of Research Equipment Engineering, contributed to the mechanical design.

Calibration was handled at the Ames Magnetic facility under Ernest J. Iufer and Robert R. Murphy.

Electronic fabrication was accomplished by Robert A. Steinhauer and Chales E. DeMarco of the Electronic Instrument Branch.

Environmental testing was done in the Systems Engineering building under the direction of George De Young, Reliability and Quality Assurance; Darrain Waters and Robert Barrow of Sterling Inc.

Joe F. De Rose, a mechanical technician with the Astrophysics Branch, and Emma V. Thiemann, a purchasing agent with the Space Physics Branch, were of particular assistance to the project.

## LPM-LSM Timetable

During the Apollo 16 astronaut's first Extravehicular Activity (EVA), scheduled for Thursday, April 20, the Apollo Lunar Surface Experiment Package (ALSEP) will be emplaced on the Moon's surface, about 300 feet from the Lunar Module.

The Lunar Surface Magnetometer (LSM) will be one of the first experiments deployed at this time. Apollo 16 Commander, John W. Young, will set up the LSM as Charles M. Duke, Jr., Lunar Module Pilot, begins the Heat Flow Experiment.

After the remaining ALSEP instruments have been deployed the astronauts will drive to Flag, then Spook Crater. There they will collect soil and crater samples, photograph the area and Young will take the first Lunar Portable Magnetometer (LPM) reading.

LPM readings may be of particular significance at this site since they will be used to investigate the effects of a crater on the Moon's fossil magnetic field. The surface field is called "fossil" because it is believed that the subsurface rocks



THE LUNAR SURFACE MAGNETOMETER . . . will again be part of an Apollo mission. As part of the Apollo Lunar Surface Experiments Package (ALSEP) it will be deployed during the first Extravehicular Activity. Pictured above with the instrument is the Experiment Manager, John S. Keeler, QUESTOL.

## Third LSM To Be On Apollo Mission

The first measurements of the Moon's magnetic field to be taken on the lunar surface were made with the Ames Lunar Surface Magnetometer (LSM) during the Apollo 12 mission in November 1969. A similar instrument was left at the Apollo 15 site. A third LSM will be emplaced on the lunar surface during the Apollo 16 mission.

The instruments are used to measure the variation with time of the magnetic field at the surface of the Moon. These variations are influenced greatly by the electrical properties of the interior of the Moon. The largest change with time in the magnetic field ever measured

were magnetized some 3 to 4 billion years ago by a large magnetic field which no longer exists on the moon.

Three LPM readings will be taken during the last EVA on Saturday, April 22. During this EVA the astronauts will travel across the Moon's Cayley Plains and Rays to the lower slopes of Smoky Mountain. Then, during the return journey, they will stop and make three LPM measurements in the vicinity of Palmetto Crater.

At the last site near Palmetto Crater on the Cayley Plains, Young will place a lunar rock on top of the LPM, take a reading of its magnetic field, then retrieve the rock so that comparison readings may be made when the astronauts return to Earth.

A total of five LPM readings will be taken during the mission. The LSM is expected to return data for several years.

in space, about 100 gamma, was detected by the Apollo 12 LSM.

Scientists hope to use data from the magnetometers to measure indirectly the temperatures of the interior of the Moon.

Dr. Palmer Dyal, of the Space Physics Branch, is Principal Investigator for the Apollo 16 LSM. Other investigators on the project are; Drs. Curtis W. Parkin, Space Physics Branch; Charles P. Sonett, Deputy Director of Astronautics; David S. Colburn, Space Physics Branch; Bruce F. Smith, also of the Space Physics Branch; and Gerald Schubert, University of California at Los Angeles.

John S. Keeler, QUESTOL, was LSM Experiments Manager for both the Apollo 15 and 16 missions. John C. Arveson, Thermal Protection, was Thermal Engineer for the project. David F. Englebert, Research Equipment Engineering, was Mechanical Engineer.

The instrument was built by Philco-Ford Corporation under the direction of Mr. Fred Bates.

(CONTINUED from Page 3)  
LSM.

Dr. Sonett is also an investigator for the Lunar Portable Magnetometer with Dr. Parkin Robert L. DuBois of Oklahoma University and Dr. Gene Simmons of the Massachusetts Institute of Technology.

The experiment was initiated in the Special Projects Office, headed by Donald Mulholland, and continued in the Space Physics Branch under the direction of John Wolfe.

## Ames Airings

... by Jeanne Richardson

FRANK PAULI, Flight and Systems Research, and his wife, Rita, returned recently from a Caribbean cruise.

They visited nine of the West Indies islands, including Nassau, Martinique, San Juan, and Barbadoes. Frank said the entire two weeks was filled with warm balmy weather and beautiful scenery.

Frank also said (proudly) that he won the ship's spoon-diving contest. For braving the deep end to the tune of 12 spoons, Frank won two of the ship's ashtrays. Congratulations Frank!



AROUND-THE-POLES PILOT . . . Elgen M. Long (left) of Woodside, the commercial pilot who flew solo in a twin-engine Navajo airplane around both the north and south poles, landed in seven continents and set a number of other world's records for a solo flight, was a recent guest at the Center. He and Mrs. Long (center) were greeted by C.A. Syvertson, Deputy Director of Ames, and taken on a tour of facilities by Anthony Cook, Technical Assistant to the Director of Aeronautics and Flight Systems. The visitors made special note of the STOL research being undertaken at the Center and were interested in the landmark 40- by 80-Foot Wind Tunnel as well as the flight simulators. Mr. Long remarked that his flight was made possible because of the carousel on-board navigation guidance system designed for the Apollo spacecraft.

Mr. Syvertson is pictured showing the couple a model of the M-2 lifting body which he helped design and develop at Ames.

## Survey Indicates Abuse of "Special"

The special messenger service provided at Ames is for use when extraordinarily fast mail delivery is necessary. It is not provided for the personal convenience of individual employees.

A recent survey by the Services and Supply Division, monitors of the mail room operation, indicated that this service has been abused. During March the daily number of calls for "Specials" was 112. During the same period last year the average was 49.

When calls are received for the delivery or pickup of flowers, parts, soiled shop coats, and the like, the special messenger is made unavailable for legitimate business.

For special messenger service call ext. 5994; however, no special service is provided after 4 p.m.

## "Thank You" Notes

"My sincere thanks and appreciation to all those good people who remember me and came to my retirement dinner, and also all those who made it possible to present me with a timely gift of a slide projector and money envelope. I thank you all kindly from the bottom of my heart and will always cherish your friendship.

Again Thank You,  
Anthony Quartuccio"

"My wife and daughter join me in expressing sincere thanks for the memorable luncheon and generous gifts from my many friends at Ames.

I feel that my life has been enriched by 28 years of association with so many very fine and capable people here at Ames. Although I will miss you all very much, I do not feel that I am leaving you - but rather feel that I am taking a little bit of each of you with me.

Best Wishes and Thanks,  
Albert G. Oswald"

## BOWLING

The Ames summer bowling league is now being formed. Anyone interested in bowling is asked to call D. Gowan, ext. 6175, or H. Garrison, ext. 6048.

## GOLF

... by Kay Bruck

The Best-Ball Twosome Tournament held at Santa Teresa on April Fool's Day was in two flights. Partners were picked out of a hat, making for some interesting handicap liaisons. Co-chairmen Clark White and Bob Sheaffer reported the following winners:

First Flight - Bob Carlson and Bill Page, first place; Jack Lee and Elmer Hampel, second place; and Howard Matthews and Ray Einberger, third place.

Second Flight - John Mulkern and Kay Bruck, first place; Vance Oyama and Howard Garrison, second place; and Ken Souza and Ruth Richardson, third place.

Low Gross winner was Frank Lazzeroni; low net winner was Mitch Radovich; and Closest-to-the-pin went to Clark White.

A hearty "Welcome to the Club" to our many new members. We hope you will improve your game and make many enjoyable friends along the way.

The next game will be at Spring Valley, Milpitas, on May 13.

## WANT ADS

The Astrogram's ad section is provided as a personal, non-commercial service to Ames employees. Advertiser must be identified by name, extension and organization. The name may be left out of the ad but is needed for records. Ads must be submitted in writing to The Astrogram, N241-4, by Thursday, a week before publication. The advertiser's home telephone number must be provided as a point of contact except in carpool notices.

### AUTOMOBILES

For Sale-1965 wagon, 352 V8, P/S, R/H, new tires, battery, carb., wiring, hoses, \$500. Runs exceptionally well. S.C. Sommer, 321-8418.

For Sale-1971 Dodge Colt. 4-speed, 4-door sedan. Radio. Pacific blue with matching interior carpeting. With car, free skis, tire chains, and tool kit. \$1633. Malcolm, 287-8678, after 6 p.m.

For Sale-1956 Chevy (64 Chevy engine), 4-dr., Sedan automatic trans., power brakes, R. & H., good tires. Excellent transportation car. \$125 or best offer. Call Chuck McClinton 272-1812 after five.

### HOUSING

For Sale-3-bdrms., 2 1/2 baths home in Willow Glen. Immaculate with new carpets and drapes. Separate hobby room with wet bar and floor to ceiling fire-place, and large enough for pool table. Must see to believe. \$33,950. Eve. 264-7426.

For Sale-Prime Santa Clara Area, Spacious br. 2-ba., AEK, very good condition, hardwood floors, forced air heating, beautiful patio, care-free landscaping. Walk to schools, shopping center, park and bus. \$29500. 243-4483.

Wanted-2 or 3 bedroom furnished home or apartment convenient to ARC for any four week period commencing July 1, 1972 to August 31, 1972, George T. Lenehan, 964-2474.

### MISCELLANEOUS

For Sale-Apartment size refrigerator, white, \$100 or best offer. Call 734-3368 after 5 p.m.

Wanted-Up to 3 or more members for ride group 7:30 - 4 vicinity of Almond School in Los Altos. Call F. Pauli, 6115 or J. White, 5446.

For Sale-H.D. Trailer hitch, fits 68-72 Ford P.U. \$30. Wooden P.G. & E. cable reel spool, one side, 2" thick x 6' diameter, makes excellent patio table. \$15. Call 378-5173 after 5 p.m.

Rototilling Service-reasonable rates, free estimates, call 378-5173 after 5 p.m.

For Sale-Have been fasting for the past 2 years, am selling my dinette and 4 chairs. 36" round, 12" leaf, woodgrained Formica top, floral avocado chairs. Hungry, however, for cash, yours for \$70 or best offer. J. Frick 736-1177.

For Sale-7 foot sofa, sable brown, contemporary style, \$30. Call 969-9485, after 5:30 p.m.

For Sale-Large portable stereo record player; 20 watt Motorola, detachable speakers, very good condition; \$30 or best offer; call 969-9485, after 5:30 p.m.

For Sale-Hiking boots (Sears-Roebuck), very good condition, size 10 1/2 B; \$7. Call 969-9485, after 5:30 p.m.

For Sale-20' vacation trailer '67 Teny Tandem. 14' Fiberglass Ski Craft w/ 35 h.p. mercury motor and trailer. Both at Lakeport Resort on Clearlake. 867-0958.

For Sale-"Huffy" gas edger-trimmer in new condition; four-wheel type with Briggs-Stratton engine \$45. Large set bronze, hand-crafted flatware made in Thailand, \$50. Call 246-3356 after 5 p.m.

For Sale-Honda CT 90 Trail bike, 1700 miles, like new, \$350 call 736-6810.

Wanted-Old or used umbrellas in any condition for Rainbow Assembly installation. Will pick up, 739-2306.

For Sale-Beautiful 1.6 acre view lot in Murphy's Calif. Many trees, sewer and utilities to lot. Walk to town. Only 38 miles to Bear Valley on Rte. 4. \$6,800. Dot Evans, 948-2084.

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# the astrogram

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## Space Shuttle Sites Selected

NASA Administrator James C. Fletcher has announced the selection of the Kennedy Space Center in Florida and Vandenberg Air Force Base in California as the sites from which the Space Shuttle will be operated.

The initial launch and landing site will be at Kennedy. This site will be used for research and development launches, expected to begin in 1978, and for all operational flights launched into easterly orbits. Facilities for all Shuttle users at KSC will be provided by NASA, largely through modifications of existing facilities built for the Apollo and other programs.

Toward the end of the decade it is planned that a second operational site will be phased in at Vandenberg Air Force Base for Shuttle flights requiring high inclination orbits. The basic Shuttle

facilities required at Vandenberg are planned to be provided by the Department of Defense (DOD).

These decisions, which have been concurred in by the DOD, were reached by the NASA Administrator after nearly a year of study by a Site Review Board chaired by Dr. Floyd L. Thompson, former Langley Director. During the past year several Shuttle configurations have been under consideration. The site selection decision follows NASA's decision announced on March 15 that the Space Shuttle will use water recoverable solid rocket boosters.

Dr. Fletcher stated that the Board's studies of all alternatives clearly showed that the Kennedy-Vandenberg combination has cost, operational, and safety advantages over any possible single site or any other pair of sites in the U.S.

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## Scientists Say Ancient Rocks May Show Early Turning Point In Life



AMES SCIENTIST . . . Dr. Keith Kvenvolden, holds 3.4 billion-year-old sedimentary rock, thought to contain evidence of photosynthesis on Earth.

Researchers may have discovered fossil evidence of the beginning of photosynthesis on Earth some 3.3 billion years ago in some of the oldest sedimentary rocks found so far.

Dr. Keith Kvenvolden, Chief of the Ames Chemical Evolution Branch, and Dr. J. William Schopf and Dorothy Z. Oehler, both of the University of California at Los Angeles, say that they have located rocks which may show the transition from primordial organic carbon to organic carbon produced by photosynthetic organisms. Since all life on Earth is based on carbon, carbon in sediments can provide good evidence of life processes.

The Ames-UCLA research team reported the find in a recent issue of "Science" magazine. They caution that other explanations of their find can be suggested and that, until further studies are made, no final conclusion should be drawn.

The research was done in connection with NASA's interest in planetary evolution and planetary biology to gain a better understanding of the evolution on planets such as Mars and Venus.

Most scientists believe that simple forms of life able to reproduce themselves appeared before organisms capable of photosynthesis. However, these earliest living things depended on the very limited natural

food already present on the primitive earth. Only with photosynthetic organisms, which could make their own food by using the energy of sunlight, was life possible as we know it. Today all animals, and man, depend on food produced by photosynthetic organisms -- plants.

The 3.4 billion-year-old carbon that may pre-date the appearance of photosynthesis was found in pre-Cambrian sedimentary rocks known as cherts. The Ames-UCLA scientists took the rocks from the lowest, and hence the oldest, layers of the Onverwacht strata located in the Barberton Mountain Land, South-eastern Transvaal, Union of South Africa. These rocks have been dated at about 3.4 billion years old by the rubidium-strontium and lead-lead methods.

The ancient carbon in these oldest sedimentary rocks was similar to organic carbon found in meteorites believed to come from the Asteroid Belt. Meteorite carbon is known to have been produced by non-biological processes. The same meteorites contain amino acids of non-biological origin.

The Onverwacht find fits the theory of chemical evolution for the origin of life, held by most scientists. Chemical evolution proposes that the energy of ultraviolet light, heat, lightning, and other phenomena, when applied to the ammonia, methane, and water of Earth's primordial atmosphere and oceans, produced ever-more-complex organic molecules. After about a billion years a molecule appeared which could reproduce itself. These first living molecules are thought to have rapidly exhausted the existing food supply of natural organic molecules, threatening extinction of life. At this point organisms that could make food by photosynthesis appeared, and life was put on a stable basis.

If the 3.4 billion-year-old ancient carbon from the lowest and oldest Onverwacht strata is, as it appears to be, of non-photosynthetic origin, it could either be primordial and non-biological in origin or contain the remains of those earliest pre-photosynthetic organisms. Further

(Continued on Page 2)



PAET TEAM EFFORTS . . . made possible the achievement of mission objectives of the Ames-managed Planetary Atmosphere Experiments Test and resulted in a NASA Group Achievement Award for some 41 members of the Ames staff, and members of the team at Goddard, Langley and Wallops. The original award was presented by the NASA Administrator during the annual awards ceremony at NASA Headquarters last October. Glen Goodwin, Ames Director of Astronautics, accepted the award in behalf of the PAET Team at that time. Duplicates of the award were presented to individual members of the team by Dr. Hans Mark (left), Ames Director, pictured here as he read the citation on the original certificate held by David E. Reese, Jr., Manager of the PAET Project. The citation states, "for outstanding contribution to the design, development and operation that led to the success of the Planetary Atmosphere Experiments Test Project. The flight results provide important technology and instrumentation of significant value to planetary missions."

# AIAA National Conferences Held

The 7th Thermophysics Conference of the American Institute of Aeronautics and Astronautics (AIAA) was held recently at the San Antonio Convention Center in Texas. The Conference was co-located with the AIAA/ASME/SAE 13th Structures, Structural Dynamics, and Materials (SDM) Conference, and the NASA Space Shuttle Working Group Conference.

Combining the three conferences brought together specialists in various disciplines from industry, government and universities to discuss current technical problems encountered in advanced transportation systems.

## THERMOPHYSICS

The Thermophysics Conference provided for ten sessions at which papers were presented on applied research, analysis application and experiments in the area of assent and thermal protection, contamination effects on thermal and optical surfaces, and the like. Several Ames research scientists participated in this Conference and presented papers or served as session chairmen. Authors and their papers were:

William P. Gilbreath, Materials Research Branch, "The Degradation of Space Shuttle TPS Metals in Dissociated Oxygen"; John P. Kirkpatrick, Vehicle System Design Branch, chairman of the Heat Pipes II Session and co-author of a paper presented at that session on "A Variable Conductance Radiator for the Lunar Surface Magnetometer (LSM)"; William C. Davy, Hypersonic Free-Flight Branch, "Vaporization Characteristics of Carbon Heat Shields under Radiative Heating"; and John H. Lundell and Robert R. Dickey, Thermal Protection Branch, co-authors of "The Ablation of Graphitic Materials in the Sublimation Regime."

## STRUCTURAL DYNAMICS

The 13th SDM Conference was under the sponsorship of the AIAA, the American Society of Mechanical Engineers (ASME), and the Society of Mechanical Engineers (SAE). Papers were presented which brought to light problems associated to research, development, and operational aspects of Structures, Structural Dynamics, and Materials technologies as related to land, sea, air and space transportation -- both manned and unmanned.

Researchers from Ames participating in the SDM Conference and



COOPERATIVE EFFORT PAYS OFF . . . Clifford D. Ryan (left), Procurement Chief of the Small Business Administration (SBA) in San Francisco, recently presented the SBA's Achievement Award to Alvin S. Hertzog (right), Chief of the Ames Procurement Division, shown accepting the certificate in behalf of the Center. The award is presented to Federal agencies that cooperate and assist the SBA in attaining or exceeding goals established by the President's Minority Business Development Program for fiscal year 1971.

their papers were: Nick S. Vojvodich, Thermal Protection Branch, "PAET Heating and Heat Protection Experiment"; H. Theodore Sumsion and Charles A. Hermach, Materials Research Branch, "Coatings to Improve Fatigue Properties of Aircraft Metals"; Lado Muhlstein Jr. of the Aeronautical Structures Branch, "Experimental Evaluation of the Aerodynamic Damping of Skin Panels at Low Supersonic Mach Numbers"; and Peter A. Gaspers, Jr. of the Aeronautical Structures Branch, "Calculation of Panel Flutter Boundaries."

## SPACE SHUTTLE

Papers for the Space Shuttle Technology Conference were invited by NASA. Selected to present papers from Ames were: Lado Muhlstein, "Assessment of Potential Buffet Problems on the Space Shuttle Vehicle"; Jules B. Dods, Jr., and Richard D. Hanley, Aeronautical Structures Branch, co-authors of "In-flight Aeroacoustic Environments on Prospective Space Shuttle Vehicles" and Howard E. Goldstein, Thermal Protection Branch, a co-author of "Reusable Surface Insulation Material Research and Development" Also participating in this Conference was Charles F. Coe, Chief of the Aeronautical Structures Branch, who co-chaired the session on Aeroelasticity and Loads.

# Film Series on Earth Science Applications

A film series on Earth Science Applications is being presented by the Ames Earth Science Applications Office in the Space Science Auditorium, Building 245, Room 296, every other week. The next film in the series, "Benefits from Space", will be shown at 12 noon on Friday, April 28.

Purpose of the film series is to inform Ames employees of the activities and accomplishments in the field of Earth observations and remotes sensing of the environment.

The films describe the role of applications satellites and spacecraft, such as ERTS and SKYLAB, in the areas of pollution monitoring, location of mineral resources, long-range weather forecasts, oceanography, agriculture, land use and urban change, watershed and forestry management, precise earth measurements and improved navigation and communications. The work depicted is currently being supported by NASA's Earth Resources Survey Program -- a program in which instrumented aircraft fly multidiscipline missions for government agencies, as well as for educational institutions and individual scientists. This program forms the basis for the gathering of data and the advancement of technology which will be used aboard spacecraft and satellite platforms.

With this information endeavor the Earth Applications Office staff members hope to stimulate interest among the Ames staff in the application of some facet of their work to the needs of the environment through the Earth Resources Program. The film to be shown on April 28 gives a brief glimpse of the space program in the next decade. Major benefits are proper management of our environment, technological development, and increased knowledge.

## Ancient Rock Find

(Continued from Page 1)  
studies will be needed to determine this.

The entire 19-kilometer-thick Onverwacht section of strata has been turned on its side by Earth movements, and lies on the surface, so it can easily be studied. Geologists have clearly established the originally lower and higher layers. The carbon analyses were made of 16 cherts from nine different geologic horizons.

The researchers analyzed 39 samples of pre-Cambrian rocks sediments.

The Ames-UCLA scientists made triplicate analyses of the ancient, apparently non-photosynthetic, carbon found in rocks from three sites. They ruled out contact metamorphism -- changes caused by intrusions of molten rock -- because samples were taken .4 kilometers away from any known intrusions.

## Space Brochures

Copies of a brochure entitled "Skylab" are available, by written request, from the Audio-Visual Facility, c/o Public Affairs Office, Mail Stop 201-6. Indicate the number requested and give name and mail stop.

Copies of two other publications, "Space Benefits, Today and Tomorrow" and "Space Shuttle", are still available and may be obtained upon written request.

**The Astrogram** Room 134  
Admin. Mgt. Building  
Phone 965-5422

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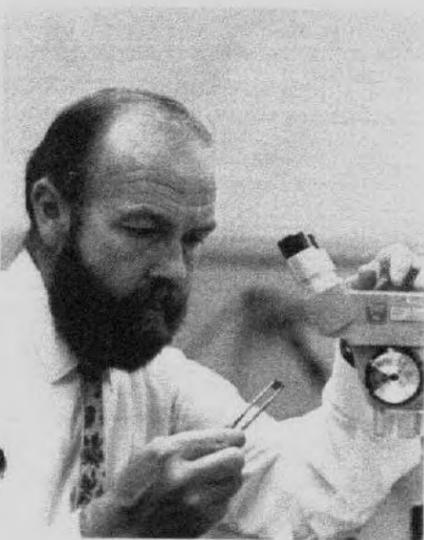
Editor . . . . . Dorothy M. Evans  
Editorial Assistant . . . . . Jeanne Richardson  
Reporters . . . . . NASA Employees

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Thursday between publication dates

# Scientists Continue Research With Apollo 16 Data

THE MOON IS MADE OF . . .

After studying lunar samples from Apollo missions 11, 12, 14 and 15, Dr. William L. Quaide, a geologist with the Planetology Branch, has determined that the Moon is not made of American cheese.



DR. WILLIAM L. QUAIDE

He found, instead, that the surface is made of various rocks, including two types of lava. One type, found in the Mare regions (the large dark areas seen on the earth-facing side of the Moon) is basalt. The second type, found in the Highland regions, is also a basalt, but of a different composition.

Dr. Quaide and his co-investigators, Robert Wrigley, Dr. Theodore E. Bunch and Dr. Kenneth G. netsinger, all of the Planetology Branch, will be studying samples from the Apollo 16 mission to determine the differences in these two types of rock and what these differences mean in terms of the history of the moon.

"At first, with Apollo 11," Dr. Quaide said during a recent interview, "we were interested in determining the nature of the lunar soil. We've come a long way since then."

Scientists have determined that the Moon was probably melted to a depth of 200 kilometers very early in its history. Two layers were differentiated from this melting, the crust and the mantle.

Then the radioactive content of the minerals below the surface caused a second heating. This second melting brought lava from the mantle to the lunar surface, filling depressions in the original crust.

With Apollo 16 and 17 samples the scientists hope to learn when the rocks at these landing sites were formed and how they fit into

a lunar time sequence, or history, as well as more about their composition.

Speaking of the ages of the previous lunar samples, Dr. Quaide said, "The oldest we've found is four billion years old, and the youngest is 3.2 billion. But, we suspect there are younger rocks. We're especially interested in the ages of the peculiar crustal rocks and the highland volcanic rocks."

"Putting all this information together; what we have learned about the Moon's formation from previous samples and what we will learn from the Apollo 16 and 17 samples, we may be able to piece together a reasonable account of lunar history."

Dr. Quaide is one of a group of scientists, worldwide, who has received lunar samples from each of the Apollo missions.

LIFE ON THE MOON . . .

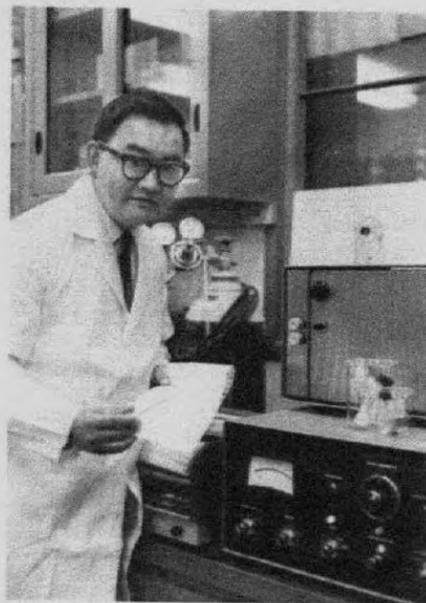
Vance Oyama, Life Detection Systems, is the only scientist chosen to look for extraterrestrial life in lunar samples. He has found none in the samples from Apollo 11, 12, and 14 missions, but he is still looking. He will soon be studying samples from Apollo 15 and 16. Oyama, with co-investigators, Drs. Edward Merck and Melvin Silverman, both of Life Detection Systems, have studied the samples in over 300 environments.

In auxiliary studies Elaine F. Munoz, Life Detection Systems, Silverman and Oyama have found that the lunar soil did not inhibit the growth of six different organisms. In some instances the samples improved deficiencies in the nutrient environment which were necessary to support some of the nonessential functions of the organism.

"We concluded," said Oyama during a recent interview, "that the Moon can indeed supply some of the things missing from our medium." Oyama compared the lunar surface to a California desert in mineral content. "Like the desert," he said, "the lunar minerals haven't been leached. So, if the right ingredients were available, and with some supplementation, it could support life."

With Apollo 15 and 16 samples Oyama will continue the culture studies using a number of environments. The Ames team will also continue to investigate the possibil-

ity that lunar soil is toxic to terrestrial life.



VANCE OYAMA

Of his future research with the lunar samples Oyama said, "There are so many undiscovered new facts. To make a prediction as to what will happen is a mistake. Besides, nonpredicted observations are often more important than the goals we set for ourselves."

"The continued work on the Viking project (the 1975 Mars probe) will probably influence our research with these next lunar samples.

"It's a continuing education process," he concluded.

A ROCK BY ANY OTHER NAME . . .

The research conducted from an Apollo Command Module (CM) while the Lunar Module is on the Moon's surface is often a forgotten part of an Apollo mission. The data collected from the Apollo 16 Command Module, however, will be as valuable to Ames scientists as that collected on the lunar surface.

Dr. Ronald Greeley, of the Planetology Branch, will be particularly interested in the photographs taken from the orbiting CM. CM pilot, Thomas K. Mattingly, II, has photographed a large area of the lunar surface during the mission, including the far side of the Moon, which is never seen from Earth.

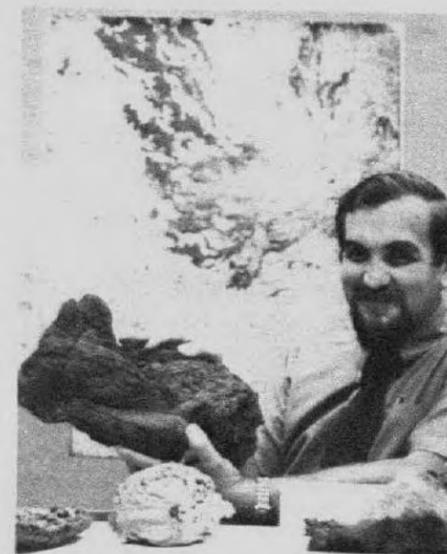
Dr. Greeley will compare these photographs with others he has taken during four years of study of geologic formations on Earth to determine how similar are the formations of the two planets.

Using Apollo 15 lunar photographs and results from his field studies of the basaltic lava flows of Hawaii, California, Washington, Oregon and Idaho, Dr. Greeley was able

to determine that many lunar rilles were formed by lava flows in the same way that Earth's lava channels are formed.

With Apollo 16 photographs Dr. Greeley hopes to determine, among other things, the origin of what is called the Cayley Formation. The formation covers much of the highlands of the Moon. It appears to be a light-colored material which gives a softening effect to the surface features, and has distinct boundaries.

At the Apollo 16 landing site this mantle covers an area that is heavily pocked with craters, a characteristic that usually indicates the formation is very old. The mantle itself, however, indicates that it may have formed rather recently, geologically speaking.



DR. RONALD GREELEY

Dr. Greeley hopes to learn how and when the mantle was formed from photographs and the results of Apollo 16 lunar sample research, also conducted at Ames under the direction of Dr. William Quaide (See story on this page). In the same way he will also study the Descartes mountain region to determine its geology and time of formation.

Results of Dr. Greeley's Earth field study are also being applied to the Mariner 9 mission to Mars. Comparing his photographs and knowledge of Earth's formations with the Mariner 9 data, scientists have been able to determine that basalt is also present on the Martian surface.

Scientists hope to gain insight into the origin and evolution of our solar system with the results of Dr. Greeley's research and those of related research.

## Ames Airings

... by Jeanne Richardson

I was thumbing through "Adventures in Research" recently and found some interesting and little-known facts about Ames Research Center that I thought should be shared (particularly since I haven't heard of any weddings, vacations or good dirt lately).

They are just short sidelights to the history of the Center which have evidently been overlooked in the past. Some of the more with-it old timers may already have heard these. If so, go on back to reading the Want Ads.

### LITTLE KNOWN FACTS ABOUT THE HISTORY OF AMES:

Despite fears that the area was slowly sinking beneath San Francisco Bay, Moffett Field was chosen over Dismal Swamp, Virginia as the place to build Ames Lab.

Although Moffett Field should have been identified with the nearest town, Mountain View, Sunnyvale was used for its address instead. (An arrangement that often goofed up the mail.) It was felt that Sunnyvale . . . "presented a more pleasing image for an airfield and seemed less likely to elicit critical questions about the site."

Dr. Vannemar Bush, for whom the circle is named, once beat on a table to make a Senate Subcommittee listen to him about a bill to build Ames. They didn't pass the bill, but they did listen.

## Credit Union

The Board of Directors of the Moffett Field Employee's Credit Union has made major changes in loan policy, according to John F. Pogue, Chairman of the Board. Drastic changes have been made in the limits on the amount and maturity of loans -- for the benefit of the members, and interest charges on certain loans have also been reduced.

Mr. Pogue stated that share secured loans (100 percent secured by shares) and motor vehicle loans have been increased up to \$10,000 and ten years. "Our entire loan policy has been rewritten to extend even greater service to our membership. We know that our members will be pleased with this new policy", he said.

The changes are too extensive to list; therefore, members who are considering the financing of an item are urged to check with Fred Mayer, Credit Union manager, 966-5494.



WOULD YOU BUY A PAINTING FROM THIS MAN? . . . Cary O. Fisk, Fiscal Division, was recently notified by the American Federation of Arts that his oil painting had been chosen as a winner of the prestigious 10th annual Benedictine Art Awards.

## Ames Artist Honored

The American Federation of Arts recently chose an oil painting by Cary Fisk, Ames' Fiscal Division, as one of 35 winners of the prestigious 10th annual Benedictine Art Awards.

Chosen from a field of over 3000 entries, the painting will be displayed in a special exhibition in the Manufacturers Hanover Trust Gallery, New York City, through May. Many talented artists have gained recognition through the presentation of these awards.

"I was very pleasantly surprised," Fisk said of receiving the award. "I thought the chances were rather slim. Many top painters and art instructors enter the contest, so the competition is rather stiff."

Fisk, who began painting as a hobby in 1967, has never taken an art course. "I've acquired quite a library on painting though," he said of his education.

For the 18" by 24" traditional composition of a bag of groceries, eggs, onions and a bottle, he will receive a certificate of merit from the Federation and a monetary award.

### "Thank You" Note

"I would like to take this opportunity to thank every one that took part in making my retirement luncheon, March 16, a memorable occasion. I also thank each one for the certificate for golf lessons. And, a special thanks to Ralph Simin and Norman Barsi for taking time to get the occasion in order.

Kermit L. Hinton"

## Shuttle Site Selection

(Continued from Page 1)

Preliminary estimates for establishing the developmental and operational facilities required at KSC are about \$150 million. This amount is a part of the total of about \$300 million previously estimated by NASA for facilities required for the development, production, test, and initial operation of the Space Shuttle.

The operational facilities and equipment required at Vandenberg AFB are expected to cost about \$500 million. This amount is compatible with the allowance for facilities in the estimates of future investment costs for Shuttle operations included in the NASA and DOD studies which demonstrated that the Space Shuttle will produce a substantial net savings in future civil and military space program costs.

## Youth Football

Assistant football coaches are needed for Cupertino area youth football teams. These teams are part of the greater San Jose PAL Pop Warner tackle football program.

Previous coaching experience is desired but not required. Coaching clinics are provided by head coaches and team organization. If interested please contact Don Ciffone, 255-6106.

## WANT ADS

The Astrogram's ad section is provided as a personal, non-commercial service to Ames employees. Advertiser must be identified by name, extension and organization. The name may be left out of the ad but is needed for records. Ads must be submitted in writing to The Astrogram, N241-4, by Thursday, a week before publication. The advertiser's home telephone number must be provided as a point of contact except in carpool notices.

### AUTOMOBILES

For Sale-1961 VW with Sun Roof, needs work \$150. Tel. 371-1453.

For Sale-1966 wagon Ply. Fury I, 315, V8, P/S, R/H, 53,000 miles. Good condition. \$875. J.E. Maher, 294-1160.

For Sale-1970 Plymouth Fury II, V8, A/T, P/B, R/H, excellent condition, \$1695. Has \$1550 loan with the Moffett Credit Union, 327-7078.

For Sale-1952 Ford F-100 pickup, '68 Corvette eng. and trans., new accel. ignition, \$450/offer. Stephen Willner, 415, 493-7434.

For Sale-1964 Oldsmobile Dyn. 88, V8, 4-door, std. transmission, power seat, fine condition, \$420. 326-5990.

For Sale-1958 GMC pickup, 347 V8, 4-speed auto trans, P/S, R/H, long bed, overboard, split rims, barden bumper. Good Cond. \$400. Call G. Mateer 353-2357.

For Sale-Triumph Spitfire '65, \$450. 323-1582.

### HOUSING

For Sale-40 acre parcel off Skyline, 45 minute drive from Palo Alto. Redwoods, year-round creek and spring. \$36,000. Call 736-0533.

Wanted-Two girls looking for a third to share expenses in 3-bedroom, 2-bath apt. with fireplace, swimming pool. \$103 each. Call 964-4446.

For Sale-Must sell fast, 20 x 43, 1970 Parkhome, mobile home, 2-bedroom, 1-bath, skirting and awnings and many extras. \$1000 down take over payments. 734-4738 after 5 p.m. or weekends.

### MISCELLANEOUS

For Sale-One suit and several men's sport coats, good condition, size 38-40, regular. Phone 243-1176.

For Sale-Used oven, electric built-in, brushed stainless steel front, with timer, works perfectly. \$20 after 5 p.m. 732-6758.

For Sale-Used easy lift hitch for trailers, 750 pounder, \$30. Contact O.B. Ray, 736-4120.

For Sale-Admiral refrigerator, white, good working condition, \$40 or best offer. Call 245-9461.

For Sale-Portable Sewing machine, by Brothers, Zig-zag with cabinet. Excellent cond. both for \$40. Call 262-2504 after 5 p.m.

For Sale-Bass guitar. "Crown" fretless violin bass with 2 pickups. Very good condition. \$70/offer, call Dave Reese, Jr., at 321-4789.

For Sale-Bonanza mini bike w/ fiberglass tank, 4 hp tecumseh, heavy duty frame, front and rear suspension, excellent cond. \$100. Tel. 371-1453.

For Sale-Two 7.75 x 14 snow tires mounted on Ford Fairlane wagon wheels, \$20. 493-6462

For Sale-Six-year crib and mattress. Like new. \$25. Call 493-6462.

For Sale-New G.E. electric range, 30", copper-tone. Has self-cleaning oven, rotisserie, meat thermometer, sense-a-temp burner and griddle. Never used, still in packing case. Retail for \$475, will sell for \$350. Call 257-2514 after 5 p.m.

For Sale-20" Craftsman rotary power lawn mower, 3 1/2 h.p., 4 cycle engine, magnesium housing with quick-change cutting height control. Excellent cond. \$40. Craftsman single-speed sabre saw, with case, excel. cond. \$18. 20" Shopmaster jigsaw with attachments and blades, like new condition, \$35. Phone 379-4305.

For Sale-12 cu. ft. Westinghouse refrigerator, white. Great for apartment or small family, \$75. Call 257-3824.

For Sale-Hoffman hifi, Garrard changer, oak cabinet, good sound, \$45. Executive secretary maple desk, very good condition, \$60. Call 493-6707 after 5 p.m.