the astrogram

VOLUME XIV
NUMBER 8
February 3, 1972

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

Ames Telephones Convert to Centrex

The new Centralized Telephone Service (CENTREX), with direct inward dialing capability, is now being installed at Ames.

Similar CENTREX systems are already in use in organizations throughout the country and have proven more efficient than the old familiar switchboard-answered method.

Cutover date to this new telephone system is now scheduled for the weekend of March 11 and 12. There will be very little telephone service during the cutover period.

The main number at Ames will be 965-5000. The number changes will be distributed to organizational units as soon as they are completed. Post cards for the purpose of notifying callers of employee number changes will also be distributed to all organizations. A telephone directory with the new numbers is being printed and will be sent out the week prior to the cutover.

One of the major advantages of the CENTREX system is that calls may be dialed directly from either the commercial or FTS networks without operator assistance. This eliminates the need for night connections at the Center, since all telephones will be able to receive incoming calls 24 hours a day.

Other advantages are the ability to transfer calls without operator assistance; consultation calls from one extension user to another while the outside caller waits on the same line; add-on conference calls where the incoming caller remains on the line while another extension user is added to the conference; and in addition to the latter, the more familiar operator-controlled conference calls can continue to be arranged.

TRAINING SESSIONS

To familiarize all Ames users with the new CENTREX system the Communications Branch, in cooperation with the Employee-Development Branch, is scheduling a series of training sessions beginning Wednesday, Feb. 16. Personnel at Ames who will be users of the system are strongly urged by Center management to attend these training sessions. Representatives from the GSA office will answer questions relating to the FTS.

A SIMPLE AND ACCURATE VISION TESTING DEVICE. . . developed at Ames. Dr. Richard F. Haines, of Ames Human Performance Branch, adjusts the device for another Ames employee, Noelie Hall. The vision tester is expected to be useful in the diagnosis and treatment of a wide range of disorders which affect vision.

Nixon Commends Ames Employee

Roger Hernandez of the Ames Reproduction Services Branch, was the pleased and surprised recipient recently of a Commendation certificate and letter from President Nixon in recognition of exceptional service to others.

Mr. Hernandez is a member of the East San Jose Chapter of the Disabled Veterans and for the past several years has been active in the Veterans Administration blind program.

The letter from the President read, "It was a pleasure to read of your splendid activities in helping members of blinded veterans' families. I understand you arrange for voluntary financial support to aid the program in providing lodging, meals and transportation for an immediate family member to join the blinded veteran during his last week of training at the Western Blind Rehabilitation Center in Palo Alto.

"Your dedication and devotion to our nation's physically handicapped veterans deserve the praise of all our fellow citizens. As a token of my admiration for the splendid work you are doing . . . "

Vision Tester Developed by Ames Scientist

A simple, accurate, and easy-to-use device to map individual vision patterns of the eye has been developed at Ames.

The device is expected to be particularly valuable in the diagnosis and treatment of a number of disorders, including brain damage caused by tumors or injuries, optic track degeneration, glaucoma, detached retina, etc.

The machine, which is called the Automated Visual Sensitivity Tester, maps the position and extent of the normal blind spot of each eye. Characteristics of this blind spot, which is the area of the eyeball where there are no nerve endings to sense light, are a strong indication of the state of a patient's visual health.

The tester can also plot the presence of abnormal blind spots, called scotoma, which may be caused by looking at the sun, welder's arc, or other intense light sources, or by retinal detachment or various metabolic diseases.

The machine itself looks something like a big slide viewer. The patient looks into the front of the machine first with one eye and then the other. Inside, he sees a stationary red cross and a moving white dot. He fixes his gaze on the red cross and pushes a button whenever the white dot disappears from his vision.

Output of the machine, for the doctor, is a graphic plot of the patient's vision pattern for each eye. The data could be presented in many other ways, including transmitting it directly to a computer for automatic processing.

The device was conceived, designed and built by a three-man research team at Ames: Dr. Richard F. Haines of the Human Performance Branch, Salvador A. Rositano of the Electro - Systems Engineering Branch, and James W. Fitzgerald, now retired formerly with the Ames Mechanical Instrumentation Branch.

The Automated Visual Sensitivity Tester was originally designed for use in long-term confinement situations where a periodic check of visual function is indicated, i.e., space flight. The equipment was used in a 90-day close environment chamber test conducted recently for NASA by the McDonnell Douglas Corporation.

The machine is versatile, and the developers say it can be adapted for many other tests in addition to those for glaucoma and scotoma presently being used. Tests for visual acuity and color blindness are now being developed.

Other tests which Ames scientists say could be developed for use with the device include measuring the ability of the eye to smoothly follow a moving object (dynamic ocular tracking), measuring the

(Continued on Page 4)

LADY MACHINIST . . . Mrs. Ann F. Boggiano, the only female tool grinder in California, works at her machine in the Ames Model and Instrument Machining Branch. She is retiring from this highly specialized and exacting work after more than 20 years but has plans for a full and busy life as a homemaker.

Ames' Only Lady Machinist Retires

The only woman tool grinder in all of California exchanged her machinists apron for more housewifely apparel when she retired recently from Ames after more than 20 years.

Mrs. Ann Boggiano says she isn't sorry to become a housewife, taking care of the Los Altos home where she lives with her husband, a retired Los Altos fireman.

Now she will be "doing a lot of catching up," including a great deal of sewing, some exotic cooking and donating time to hospital work.

During World War II, when Mrs. Boggiano was just beginning her machinist trade at Hendy's Machine Shop in Sunnyvale, she worked a full day and then contributed four more hours at a local hospital -- this in addition to keeping house and raising a family (two children).

After the war, she went to work for General Electric in San Jose as a trouble shooter for punch press operations. She also was responsible for training the women operators of these machines. When the shop Tool Grinder was disabled because of an accident and could no longer work, Mrs. Boggiano was asked to train for the job.

She wound up serving a five-year tool grinding apprenticeship at GE before coming to Ames in 1951.

Mrs. Boggiano is proud of her occupation and describes the tool grinding work station as the nerve center of the machine shop.

It is the responsibility of the Tool Grinder to maintain and sharpen all the various types of cutting tools used by the different machines in a machine shop. It is highly specialized, exacting precision work and the entire machine shop operation is vitally dependent on the Tool Grinder.

Mrs. Boggiano was born in France but has lived in the United States since 1924. She is now looking forward to a visit to her native country where she still has two brothers and "too many other relatives to mention."

She loves exotic cookery but does not limit herself to French recipes. "I love to cook in all languages," she'll tell you.

Mrs. Boggiano has spent a career working in a man's world, and she insists her sex has never caused problems. "You have to be one of them," she'll tell you. But a cardinal rule, she believes, is that there should be no socialization with co-workers.

Mrs. Boggiano's work bench at Ames is surrounded by three different types of grinding machines, each larger than the diminutive Mrs. Boggiano but over which she has been complete master.

John Hilquist, Chief of the Model and Instrument Machining Branch, reports that Mrs. Boggiano is an expert at her craft, and deserves credit for solving some really knotty tool grinding problems.

Ames now has some 80 machinists working in the shop. In past years the number has been as high as 154. Mrs. Boggianno's tool grinding work station has been a vital part of the Machine Shop operations.

Solar System Theory Published

Improved insight into the chemical composition of the early solar system was provided recently by Dr. David C. Black, a National Research Council Postdoctoral Resident Research Associate assigned to the Ames Theoretical Studies Branch. The basis for this study was data from his thesis research conducted at the University of Minnesota, in conjunction with theoretical studies of the formation of the solar system in which he is presently involved.

HYPOTHESIS

Dr. Black has hypothesized that one of the isotopic compositions of helium, neon and argon observed in meteorites represents the isotopic composition of the pre-main sequence solar wind. This composition differs slightly, but importantly, from the isotopic composition of the present-day solar wind.

The primary difference between the pre-main sequence and the present-day solar winds is that the helium 3 - helium 4 ratio of the former is nearly a factor of three lower than the ratio observed in the latter. Dr. Black attributes this difference to nuclear burning of deuterium in the present sun. Knowing the change in the abundance of helium 3 due to deuterium in the primitive solar nebula. The value he finds is a factor of 10 less than previously thought.

Some of the implications of his research were discussed in an article published in "Nature" magazine, December 17. The most significant consequence of the new value for the solar abundance of deuterium is a limit on the amount of matter in the universe. Dr. Black finds that if the deuterium present in the primitive solar system was produced "cosmologically", there is not sufficient matter in the universe to close it.

AIAA Meeting

A tour of the San Francisco Bay FAA Aircraft Control Facilities at Oakland Airport is on the agenda for the February 16 meeting of the San Francisco Chapter of the AIAA. The dinner meeting will be held at Savin's International Room at the Oakland Airport followed by a briefing and tour of the FAA facilities. The no-host social hour will be from 6 to 7 p.m., briefing at 8:30 p.m., and tour at 9 p.m. Advance reservation are required and may be made by calling Ames ext. 2121, prior to Feb. 14.

Sjoberg Appointed MSC Deputy Director

NASA Administrator Dr. James E. Fletcher, has named Sigurd A. Sjoberg as Deputy Director of the Manned Spacecraft Center in Houston.

He succeeds Dr. Christopher C. Kraft, Jr., who was promoted to Director of MSC on Jan. 17. Mr. Sjoberg has been Director of Flight Operations since Dec. 28, 1969, when he succeeded Kraft.

In his new position Mr. Sjoberg will assist the Director in planning and leading all phases of MSC operations. He will act for the Director on administrative and technical matters and will represent the Center in all phases of activity.

Sjoberg will also continue as Director of Flight Operations until a successor is selected.

Mr. Sjoberg was born in Minneapolis, Sept. 3, 1919. He received a BS degree in aeronautical engineering from the University of Minnesota in 1942. That same year he began his career with the National Advisory Committee for Aeronautics, NASA's predecessor. In October 1959 he joined the Space Task Group, forerunner to MSC.

Revised Apollo 16 Timetable Revealed

The Apollo 16 mission to the Moon is now scheduled for launch 12:54 p.m. EST, April 16, 1972. The first exploration of the Moon's Descartes area will begin 6:59 p.m., April 20, about four hours after landing. Splashdown on Earth is scheduled for 4:30 p.m. EST, April 28.

Apollo 16 was rescheduled from a March 17 launch after problems were discovered with a suit fitting, a lunar module battery, and the docking ring jettison device on the command module.

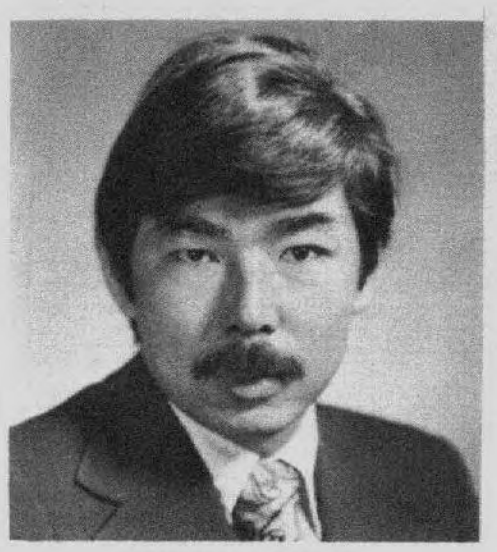
Spacecraft Commander is Navy Captain John W. Young; Command Module Pilot is Navy Lieutenant Commander Thomas K. Mattingly II: Lunar Module Pilot is Air Force Lietenant Colonel Charles M. Duke.

The astrogram
Room 134
Admin. Mgt. Building
Phone 2385

The Astrogram is an official publication of the Ames Research Center, National Aeronautics and Space Administration, Moffett Field, California, and is published bi-weekly in the interest of Ames employees.

Editor . . . . . Dot Evans
Reporters . . . . . NASA Employees

Deadline for contributions:
Thursday between publication dates



MICHIO AOYAGI

AVA JOHNSON

E.E.O. Counselors Appointed

Any employee who feels that he is being discriminated against for reasons of race, color, sex, religion, or national origin should talk to an Equal Employment Opportunity (EEO) counselor. They are responsible for maintaining an open and sympathetic channel through which all personnel may raise questions, discuss grievances, get answers and obtain resolutions to problems in equal employment opportunity.

Two new EEO counselors were recently appointed by Dr. Hans Mark, Ames Director. Ava Johnson, Research and Development Contracts, and Michio Aoyagi, Research Computation Analysis, were named to replace former counselors, Dr. Ronald E. Goldsberry and Mrs. Yvonne Russell who have left Ames.

The new appointees join counselors Jessie C. Gaspar, Programming; Joseph P. Licursi, Electrical Engineering; Manuel M. Orozco, OOL Experiments Office; Torribio G. Gonzales, Computer Operations; and Sheldon M. Smith, Physics Branch.

The responsibilities which the new appointees will assume as EEO counselors, as explained in Ames' Affirmative Action Plan, are:

Counseling any employee in a strictly confidential manner in regard to problems and complaints of discriminatory practices or attitudes appearing among fellow workers, supervisors, or management.

Discussing employee's problems with employee's supervisor or associates, with the employee's permission, in order to seek solutions to the complaint.

Seeking an informal solution to employee's problems and/or complaint within 15 working days.

Informing complainant of his right to file formal complaint, within 15 days after final interview with counsel, when attempt at informal resolution fails.

Recommending action to the Equal Employment Opportunity Officer, when the Equal Employment Opportunity Officer's involvement is necessary to reach a solution or correct a problem, using the employee's name only when permitted to do so by the employee.

Ava Johnson, during a recent interview, said she thought her counseling responsibilities would be "a challenge and very interesting."

Although she was appointed less than two months ago she has already handled a case. Referring to that case, she said she was pleased to find that the EEO committee could "operate quickly and effectively."

She stressed the importance of immediate action in handling complaints. "I know," she said, "if I called someone to complain, I would have thought about it for a long time. That means the problem would have been there for quite awhile." Therefore, she feels, "immediate action is important."

Commenting on Ames' EEO committee, she said, "We are doing quite well here at Ames. We have made excellent advancements in meeting the requirements of the Affirmative Action Plan and are fortunate to have higher management working with us."

Michio Aoyagi, a research scientist with the Problem Definition and Analysis Branch, brings a good deal of previous experience to his appointment as EEO counselor. He is presently working with the Asian-American Task Force of the Berkeley School Board.

One of the primary goals of the Task Force is the inclusion of Asian-American history in the California school curriculum.

Speaking of Ames' EEO committee he said, "The existence of NASA's position is a significant step in achieving equal opportunity for all. At least we recognize that there is a problem." He further pointed out that, "NASA can no longer be secular, there are social problems we must contend with."

Expedition Studies Clouds

Scientists last week were probing high-altitude cloud formations from the NASA-Ames airborn research laboratory, the Convair 990 aircraft, in an attempt to solve a meteorological problem applicable to short-term weather forecasting and to transfer the technology to weather satellites. The scientific expedition, managed by Earl V. Peterson of the Ames Airborne Science Office, was over the northwestern United States and the Caribean Sea.

The experimenters were looking at sunlight-scattering cloud particles at various altitudes, up to 45,000 feet, to see if ice and water particles could be identified and if the size and number of water droplets in a cloud could be measured via remote sensing instrumentation.

These measurements were correlated on the aircraft with measurements made directly within the clouds to give a precise picture of cloud composition and particle sizes. Such information relates to the intensity of weather fronts, storms and the nature of severe weather processes. Up to now, this type of information has not been available from remote sensing techniques.

These data, when obtained globally from satellites, would be valuable to pilots, aviation meteorologists and weather forecasters who need all available information on severe weather systems.

A team of scientists from NASA, the University of Arizona, and the Arthur D. Little Co., headed by Dr. Warren Hovis of the NASA-Goddard Space Flight Center, used three basic experiments for the project. The first was a filter wedge spectrometer and a near-infrared Ebert spectrometer to measure solar energy reflected from clouds. The reflective properties of clouds vary and can be analyzed to determine their physical characteristics and altitude. In the second experiment an infrared polarimeter was used to study how clouds reflect polarized light and the extent to which the reflectivity shows the cloud's composition and height. The third experiment, a nephelometer with a laser beam, made direct measurements of cloud particle size, concentration and distribution while the aircraft flew through a cloud.

Flights over the Pacific Northwest were completed in mid-January. The second part of the expedition, covering highly active cloud formations in the caribbean Sea, was based at Piarco Airport, Trinidad, and Tobago.

Program management of the expedition was under the overall direction of NASA's Office of Applications.

TANGIBLE SAVINGS . . . resulting from an employee suggestion were the basis for an award of $190 for George M. Alger (left) an apprentice aerospace laboratory technician in the High-Enthalpy Research (HER) Branch. He proposed a revision to the contract for water cooled constrictor disks which would place the full responsibility on the manufacturer to deliver disks that are completely machined and ready for installation. The improved quality control has resulted in first-year savings of $2800. Dr. Dean R. Chapman (right), Chief of the Thermo and Gas-Dynamics Division, presented the award check to Mr. Alger at a ceremony attended by William Carlson (center), Assistant Chief of the HER Branch.

Ames Airings

. . . by Jeanne Richardson

Ever wonder what's really going on over in the Administration building? Last week they were having bicycle races in the halls. CAROL GRAHAM, former secretary for LEONARD ROBERTS, Director of Aeronautics and Flight Mechanics, was presented with a new bicycle as a going away present from her friends. To make sure it worked okay she and DARLENE MOEN, who is the secretary to CHARLES (CHUCK) SONETT, who is the Director of Aeronautics, had a contest to see who could ride down the hall, around the table in the main conference room and back again fastest. Carol, by the way, has gone to San Francisco to work for the Environmental Protection Agency.

Who won the race? They aren't saying.

If the way to a man's heart is through his stomach LARRY ERICKSON's (Aeronautical Structures) wife, Marilyn, must have won him as easily as she won finalist standings in the 23rd Bake-Off. Sponsored by Pillsbury and General Electric, the Bake-Off is the nation's largest and oldest cooking contest.

Marilyn won a G.E. self-cleaning oven range, $100 cash and an all-expense-paid trip to Houston, Texas for her recipe for breakfast rolls. Her recipe now has a chance to win $25,000, first prize in the Bake-Off Feb. 26 through 29. Good Luck in Houston, Marilyn.

CONGRATULATIONS

DONALD DE VINCENZI, and his wife Lois, came up with a new creation January 5; David De Vincenzi. David, who weighed a hefty 9 lb. 5 1/2 oz., is their first son. Previously Donald and Lois were only able to come up with daughters (two). Maybe working in Life Sciences helped.

Stacey Noelle Sumsion waited for her father to come home from Fort Benning, GA. to make her first grand entrance. Lieutenant Robert S. Sumsion, formerly of Project Pioneer, arrived home on leave Dec. 19 and Stacey Noelle arrived Dec. 20 at Good Samaritan Hospital. She weighed 8 lbs. 2 oz. and was 21" long at the time. TED SUMSION, Materials Research Branch, and his wife, June, are the doting grandparents.

The Astrogram office received the following message from JIM BIGGERS, Large-Scale Aerodynamics, "We have recently been notified that OART has been changed to OAST. Do you know what an OAST is?"

1971 MATCH PLAY CHAMPIONS . . . of the Ames Golf Club proudly display their trophies. Winners of the three flights are: 1st Flight, Frank Lazzeroni and runner-up Otto Meckler; 2nd Flight, Earl Menefree and runner-up Larry Hochstein (not in picture); 3rd Flight, Ken Souza and runner-up Howard Garrison.

Weekly Ski Trips Planned

Skiers who wish to form car pools for a one day trip on any Friday, call Lou Mazer, ext. 2479, by Thursday of that week.

The advantages of Friday skiing are:

1. Eric Johnson, the Ski-Reporter, summarizes conditions Thursday evening. If conditions are not suitable, the group may elect no to go.

2. Slopes and parking lots are usually groomed and all equipment is operating in preparation for the weekend.

3. As on any other weekday, there are no lift lines nor parking problems.

JAMES (ABE) GONSALVES . . . (above) looked so much like Abe Lincoln when he grew a beard and mustache that the boys in Electrical Services dressed him up in a top hat and swallow tail coat for this portrait. They said the photograph was just for fun, but several odd looking $5 bills have been found in the cafeteria lately.

Vision Tester

(Continued from Page 1)

ability of the eye to smoothly follow a moving object (dynamic ocular tracking), measuring the ability to correctly discriminate different simple and complex forms (indication of possible brain damage), measurement of the Optokinetic Nystagmus Reflex which is the tendency for the eye to follow repeated apparent motion, e.g., a barber pole, and measurement of sensitivity to various colors in different parts of the visual field.

It appears the tester may be useful as a mass vision screener in schools, and might be helpful in the diagnosis of brain damage in children. It is scheduled for clinical evaluation at ophthalmological clinics and for possible inclusion in remote mobile health care service being planned by the Space Sciences Research Center, University of Missouri.

The device uses film loop cassettes, and audio instructions can be recorded thereon. Changing from one test to another merely requires plugging the appropriate film cassette into the machine.

For Rent-Motorhome for rent. 1972 20' fully self-contained. Sleeps 6 adults. Rent for a day or for a week. $23/day and 7¢/mile. Call 966-5002 or 263-4867.

For Sale-1963 Admiral B. & W. 23" TV consolette, all VHF channels. Good picture. $30. 967-0896.

Collecting Junk-Clothes, appliances, furniture, odds and ends, etc., any condition. Can pick-up at home or work, whichever is more convenient. Also will clean garages etc., for payment of junk. PLEASE CALL Del or Loretta - 379-8763.

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 wiriting to The Astrogram., N 241-4 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-1966 Mustang V8/289 R/H, 36,000 mi. New license, $1195, automatic. Call 267-2935, after 5 p.m.

For Sale-1970 Chevrolet 1/2 ton pick-up 350 CID, 4 spd., heavy duty springs, low mileage, $2600. Phone 961-8239.

GIVE 289 PONIES A NICE HOME: 66 mustang, 68 eng./30,000 miles, 4-spd., front disk brakes, new exhaust system, radio, excellent condition throughout. Asking $1150. Call 243-0268 from 10-12 days and 5:30 to 8 p.m. evenings. We'll miss ole paint, but we have a new little filly waiting.

For Sale-1959 Austin-Healy, six cylinder roadster, low mileage, no dents, wire wheels, overdrive, tonneau, sliding windows, no top, needs paint, $449, call 328-8756.

For Sale-1971 Toyota Corello 1600 engine, 20 r model, only 5,000 miles. Call Dave Few at 328-1479.

For Sale-1964 Sunbeam Alpine,. New tires, hardtop, Recent overhaul. Very good condition. $600 or offer. Also, 21" b. and w. Motorola cabinet TV, $25; barbeque with elec. spit, $3; bricks for bookshelves - offers? Owner leaving state in Feb., so must sell. Phone 964-8879 after 6 p.m.

HOUSING

Wanted-Teacher wants to find cottage or one bedroom house to rent with fenced yard. Likes gardening. Sunnyvale-Menlo Park area, up to $150. Call 948-2006.

MOBILE HOME-1969 La Carona, 24 x 60, 2-bdrms, 2-baths, w/w carpet, dishwasher, disposal, washer, dryer, quality plus many extras, next door to Ames. 967-3682 between 5-7 p.m.

For Rent-Cabin in the Donner Pass area. Snug, warm, and cheerful. Many electric appliances. Circular fireplace and lots of wood. Dependable electric heating. Close to major ski resorts. Ideal for snow play and cross country skiing. Leo Poppoff, 323-2375.

For Rent-Three bedroom, 2-bath home in quiet area of Los Altos. 5 min. to Ames by freeway. Fireplace, patio, mature trees, fenced yard. R. Munoz, 941-3589.

MISCELLANEOUS

For Sale-Skis, 3 pair, wood with bindings. Child's, adult: $5, $8 and $15. Fencing mask $6, Revere, Wollensack slide trays 45c. Old Natl. Geographics, 50c. 941-3589.

Carpool-South San Jose area; near IBM, needs another rider/driver. Call 2487.

For Sale-Aluminum storage house, like new, 10' x 10', $100. Steve Vice, 258-1675.

For Sale-Samoyed AKC pups, male and female, Whitecliff line, start $125. 226-1446.

For Sale-Home bar, orange with white and gold trim. Three stools and mirrored shelf with light. Never been used. $100. Clay Hart, 255-0893 after 4:30.

For Sale-1967 VW camper, ice box, port. toilet, 11 gal. water tank, side tent, 5 new wt. ovals, 45k miles, engine frozen. $1375. Call 253-6259.

For Sale-1968 Honda CM91 motorcycle, $100 or best offer , 243-1583.

For Sale-27" 10-speed Cyclone-Huffy racing bike, used 3 months like new. Original price $95, asking $65. Bob White, 255-1072.

For Sale-Sears manual water softener, 3-years old, $25. Call after 5 p.m. 867-9287.

For Sale-Gaffers and Sattler built-in dishwasher. 6 months old (like new) $95. Call 408 - 243-5382, after 6 p.m.

For Sale-100 m.p.h. This one of a kind, 4-passenger Ski-Hydro is equipped with a 427 c.i. Ford engine-Casale Z drive with 45 % overdrive 12" x 18" Record Prop-Jones Rudder-custom trailer and much more. Complete Rig $3,500. Call Cliff Eaton, 255-8617.

the astrogram

VOLUME XIV
NUMBER 9
February 17, 1972

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

Dr. Carlson Takes Key Army Position

Dr. Richard M. Carlson was recently appointed head of the Advanced Systems Research Analysis Office of the Army Air Mobility Research and Development Laboratory Headquarters, located at Ames. His selection for the key executive position was announced by the Director, Paul F. Yaggy.

Dr. Carlson's qualifications for the office include a distinguished career in rotary-wing aeronautics and 24 years of experience in the research, development, test, design and evaluation of heliocopters.

Before joining the Army Laboratory he was Division Engineer for the Lockheed-California Company at Burbank, California. He has been a lecturer in aeronautical engineering at Stanford University since 1958, conducting courses in VTOL Aerodynamics, VTOL Dynamic and Aeroelastic Problems, and VTOL Configuration Design.

Dr. Carlson, who was the first foreign member of the Swedish Society of Aeronautics and Astronautics, is an Associate Fellow of the AIAA, a member of the American Helicopter Society and a Fellow of the Royal Aeronautical Society. He received his Ph.D. degree in Engineering Mechanics from Stanford University.

NASA-DOT in Air Safety Effort

NASA is working with the Department of Transportation to better define the characteristics of clear air turbulence and to develop methods of detecting it in flight.

Clear air turbulence (CAT) is a phenomenon that is usually invisible. It occasionally tosses airplanes around with its sudden onslaught of violent action.

At the NASA Flight Research Center a B-57 aircraft is being flown to carry experimental instruments. The flights are made throughout the western part of the United States, at altitudes ranging up to 50,000 feet in areas where turbulence is expected to be found or where it has been reported by other aircraft. If actual turbulence is encountered, a 30-minute flight pattern is flown to record data while repeatedly probing the turbulent area.

Thirteen flights have been flown since the B-57 tests began approximately one year ago.

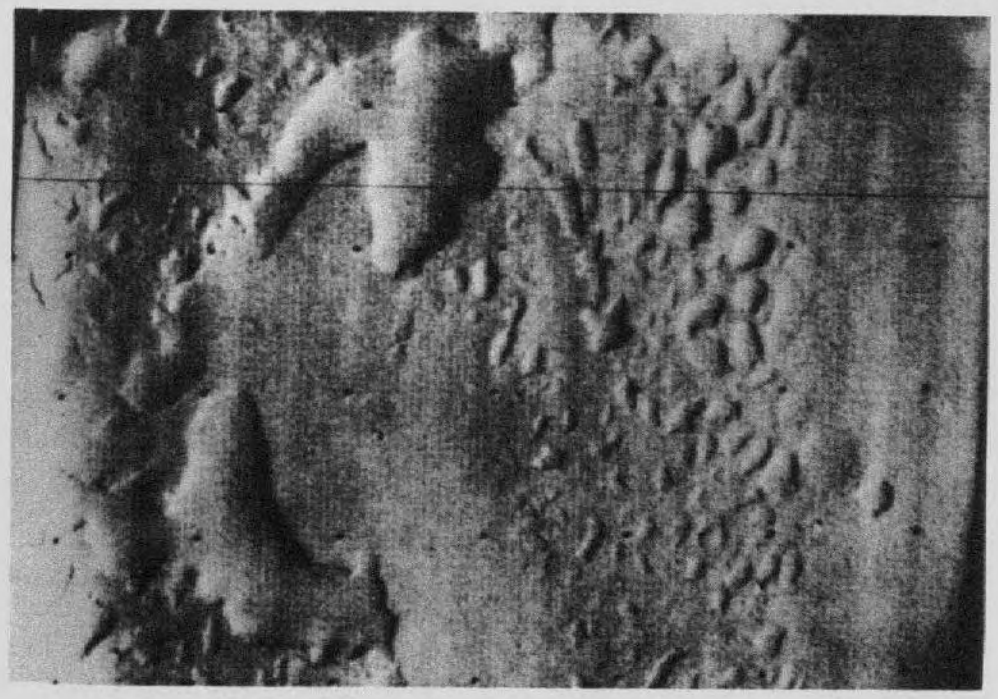
The right wing tip pod of the B-57 carries the DOT-sponsored prototype radiometric sensor that may be able to detect CAT up to 50 miles ahead of the aircraft. At jet transport speeds, this remote detection would provide a three-to-five-minute advance warning of impending turbulence.

The DOT sensor is designed to receive microwave signals associated with the air temperatures ahead of the airplane. Other studies have shown that abrupt temperature variations are usually associated with CAT. The B-57 flights are conducted to determine the amount of advance warning time that is possible with this type of detection equipment and to find out how well it can distinguish between false detections.

Working under a NASA grant, the University of Wyoming has installed an aerosol and ozone detector on the B-57. This device counts aerosol particles in the one-fourth micron and larger range using a pulse height analyzer and a photomultiplier. The research is aimed at determining if there is a positive relationship between the presence of aerosols or ozone and the atmospheric conditions that cause CAT.

In related research, Langley Research Center is developing a flight system to investigate the characteristics of CAT caused by various types of air flow in the atmosphere. Later this year the B-57 will carry this system to investigate the amount of energy contained in various sizes of turbulent eddies.

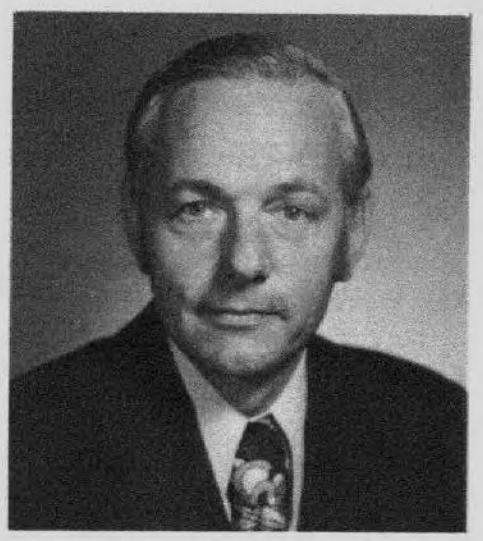
Marshall Space Flight Center is seeking to adapt laser doppler technology for use in future flight research programs.



EXTRAORDINARY PITS AND HOLLOWS . . . never before seen on Mars were photographed by Mariner 9. Located about 500 miles from the Martian South Pole, these photos pose some provocative questions about the geological processes which have shaped the landforms of the polar regions. The picture was taken from 2,072 miles above Mars.

New Deputy Director of Research Support Named

The appointment of Robert E. Eddy as Deputy Director of Research Support was announced last week by Dr. Hans Mark, Director of Ames.



ROBERT E. EDDY

In this newly established position Mr. Eddy will share the substantial responsibility of the Director of Research Support for the management of over 500 civil service employees and diversified research facilities which provide a broad spectrum of technical support for the Center's research programs. He will also continue to serve as Chief of the Technical Services Division, a position he has held for over two years.

Mr. Eddy joined the Ames staff in August 1962 as a research engineer after selling a highly successful machine business in Akron, Ohio, which had been founded by his father. He served as president and chief design engineer of the company which specialized in the development and building of automated production equipment.

Before being named to the Technical Services Division position Mr. Eddy was Chief of the Research Facilities Engineering Branch responsible for the design and construction of Center research facilities.

A native of Ohio, Mr. Eddy was born in Akron in 1929. He received his bachelor of science degree in engineering from Princeton University with honors, and was elected to Phi Beta Kappa. Following graduation he joined the U.S. Navy and completed a two-year tour of duty. During that time he attended the U.S. Navy Postgraduate School in Monterey where he studied Aerology. In 1968 he was nominated for and participated in the Stanford-Sloan Fellowship Program during the 1968-69 academic year.

Mr. Eddy and his wife, Claudia, make their home in Menlo Park.

TV Class Schedules

The schedule of classes to be televised on the Stanford Instructional TV Network during the Spring Quarter has been published. Copies of this schedule are now available in all branch offices. Instruction begins March 28.

Alviso Project Ideas Needed

The Ames Technology Utilization Office has undertaken a cooperative program with the Community of Alviso in an attempt to apply aerospace technology and know-how to Alviso's many problems.

Through the NASA-contracted Technology Applications Team at Stanford Research Institute, a large number of used railroad ties have been made available to Alviso in the hope of using them to form a business and thereby adding to the almost non-existent economic base of the community.

Any suggestions by Ames employees sent to mail stop 240-2 or called to ext. 2301, will be welcome. Please rule out obvious uses, such as retaining walls, steps, terracing, etc.

"The Astrogram" will report on further progress of the total program as it develops.

Credit Union

The annual meeting of the Moffett Field Employees Credit Union was held January 28 at the Old Plantation Restaurant in Sunnyvale.

Chairman of the Board, John F. Pogue, of Ames' Contract Management Branch, traced the progress of the credit union during this past year. He noted that assets increased to over $3.7 million, member share capital to over $3.3 million. Loan volume topped $3.4 million for the year and earnings on member share accounts improved for the period.

Franklin T. Stephens, Captain, U.S.M., Pat Marshall Major, U.S.A.F., and Edward Seward, NAVPRO, Lockheed, were elected to the Board of Directors.

Elected to the Supervisory Committee were; Glen Rasmussen, Accounting Chief, NAS: Princess Iverson, Supply, NAS; and Ernest Iufer, Ames.

NASA Group Life Insurance Offer

The annual enrollment period for NASA group life insurance, underwritten by the Home Life Insurance Company of New York, has been announced by John Leveen, President, Ames Chapter of the NASA Employees Benefit Association.

Applications received by March 10 can be processed for coverage effective April 1. Present membership is 15,000.

CONRAD

KERWIN

WEITZ

NASA Names Flight Crews for Skylab

Flight crews for Skylab -- the United States' first Earth-orbiting space station -- were announced recently.

The Skylab orbital workshop will be launched unmanned in the spring of 1973 and will be visited three times by three-man crews over an eight-month period.

Each Skylab crew will consist of a commander, a science pilot and a pilot.

The prime crews, listed in that order, are:

First mission: Charles Conrad, Jr., Dr. Joseph P. Kerwin and Paul J. Weitz.

Second mission: Alan L. Bean, Dr. Owen K. Garriott and Jack R. Lousma.

Third mission: Gerald P. Carr, Dr. Edward G. Gibson and William R. Pogue.

Backup crewmen for the first mission are Russell L. Schweickart, Dr. Story Musgrave and Bruce McCandless II. Serving as backup crew for both the second and third missions are Vance D. Brand, Dr. William E. Lenoir and Dr. Don L. Lind.

Astronauts Kerwin, Garriott, Gibson, Musgrave and Lenoir are scientist astronauts; the remaining Skylab crew members are pilot astronauts.

The first manned visit will last 28 days, while the second and third will last 56 days each.

The Skylab program will test earth resources remote sensing equipment and techniques to gather information on Earth's ecology, oceanography, water management, agriculture, forestry, geology, and geography. Astronomy experiments will substantially increase knowledge of the Sun and its affects on man's existence on Earth. Habitability, biomedical, behavioral, and work effectiveness experiments will further evaluate man's capabilities in space flight.

CONTRIBUTIONS TO WORK EXPERIENCE PROGRAM. . . were recognized recently when Donald C. Ayers (center), a Model Maker in the Metals Fabrication Branch, received a NASA Special Achievement Award. The award check and a letter of commendation from the Director, Dr. Hans Mark, were presented by Robert E. Eddy (right), Deputy Director of Research Support, as Edwin R. Vernon (left), Chief of the Metals Fabrication Branch, watches with approval.

Mr. Ayers was recognized for exceptional work in developing and teaching course material for the Ames-Foothill College Work Experience Program.

Proposals Invited for Experiments

Research scientists have been invited by NASA to submit proposals for experiments using the weightlessness of space to develop improved techniques for preparing biological materials and for studying crystal growth, soldification and other aspects of non-organic substances.

The potential flight opportunities include the Skylab manned Earth-orbital missions starting in the Spring of 1973. The proposals must be in by March 30 for consideration on a Skylab mission.

One invitation is for studies involving samples of materials to be processed in a preparative electrophoretic apparatus. It is anticipated that most uses of the apparatus will be for biological preparations.

Electrophoresis refers to the motion of charged particles through a fluid while under the influence of an electrical field. As molecules or larger tissue cells acquire added electrical charges they are caused to move about in the fluid. Because the particles are different in nature and size, some move faster and farther than others and they become separated. Thus, the electophoretic apparatus may be used to separate different cells or parts of cells.

A wide variety of previously difficult or impossible applications may be developed for orbital electrophoresis such as: vaccine purification, preparation of pure virus strains, theraputic cell and cell-fraction preparations and separation of pure materials for medical research.

The second invitation is for investigations of solidification effects crystal growth and other phenomena in weightless materials which will use either of two types of apparatus being developed for flight: (1) a small multi-purpose electric furnace and (2) a system for levitating (floating) small samples of molten materials and closely observing them as they cool and solidify.

The astrogram Room 134 Admin. Mgt. Building Phone 2385

The Astrogram is an official publication of the Ames Research Center, National Aeronautics and Space Administration, Moffett Field, California, and is published bi-weekly in the interest of Ames employees.

Editor . . . . . Dot Evans
Reporters . . . . . NASA Employees

Deadline for contributions:
Thursday between publication dates

Ed. Note:

Below are excerpts from an article by Gunnar Sevelius, a medical doctor with the Ames Health Unit. The article was so well received by several members of the Center's staff that publication in The Astrogram was requested.

Exercise Program Strengthens Heart

Exercise is prescribed by many physicians as a means of preventing heart disease. But, exercise must be approached with caution and a full understanding of its effect on the heart.

The volume of blood the heart pumps with each contraction is called stroke volume, which increases with the training of the heart muscle.

A person in good physical condition can do more work at a given pulse rate than an untrained person because of this larger stroke volume.

The heart meets the demands placed upon it during exercise by increasing the pulse rate. Two critical pulse rates are of interest.

A pulse rate of about 140 is the lowest at which the oxygen demand of the heart muscle is enough to stimulate strengthening of the heart. At pulse rates above 160 the venous return is not sufficient to fill the heart, and the heart pump is inefficient.

At either of these pulse rates a strong heart with large stroke volume can pump more blood than a weak heart and therefore, the body can do more work. A strong heart is also able to recover faster after work.

The heart, like any muscle, strengthens if it is made to work under a high oxygen demand. This demand can be sustained for the longest period of time with a pulse rate of about 140. Jogging and many other forms of exercise will bring the pulse rate to this level. Exercises which do not bring the pulse rate to 140 per minute are generally of less value.

The beginner wishing to improve his condition should start his training by bringing his pulse rate to 140 three times in the same session, letting it drop back to 100 in between. As the heart grows stronger, he will have to work harder to bring his pulse to 140.

The particular exercise used does not matter. Running is one of the better exercises because it assures good venous return from the repetitive contractions in the leg muscles and the accompanying deep breathing. Daily training will usually enable a beginner to run a mile in a few weeks.

CHECK WITH DOCTOR

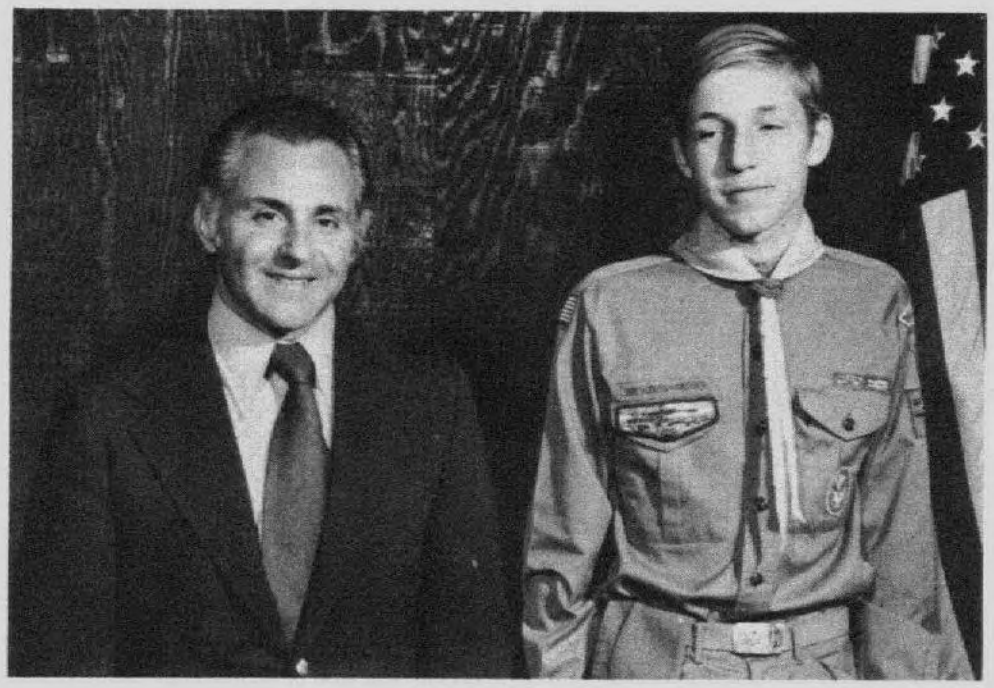
A person with a known heart disease should check with his doctor, but this program is safe for most people. Any exercise program based on a preset work load, disregarding the pulse rate, is unsafe.

Exercise should be started with a short warm up period. During this period the blood circulation shifts from the viscera to the muscles that will do the heavy work.

Keeping fit for a normal work day requires only enough exercise to keep the pulse rate at 140 for 15 to 20 minutes every other day.

ADVISOR SPONSORS SCOUT . . . Mr. Warren Winovich, High-Enthalpy Research Branch, is pictured above with Eagle Scout, Randall W. Stender. Mr. Winovich, who is advisor to the Ames Astronautics Explorer Post No. 12, hosted the Eagle Scout here, Jan. 18, then accompanied him to the 32nd Annual Recognition dinner of the Stanford Area Council Boy Scouts of America.

Eagle Scout Sponsor Dr. Ralph Pelligra, Chief of the Ames Medical Services Branch, is pictured below with Peter J. DeGraaf of Palo Alto at the recognition dinner. More than 30 new Eagle Scouts from the local area were recognized.



Scout Sponsors

Warren Winovich, High-Enthalpy Research Branch, and Dr. Ralph Pelligra, Chief of Ames' Medical Services Branch served as Eagle Scout sponsors at the 32nd Annual Recognition dinner of the Stanford Area Council Boy Scouts of America, January 18.

Each sponsor was selected as a representative member of the career field the Scout plans to pursue.

Mr. Winovich hosted Randall W. Stender of Los Altos at Ames Jan. 18 and accompanied him to the dinner that evening. Dr. Pelligra hosted Peter J. DeGraaf of Palo Alto.

The Scouts were taken on a tour of the Center which included the Data Reduction Center; the 40- by 80- foot Wind Tunnel; the High-Enthalpy Branch and the Medical Services Branch.

Mr. Winovich, who is advisor to the Ames Explorer Post 12, commented that acting as an Eagle Scout sponsor had been "very rewarding. It's nice to find boys so interested in what's going on around them", he said.

FPC Scholarship Annonnced

The Federal Personnel Council of Northern California has announced the establishment of the eleventh annual college level scholarship fund. As in the past the scholarships are for children of Federal civilian employees and for a youth employed under the Youth Opportunity Programs (the President's Stay-in-School Campaign and the Summer Youth Opportunity Campaign).

Seven or more $350 Scholarship Awards will be granted.

The scholarships will be paid to the winners upon their enrollment in a recognized junior college or accredited college or university. Selections will be announced at a luncheon in May.

To be eligible the applicant must be the son or daughter of a career civilian employee presently employed in a Federal agency in Northern California; or the son or daughter of a retired or deceased career civilian who was employed by a Federal agency in Northern California at the time of retirement or death; or currently employed in a Federal agency in Northern California under the President's Stay-in-School Campaign; or have been employed during the summer of 1971 under the Summer Youth Opportunity Program; and a high school senior graduating in January or June 1972 (or between those dates). Northern California includes Monterey, Kings, Tulare, Inyo and all areas in California north of these counties.

The $350 scholarship will be based on scholastic ability (from high school records and results of scholastic aptitude tests of the College Entrance Examination Board); leadership potential (from autobiography and letters of recommendation); and essay entitled "The Role of Youth in Meeting the Challenge of Today."

Deadline for submitting applications to the Scholarship Committee is April 3. Application forms are now available in the Ames Training Office, Room 140, Bldg. 241, ext. 2604.

"Thank You"

"To my many Friends and Colleagues,

Sylvia and I wish to extend our profound thanks for the tremendous response to my recent Retirement Luncheon . . . To say I was overwhelmed would be the understatement of the year.

The occasion was one of happiness -- sadness -- and all the emotions that one can feel. I am still aglow with the warmth of all your good wishes.

I would be remiss if I did not tell you how very delighted I am with the magnificent gifts . . Thank Your from the bottom of our hearts . . .

Lastly, Sylvia and I would like to say that our lives have been enriched by working with, and knowing all of you.

Sincerely,

Irv Israel"

"Hi Gang,

Guess what I did Sunday! I rode my blue "Buffalo" (Augmentor wheel) across the Golden Gate Bridge. Can't tell you how really fantastic it was. It's one of the nicest gifts I have ever received - can't tell you how much I love it!

Next time I get a day off I'll ride down and see you all.

My days at Ames were really good days and that's thanks to you kids.

Take care and please keep in touch.

Love, Carol" (Graham)

"My sincere appreciation is extended to the many friends who expressed their sympathy at the death of my mother.

Dell Duke"

GOLF

. . . by Kay Bruck

The first tournament of the 1972 Ames Golf Club schedule was played at San Jose Municipal. Despite threatening weather there was a good turnout with the following winners reported by the Co-Chairmen Jim Nelan and Fred Carpenter:

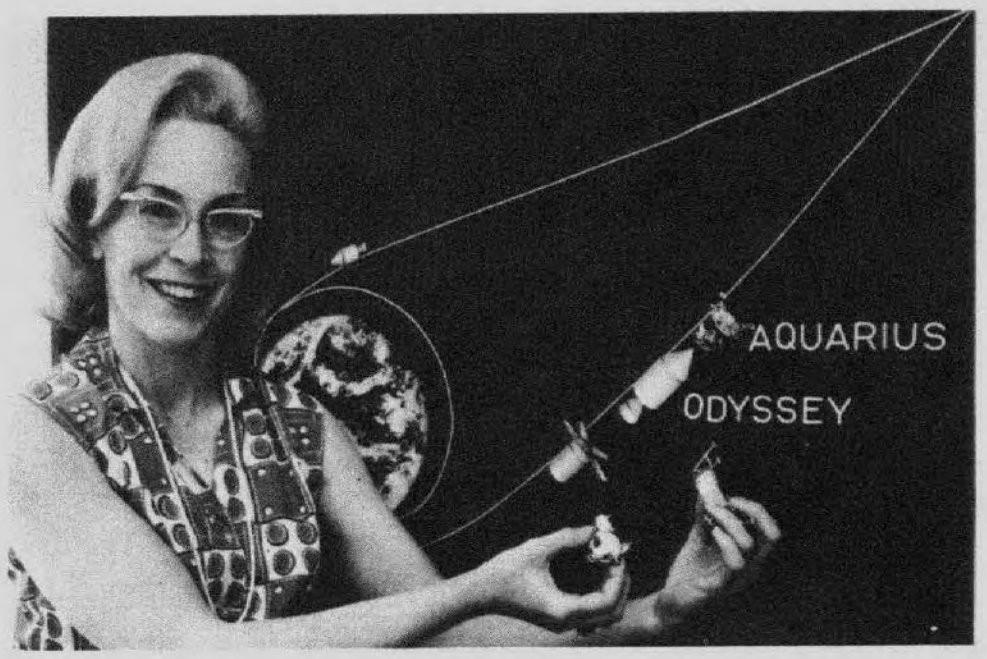
First Flight-1st place, Paul Barasich; 2nd place, John Hawkins; 3rd. place, Bob Eddy; and 4th place, Bill Gideon.

Second Flight-1st place, John Rakich; 2nd place, Howard Matthews; 3rd place, Ken Souza; and 4th place, Mitch Radovich.

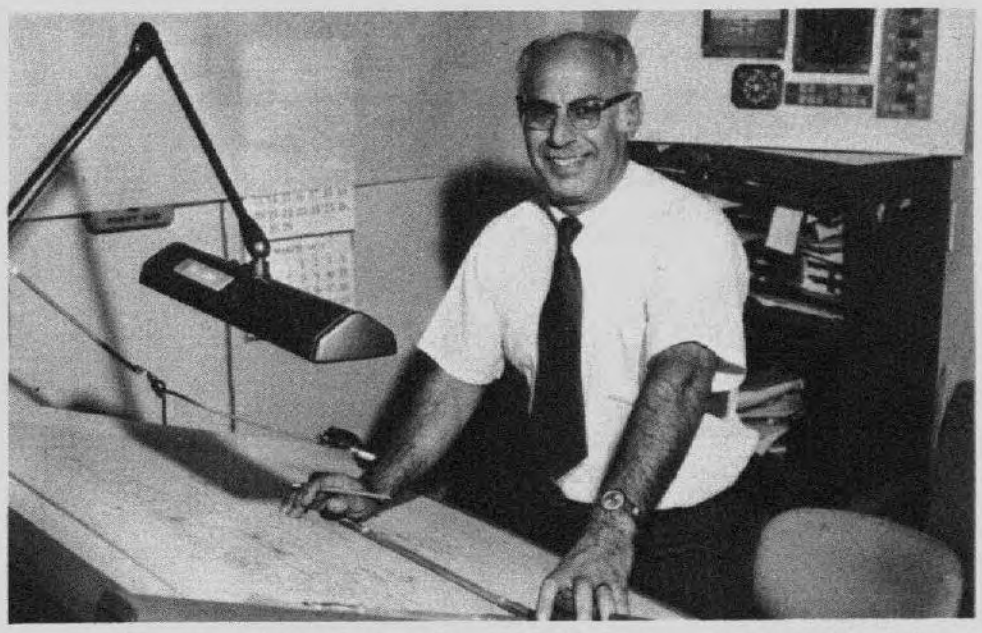
Third Flight-1st place, Elmer Hampel; 2nd place, Barry Scott; 3rd place, Howard Garrison; and 4th place, Ray Forrest.

Hole-in-one went to Herb Ginoza.

The next tournament is March 6.



RETURNED TO THE BOARD . . . Barbara Busch, Public Affairs Office, was returned to the 1972 ARA Executive Board by popular election last month. Miss Busch, who served on the 1970 ARA board, joins Loretta Vice, Technical Information; Janet Konrath, Data Management Analysis; Armando Lopez, Flight and Systems Research; Jessie C. Gaspar, Programming; Roger C. Hedlund, Electronic Instrument Development; Emerson N. Shaw, Photographic Technology; and Peggy S. Larson, Materials Research, as a member of this year's board.



ARA EXECUTIVE BOARD MEMBER . . . Sal Tardio of the Electronic Development Systems Branch was recently elected to serve on the 1972 ARA Executive Board. Sal has been with Ames for 11 years and for the last 5 years has taken an active part in the annual Children's Christmas Party. He is looking forward to working with the Board on their various activities.

AMES GOLF CLUB OFFICERS FOR 1972 . . . (left to right) Frank Lazzeroni, Handicap Chairman; Kay Bruck, Secretary; John Mulkern, President; Larry Hochstein, Vice-President; and Clark White, Treasurer.

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 wiriting to The Astrogram., N 241-4 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-Austin Healy Sprite parts (includes engine, windows, transmission, etc.) Also 1960 Ford Hardtop at $260. Call before 7:30 p.m., 736-7984.

For Sale-1967 Ford Ranchero, 289, $850. Call K. Skrettingland, 246-8708.

Believe it or Not - I've recently been given a new Mazda. Therefore, I'm selling my 1968 Fiat 850 sport coupe to help finance my way through college. Economical, good brakes and tires. Recently rebuilt engine. Fine condition. $875. Laurel at 736-7154.

HOUSING

For Rent-Extra large 2-bedrooms, 1-bath, ww carpets, drapes, all electric kitchen. San Tomas and Stevens Creek Blvd. $180 unfurnished, $200 furnished. Call G. Cooper, 867-3335.

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.

For Sale or Lease-Beautiful Glenmoor Gardens in Fremont. 3-bedrooms, 2-baths, all electric kitchen, separate family room with fireplace, 2-car garage, new wall to wall carpets thruout and drapes. Large lot, 85 x 110. Free membership in Swim & Racquet Club. Near all shops and schools. sell for $32,950 with excellent financing or lease for $286 with possible option to buy. Al Ghan - 269-5578.

For Rent-S. Tahoe 3-bedroom, 2-bath modern home on Pioneer Trail, 1-mile from Heavenly Valley, fully furnished, $125 wk., $70 weekend. 321-8745.

MISCELLANEOUS

For Sale-Pool table, slate top, new balls, excellent condition. $225. For more information call 257-5686 after 5 p.m.

For Sale-Fine mahogany dining room table and six chairs, $150 set. Chinese oriental rug, 9 x 12, $900. Gowdey, 739-2228.

For Sale-Cameras, Canon Pellix QL, Canon 50 mm, 1.4, $175. Canon 135 mm - 2.5, $70. Canon 518 Zoom Super 8 movie camera - $70. David D. Harmon 257-6659.

Rent or Buy-Tire chains to fit size 700-14 tire. 257-0388.

For Sale-Birch Bi-fold doors, fit 60" opening, $25. Bob Jackson, 327-6317.

For Sale-Fisher 125 Stereophonic Home Music Center (AM/FM receiver includes a record changer) and two matching Fisher XP-55B Free-Piston Speaker system. Call 247-7934 after 6 p.m.

For Sale-Ode electric guitar, Hofner, good cond. $100. 1/11 karat diamond engagement ring, white gold $150. Contact Ron Evans, 248-2376.

For Sale-Child's skis (4') wood with plastic base, bindings and poles, $12.50. Call 321-2380, evenings.

For Sale-Tire chains for 15 inch wheels, used once. $6. Vito D'Alola, after 5 p.m., 296-3982 (S.J.)

For Sale-7-foot king size round bed. Box springs and foam mattress, included are, (1) 2 round, fitted sheets; (2) deluxe, blue, quilted bedspread; (3) velvet pleated skirt; (4) deluxe, quilted, semi-circular headboard; and (5) 2 cover pillows. All for $175. Phone 253-4475.

Pollutant Detector

A sophisticated pollutant detector developed for NASA at the Jet Propulsion Laboratory, will go to work this week on Los Angeles smog.

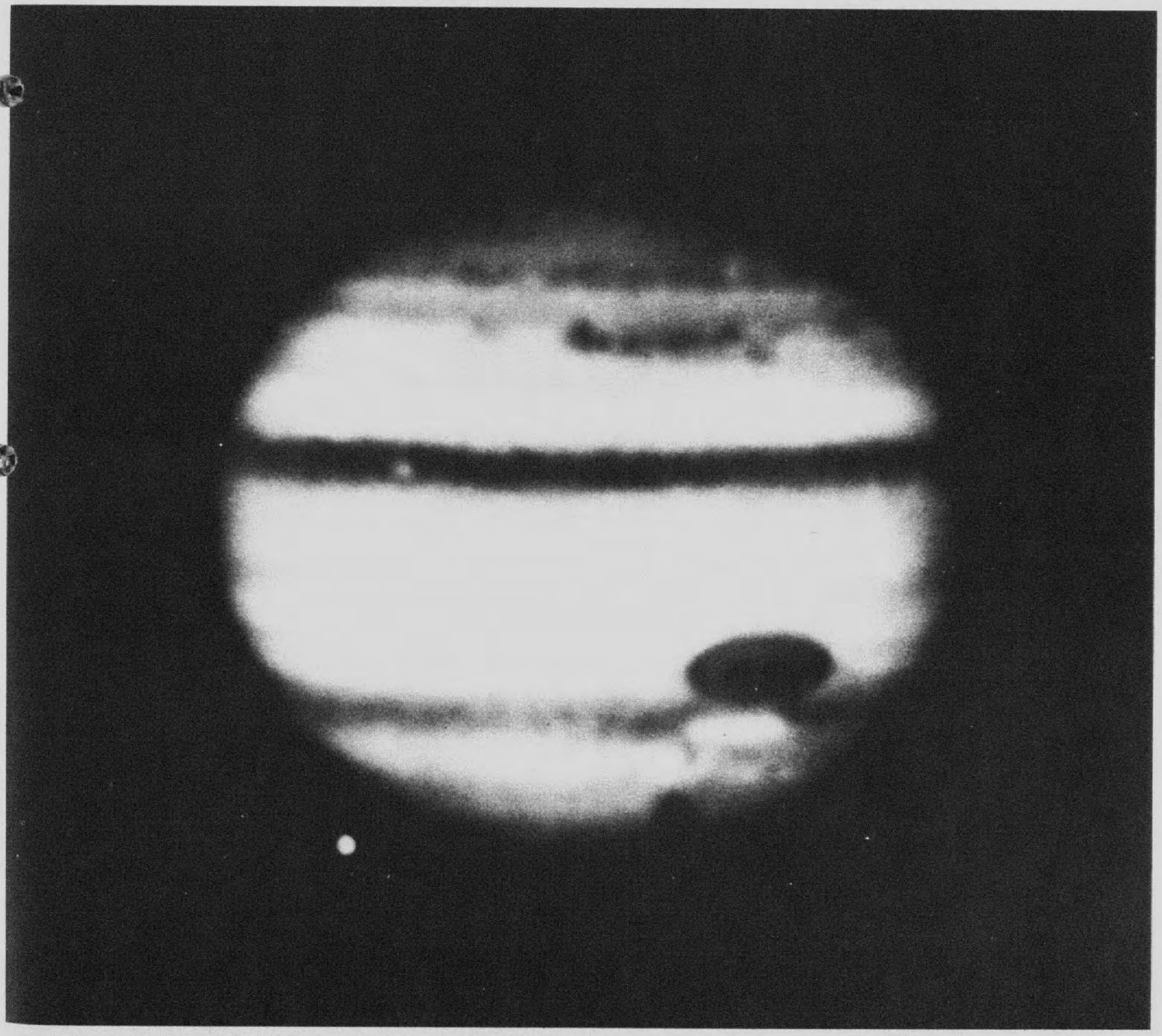
The instrument, called a high-speed interferometer (HSI), will monitor the busy Santa Monica Freeway.

At the request of the California Division of Highways, JPL engineers will record the levels of up to a dozen smog chemical components, particularly during the morning and evening traffic peaks.

The Astrogram

Volume XIV No. 10 NASA/Ames Research Center, Moffett Field, California February 24,1972

PIONEER MISSION TO JUPITER - Special Issue



PIONEER-JUPITER MISSION BEGINS NEW SPACE ERA

The era of the exploration of the outer planets is about to begin. Pioneer F, managed by Ames, is scheduled for launch from Cape Kennedy on Sunday, February 27. It will reach out beyond Mars to give man the first close-up look at the bizarre and giant planet Jupiter.

If the mission proceeds as planned, the trip to Jupiter will last less than two years from launch with arrival time at the planet around Christmas 1973.

Jupiter is a spectacular planet and is potentially the most interesting in the solar system. It is distinguished by the glowing yellow-orange and blue-gray stripes with the huge red spot in the southern hemisphere known as the "Eye of Jupiter". It appears to have its own internal energy source and is so massive that it is almost a small star. Scientists have raised the possibility that the necessary ingredients to produce life may exist. The volume is 1000 times as great as that of the Earth, and it has more than twice the mass of all the other planets combined.

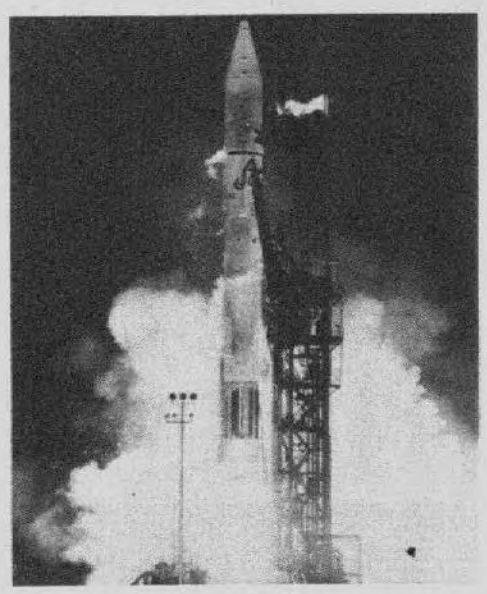
The mission of the unmanned Pioneer includes a number of other firsts. Pioneer F is expected to make the first reconnaissance of the Asteroid Belt between the orbits of Mars and Jupiter. It is planned to be the first man-made object to escape the solar system, and the first such object to use the orbital velocity and powerful gravity of Jupiter for escape.

Charles E. Hall, Pioneer Project Manager, has minimized the hazards of the spacecraft travelling through the Asteroid Belt. He stated that in a simulated Pioneer mission through the Belt only 10 asteroids came close, but not close enough to be hazardous.

After successful passage through the Asteroid Belt, the spacecraft could return data out 1.5 billion miles or more from the Sun, a point it will reach in about seven years, over a curving trajectory about 2.3 billion miles long. This point is 600 million miles beyond the orbit of Saturn, two thirds of the distance between the orbits of Saturn and Uranus.

LAUNCH VEHICLE

The Atlas-Centaur-TE-M-364-4 launch vehicle will drive the spacecraft away from the Earth initially at 32,000 mph -- faster than any man-made object has flown before. For the first week, the spacecraft will travel an average of half-million miles per day. Pioneer Jupiter will pass the Moon's orbit in about 11 hours.

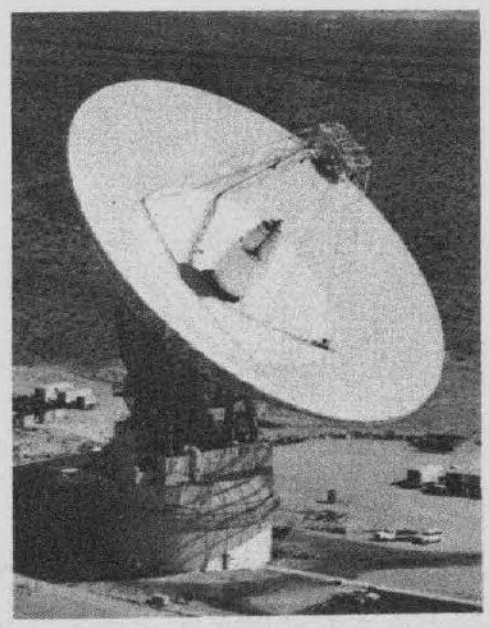


LAUNCH VEHICLE . . . for Pioneer F mission to Jupiter, Atlas-Centaur.

SCIENTIFIC EXPERIMENTS

Thirteen scientific experiments on the spacecraft will carry out scientific exploration on a totally new scale. They are expected to provide massive amounts of new knowledge about Jupiter and many aspects of the outer solar system and our galaxy. The spacecraft will return the first close-up pictures of Jupiter, and will make the first measurements of Jupiter's night side, never seen from the Earth.

Pioneer F is intended in part to develop technology for other outer planet missions. The spacecraft will test out the hazards of high-velocity impact of cosmic debris in the Asteroid Belt, and it will sound Jupiter's radiation belts, which could cripple or destroy it. The belts are estimated to be as much as one million times more intense than the Earth's Van Allen radiation belts.



DSN 210-FOOT ANTENNA

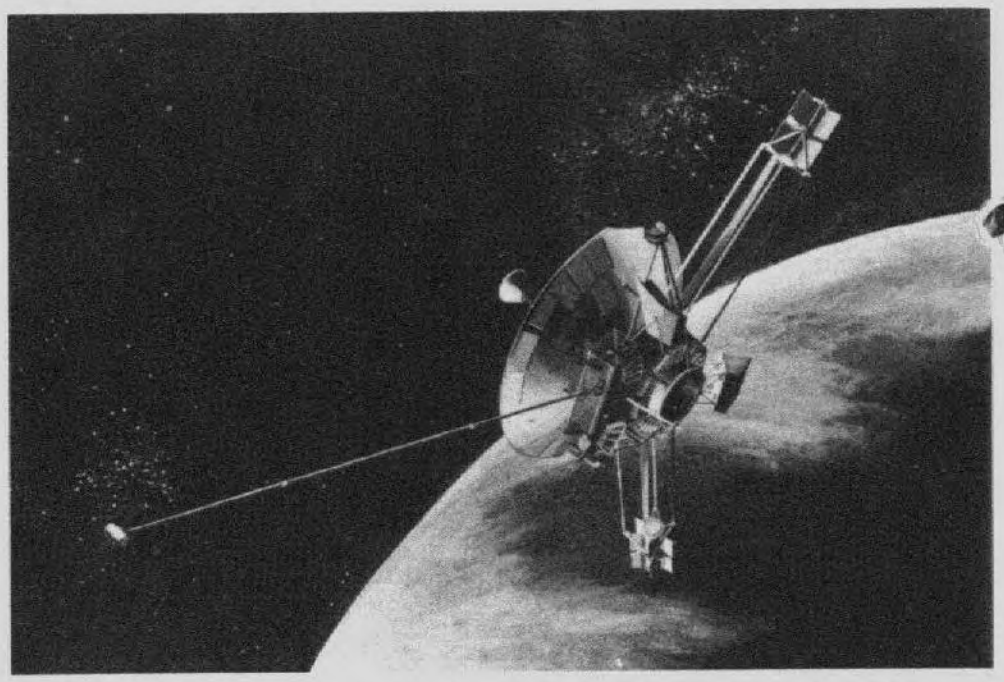
COMMUNICATIONS

Jupiter is so far away that radio messages (moving at light speed) will take 45 minutes to reach the spacecraft there, with a round trip light time of 90 minutes. This will demand intensively-planned command operations. The flexible Pioneer is controlled largely by 24-hour-a-day commands, not by advance instructions in on-board computers.

To carry out the mission the advanced communications technology of NASA's Deep Space Network (the DSN) will be strained to the limit. The DSN's 210-foot "big dish" antennas, which now hear the whisper of a whisper from Mariner spacecraft at Mars orbit on the other side of the Sun, will have to hear seven times as far.

Pioneer's 8-watt signal, transmitted from Jupiter, will reach DSN antennas with a power of 1/100,000,000,000,000 watts. Transmitted for 19 million years, this energy would light a 7.5 watt Christmas tree bulb for one-thousandth of a second.

Spacecraft reliability requirements are very severe.



PIONEER F . . . a new design for exploring the outer solar system.

NEW DESIGN

Pioneer F is a new design for the outer solar system, but it retains many tested systems of its predecessors, the Pioneer 6 to 9 spacecraft. All four are still operating in interplanetary space. Pioneer 6 is in its seventh year.

The 570-pound spacecraft is spin-stabilized giving its instruments a full-circle scan. Nuclear sources are used for electric power because solar radiation is too weak beyond Jupiter for a solar-powered system. The spacecraft's nine-foot dish antenna will be locked on the Earth throughout the mission -- constantly looking back at the Earth and changing its view-direction as the the home planet shuttles back and forth, circling the Sun. Pioneer's entire flight path is in, or very close to, the plane of the Earth's orbit (the ecliptic).

Jupiter itself is little understood. It broadcasts predictably modulated radio signals of enormous power. Though it has only 1/1000th the mass of the Sun, it seems to have Sun-like internal processes, apparently radiating about two and a half times as much energy as it receives from solar radiation.

The most bizarre feature of the planet is the Great Red Spot. Theorists say that it may be an enormous standing column of stagnant gas, or according to one scientist, a "raft" of hydrogen ice floating on a bubble of warm hydrogen in the cooler hydrogen atmosphere, and bobbing up and down at 30-year intervals, as the spot disappears and reappears. The Spot appears to rotate at a different speed than the planet.

A second spacecraft (Pioneer G) will be launched to Jupiter in early April, 1973.

NASA's Office of Space Science and Applications assigned project management for the two Pioneer Jupiter spacecraft to Ames. The spacecraft are built by TRW Systems in Redondo Beach, Calif. JPL operates the Deep Space Network, and Lewis Research Center manages the launch vehicle built by General Dynamics and Thiokol Chemical Co.

PIONEER "FIRSTS"

PIONEER IS:

The first mission to be sent to Jupiter. It will explore for the first time at close range, the satellites, ionosphere and atmosphere of the planet, including the mysterious "Red Spot."

The first mission to explore the Asteroid Belt. It will attempt to survey the great belt of meteoric matter that orbits the Sun between Mars and Jupiter.

The first mission to attain a speed of 47,000 to 48,000 feet per second. It will travel the 500 million miles from Earth to Jupiter in about two years at half a million miles a day, traveling faster than any man-made object has before.

The first man-made object to leave our solar system. After coming within 100,000 miles of Jupiter, Pioneer will pass Saturn, Uranus, Neptune and Pluto, then leave our solar system.

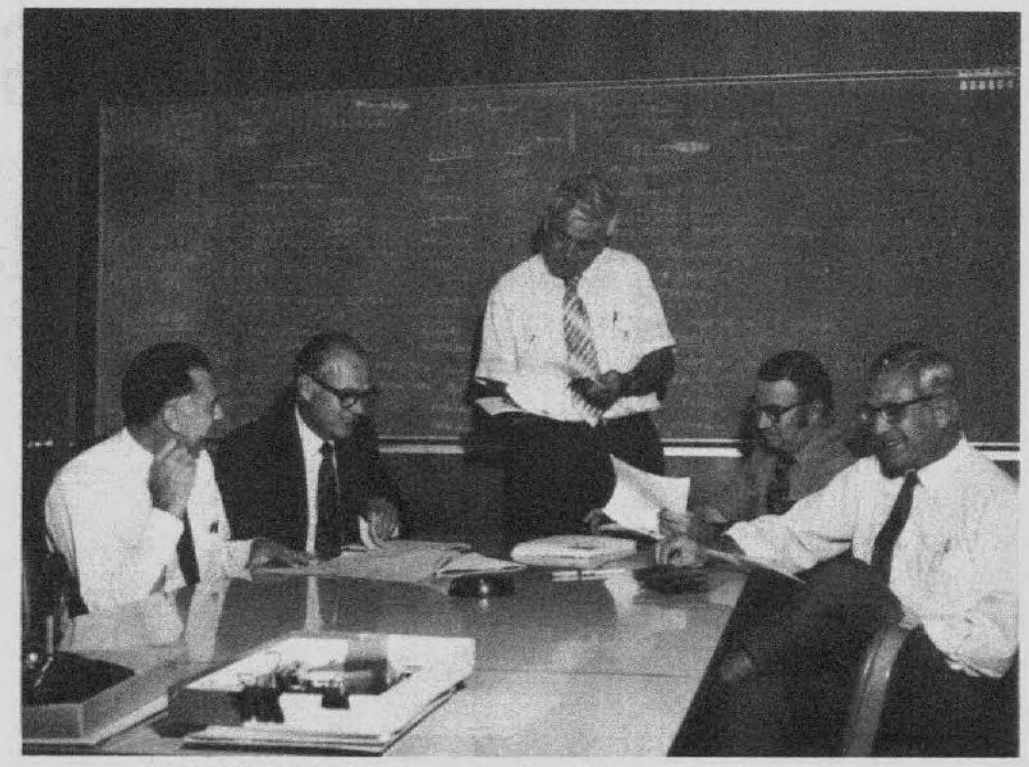
The first mission to be subjected to such great coldness. The flight trajectory will take it farther and farther from the Sun, month after month, and subject it to greater coldness than any of NASA's previous probes of the solar system.

The first time man will condut scientific experiments at such long distances from Earth. It will communicate across 1.5 billion miles, using only an

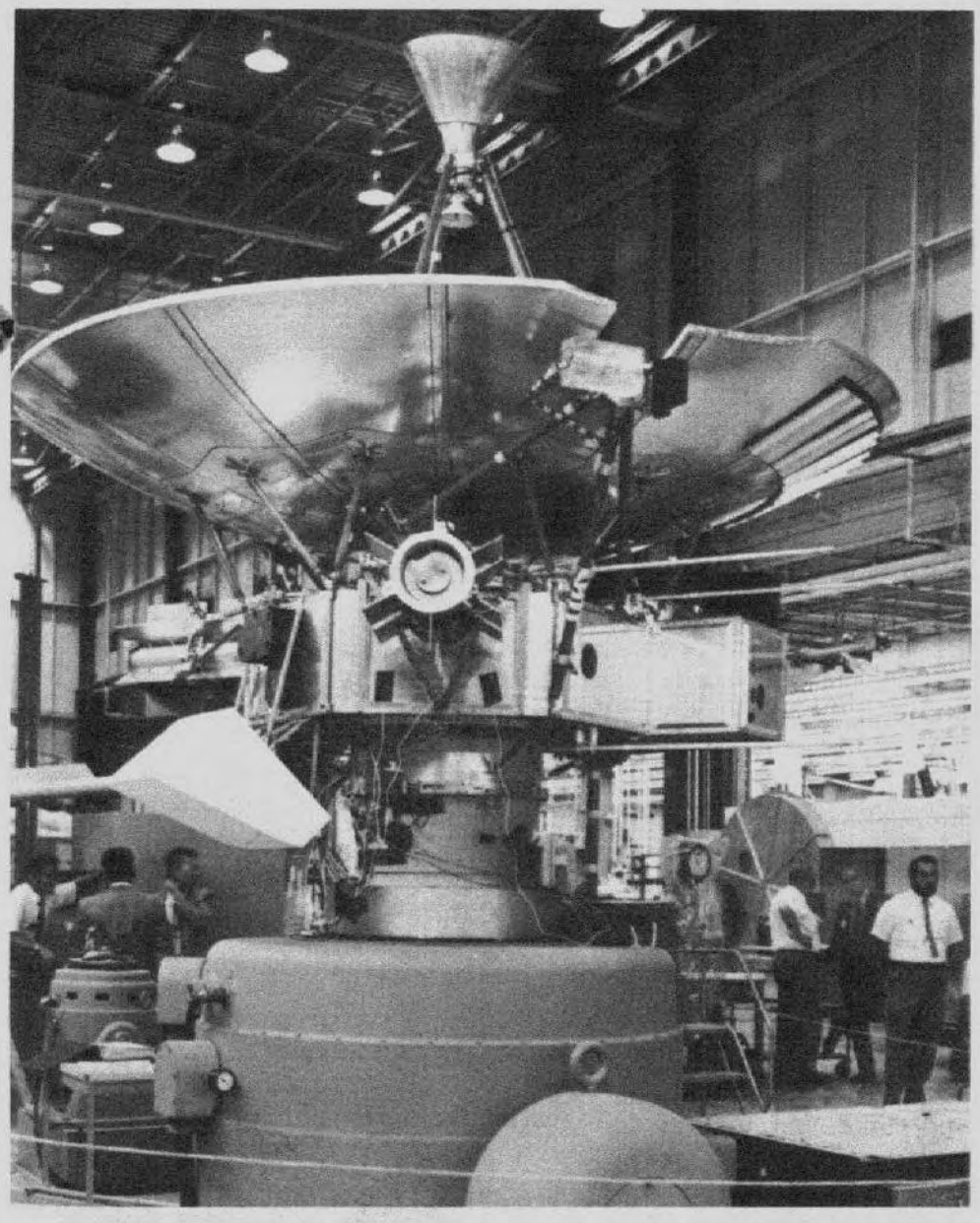
The first time spin-scan imaging will be attempted from an interplanetary vehicle.

The first deep-space probe to be powered by nuclear energy.

The first launch vehicle to use the third stage of the Atlas Centaur combination rocket.



SPACECRAFT TEAM . . . makes plans for the launch of Pioneer F and G. The group includes (from l to r) Joseph E. Lepetich, Experiments Manager; Bernard J. O'Brien, TRW Pioneer Project Manager; Charles E. Hall, Ames Pioneer Project Manager; Ralph W. Holtzclaw, Spacecraft Manager; and George J. Nothwang, Spacecraft Management Office.



AT THE PLANT . . . Pioneer F in final assembly at TRW Systems, builders of the spacecraft.

Potential Mission Benefits

Potential benefits of the Pioneer Jupiter mission and others like it are:

- Increased knowledge of "collisionless plasmas" of the solar wind. This bears directly on the "ultimate" clean system for electric power production, controlled hydrogen fusion.
- Useful new knowledge from the huge particle physics lab of the solar atmosphere.
- Better understanding of the Earth's weather cycles, believed triggered by solar particle storms; and insight into Earth's atmosphere circulation through study of Jupiter's rapidly rotating atmosphere.
- Indications of Jovian resources, such as perhaps a quantity of petrochemicals equivalent to the Earth's atmosphere circulation through study of Jupiter's rapidly rotating atmosphere.
- Indications of Jovian resources, such as perhaps a quantity of petrochemicals equivalent to the Earth's consumption for a million years.
- Pioneer's propulsion system can change its velocity for course changes by up to 450 mph. From Jupiter, its telemetry system can return 1024 data bits per second to Earth. The spacecraft will carry a 65-pound experiment payload. It will make 20 types of measurements of Jupiter's atmosphere, radiation belts, heat balance, magnetic field, moons and other phenomena. The heliosphere (solar atmosphere) will be characterized; perhaps the interstellar gas; cosmic rays; asteroids; and meteoroids between the Earth and 1.5 billion miles from the Sun.

LOW COST

Cost of two Pioneer Jupiter spacecraft, scientific instruments, and data processing and analysis is less than $100 million. This does not include costs of launch vehicles and data acquisition.

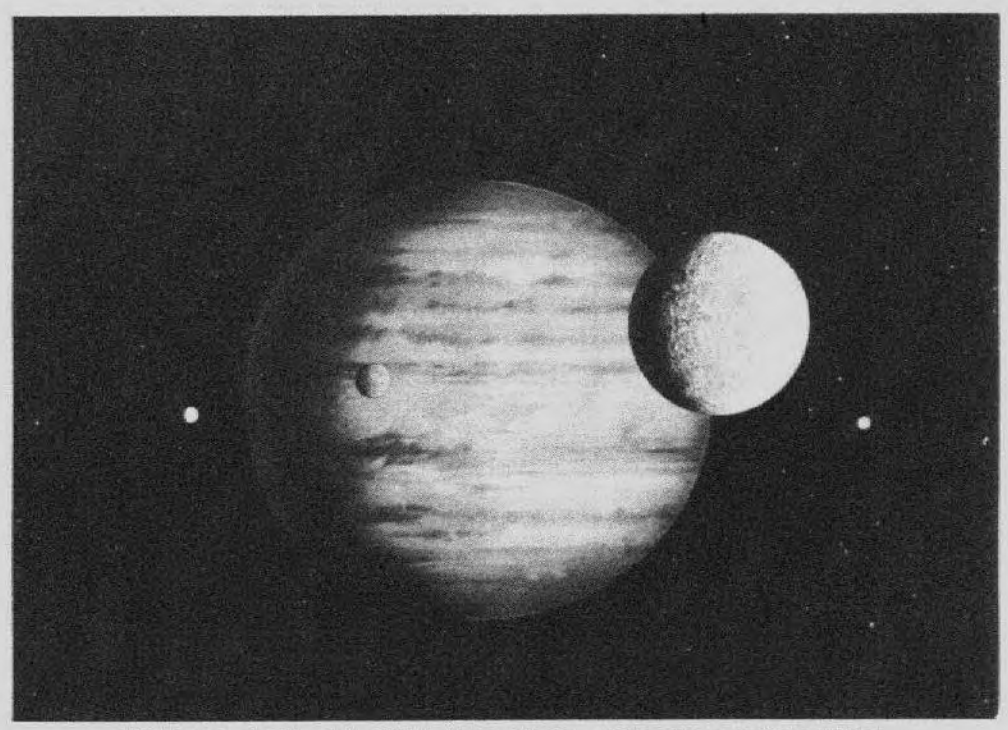
Magnetically Clean

Pioneer F is among the most magnetically "clean" spacecraft ever built. It has been made so to provide the least interference with the magnetometer as it measures the weak interplanetary magnetic field. Ernest J. Iufer, head of the Magnetic Standards Laboratory of the Ames Systems Engineering Division, has been responsible for this phase of Pioneer Project operations.

Since virtually any electric current flow within the spacecraft can produce a magnetic field, demagnetizing is difficult. A wide range of special components and techniques have been used in the electrical system to achieve this low spacecraft magnetism of 0.2 gamma (less than 1/2 500,000 of Earth's surface field) at the magnetometer sensor.

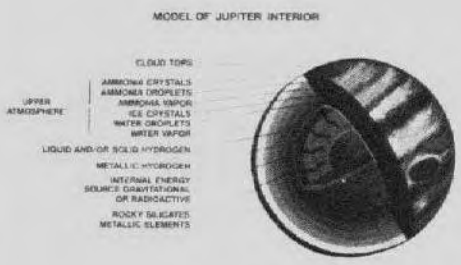
PIONEER MAY SOLVE MYSTERIES OF THE UNIVERSE

Ames' Pioneer F will be launched Feb. 27. Two years and 620 million miles later it will pass Jupiter, our solar system's largest and most distant planet. As it moves toward the outerlimits of the solar system it will travel at a greater speed than any man-made object has before. As it approaches Jupiter it will send to Earth data that may answer questions as old as astronomy.



JUPITER-GOD OF THE HEAVENS AND THE WEATHER . . . Supreme deity of the ancient Romans and identified with the Greek god Zeus. In the artist's conception above four of the planet's 12 moons are illustrated. Jupiter's 12 natural satellites have some odd characteristics. The close moon Io is distinctly orange in color and has odd reflecting properties. Energy is reflected straight back from the Moon's surface, as with a mirror. This reflection property is more pronounced for Io than for any other known object in the solar system.

The inner Moons in order from the planet are: tiny Amalthea which orbits Jupiter twice a day, and the four large moons Io, Europa, Ganymeade, and Callisto. The inner three of the seven tiny outer moons are Hestia, Hera and Demeter. The four outermost moons are Andrastea, Pan, Poseidon, and Hades, all in "backward" orbit.



QUEST FOR KNOWLEDGE

Astronomers would like to know much more about the history and status of the universe as well as the history and status of our solar system. Better deductions might then be possible regarding the universality of physical laws, feasible applications of those laws to new processes on the Earth, and the probability that life exists elsewhere. Pioneers F and G will assist scientists in their quest for basic information and engineers in their use of scientific knowledge for mankinds benefit.

Galileo discovered four satellites orbiting Jupiter, and Ole Romer discovered the finite speed of light by observations of those satellites.

SATELLITES

Jupiter is now known to have at least 12 satellites. In this and other interesting aspects, it resembles the Sun more nearly than it does the Earth. Although it is more than 1000 times as large as the Earth, it has only slightly more than 300 times the mass of the Earth. Yet the total mass of Jupiter and its satellites perturbs the orbits of comets, asteroids, and other components of the solarsystems so greatly that a noted modern astronomer calls it "the dominating planet." It is so radiant that another writer refers to Jupiter as "a potted star," and there is reason to believe that it, like the Moon, may prove to be a "Rosetta stone," from which much may be learned about the solar system's origin and development.

Jupiter rotates faster than any other planet of the Sun. Light and dark bands cross its golden disk, and a great current sweeps around its equator faster than other visible features rotate.

RED SPOT

An enormous Red Spot, about which there are many conflicting theories, floats in its deep atmosphere. Known as the "Eye of Jupiter", this huge oval is 30,000 miles long and 8,000 miles wide, large enough to swallow up several Earths with ease.

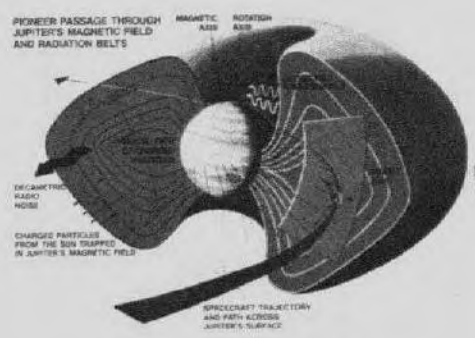
The planet's appearance from the Earth constantly changes and intensive studies of it from the Earth have indicated the presence of hydrogen, helium, water vapor, and ammonia and methane gas in the atmosphere.

Recent research also has suggested that the same chemical reactions which are believed to have preceded the appearance of life on the Earth are taking place now on Jupiter.

ENERGY

Jupiter, furthermore, seems to be radiating more energy than it receives from the Sun. More radio noise reaches the Earth from Jupiter than from any other source except the Sun. Bursts of radio noise from this planet sometimes are equivalent in energy to several hydrogen bombs or billions of simultaneous lightning flashes. Three distinct types of radiofrequency emissions from Jupiter have been recognized, and analysts of that noise believe that Jupiter has radiation belts comparable to those discovered near the Earth by predecessors of Pioneers F and G.

"It may be," according to Dr. Robert Wildey of the U.S. Geological Survey's Center of Astrogeology, "that Jupiter has not quite finished 'falling together' into a rigid planet from the original interstellar material from which it was formed so that its power generation is essentially gravitational energy conversion."

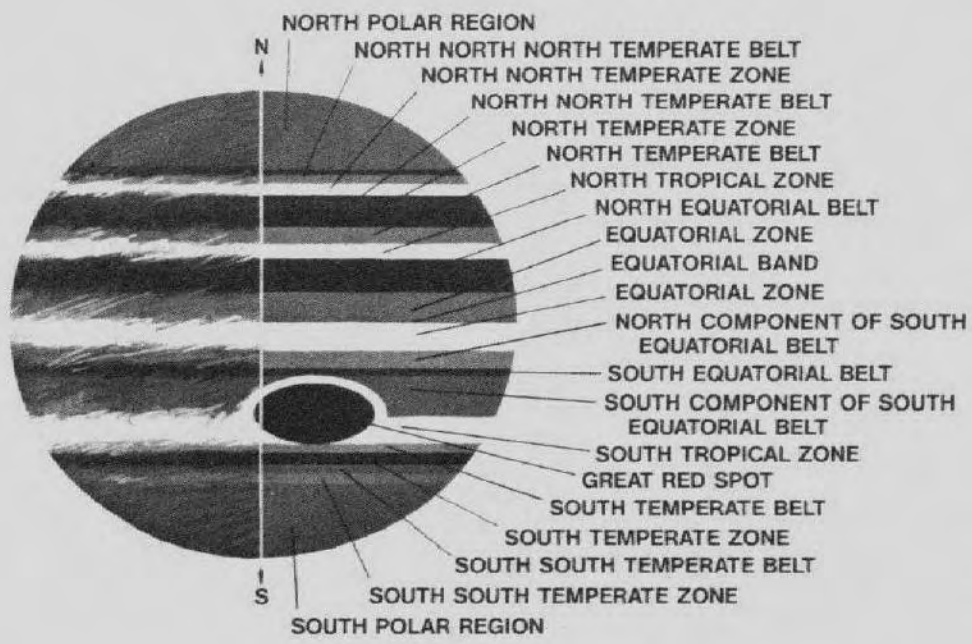


BRIGHT PLANET

Seen from the Earth, Jupiter is the second brightest planet, and fourth brightest object, in the sky. Jupiter is 480 million miles from the Sun, and circles the Sun once every 12 years. The planet has 12 moons, the four outer ones in "backward" orbit. Two of the moons, Ganymeade and Gallisto, are about the size of the planet Mercury. Two others, Io and Europa, are similar in size to the Earth's moon.

Jupiter completes a rotation at the amazing speed of once every 10 hours, the shortest day of any of the nine planets. Because of Jupiter's size, this means that a spot at the equator on its visible surface (cloud tops) races along at 22,000 mph, compared to a speed of 1000 mph for a similar spot on Earth.

JUPITER'S VISIBLE SURFACE



The Pioneer Project . . . A Decade of Success

In the decade that has passed since the Pioneer Project was transferred to Ames management in 1962, four spacecraft have been placed into orbit around the sun.

These four, Pioneer 6, 7, 8, and 9 have been among the most valuable and successful of NASA missions. The first, launched in 1965, was expected to return data on interplanetary space for six months. Today, seven years later, it is still returning valuable data. Pioneers 7,8 and 9 show promise of being equally long-lived.

The Pioneer project boasts a long history of firsts in space exploration. Several never-before experiments were made possible by the four spacecraft orbiting the Sun simultaneously. Previously unattainable data has been returned which has greatly expanded our knowledge of interplanetary space.

UNIQUE ORIENTATION

A year after launch, in 1966, it was reported that, "Because of its unique orientation, its wide-angle scan around a full circle and its extremely high rate of data return, Pioneer 6 is providing a "picture" of solar space with over ten times more detail than previous measurements."

From the first the Pioneer spacecraft have been particularly informative on the subject of solar wind. Pioneer project scientists said later that year, "This is the first time the Earth's magnetic tail has been seen beyond the orbit of the Moon. The fact that the tail extends more than three million miles behind the Earth . . . throws considerable light on the question of the overall shape of the Earth's magnetosphere, the magnetic envelope that protects man from solar and cosmic radiation."

By the following year, 1967, two Pioneer spacecraft were in solar orbit, Pioneer 6 and Pioneer 7. In a progress statement it was said, "The Ames-managed Pioneer 6 and 7 spacecraft are making the first detailed inspection of the side of the Sun not visible from the Earth, and are providing the first regular information on it to the U.S. solar weather forecasting agency."

Pioneer 8 joined the other spacecraft in 1968. Together the three were said to be doing the work of six spacecraft. NASA released a statement in August of that year reporting; "The three Ames-managed Pioneer spacecraft, now far our in interplanetary space, are doing the work of six spacecraft, and are surveying entirely new areas of space . . . Usefulness of the currently operating interplanetary Pioneers virtually doubles when they transmit data from the side of the Sun opposite the Earth."

Pioneer 9 was also successfully placed into solar orbit in 1968. In a progress statement for Pioneer 9, the continuing success of Pioneer 6 was disclosed, "A late report indicated that on Friday, Nov. 22, Pioneer 9 will be 1,871,509 miles from Earth, and Pioneer 6, launched three years ago, will pass behind the Sun providing some of the best measurements yet of the little known solar corona. Scientists began to receive good preliminary data from Pioneer 6 on the solar corona about a week ago."

Later that year a report was issued which read, "Currently, with Pioneer 8, the best measurements ever made of the distributions of solar wind particles are taking place -- again because the long life of Pioneer 6 has lined it up with the Earth and Pioneer 6."

To date the Pioneer spacecraft have stacked up an impressive list of scientific accomplishments. These include:

The most precise determination so far of characteristics of the solar atmosphere (the heliosphere);

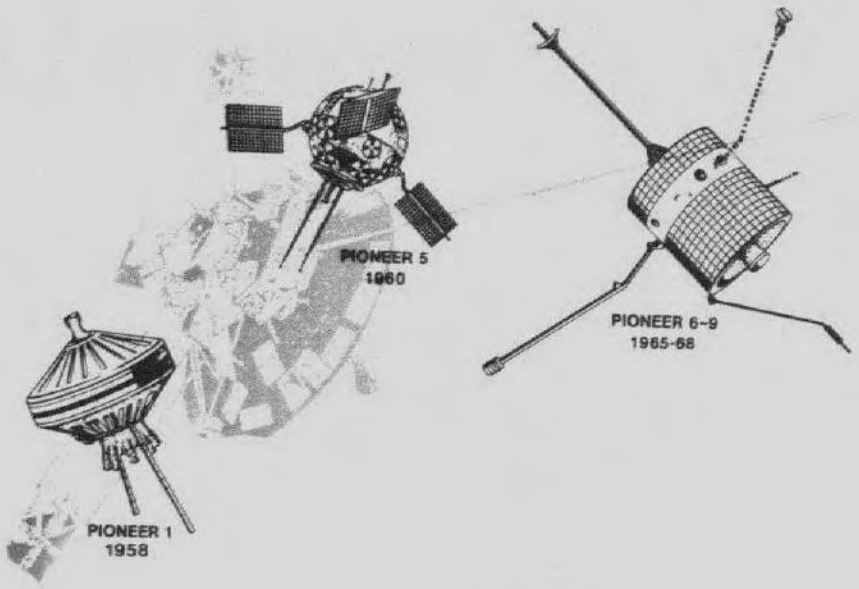
Determination of solar cosmic ray and solar wind flow patterns, and magnetic and electric field mechanisms in the solar atmosphere;

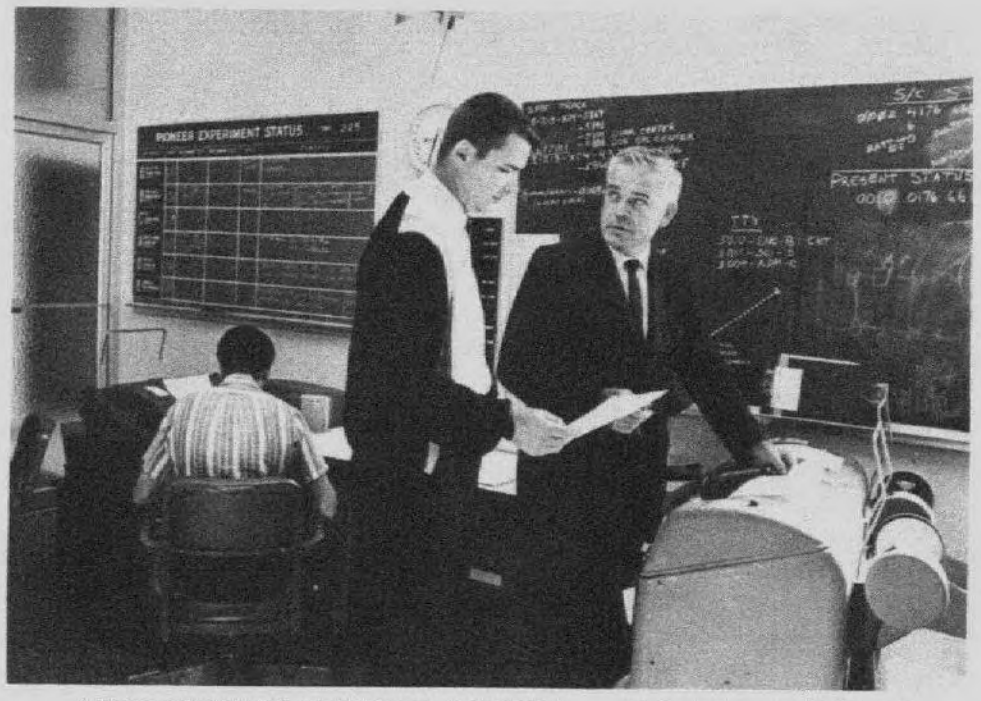
LONGEST LIVED

Longest-lived operational interplanetary spacecraft; Pioneers 6 to 9, by the end of 1971, had achieved 230 months of day-to-day tracking and data acquisition. Almost 20 billion data bits had been received, processed, analyzed and reported to the scientific community. A total or 26,000 commands had been transmitted to these four spacecraft;

Most distant intelligible telemetry data from Earth, and most distant use of command functions, 170 million miles (Pioneer 7).

A new phase of interplanetary space exploration will begin this year with the launch of Pioneer F, to be known as Pioneer 10 after launch. If the history of the previous Pioneers is any indication, knowledge of Jupiter and the outskirts of our solar system, which are Pioneer F's destinations, will increase rapidly over the next few years.



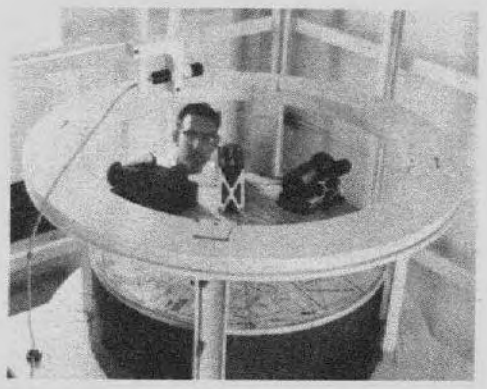


AMES PIONEER CONTROL CENTER . . . The year was 1966 and the status of Pioneer VII was checked by teletype and voice link with JPL's Space Flight Operations Facility. Robert R. Nunamaker (left), Pioneer Flight Operations Manager, and Charles E. Hall, Project Manager, read spacecraft data from the teletype.

Early Pioneers Establish Records

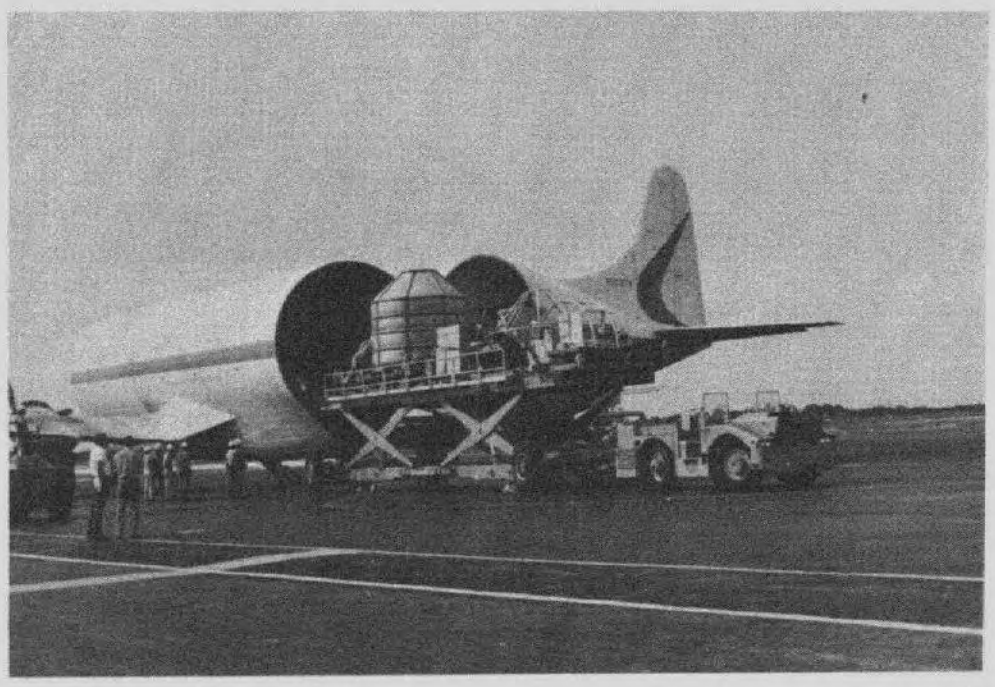
Among early Pioneer "firsts" are:

- First of telecommunications characteristics for spacecraft orientation.
- First gathering of space weather data for operational use.
- First spacecraft to use convolutional coding/sequential decoding (Pioneer 9).
- First occultations by solar disc of man-made signal source (Pioneer 6 to 9).
- First lunar occultation using an interplanetary spacecraft (Pioneer 7).
- First simultaneous receipt of two spacecraft signals using a single ground antenna (Pioneers 6 and 7).
- First particles and fields investigations of radial and spiral characteristics of solar wind and solar cosmic rays (Pioneers 6 and 7).
- First spacecraft to define character of Earth's magnetic tail (Pioneers 6 and 7).
- First spacecraft to use linearly polarized S-band antenna and therefore only spacecraft able to conduct Faraday rotation experiments during solar occultation (Pioneers 6 and 9).
- First spacecraft equipped with a telecommunications range-adaptive telemetry system.
- First major spacecraft system designed, developed, and delivered on a fixed-price incentive-fee contact.

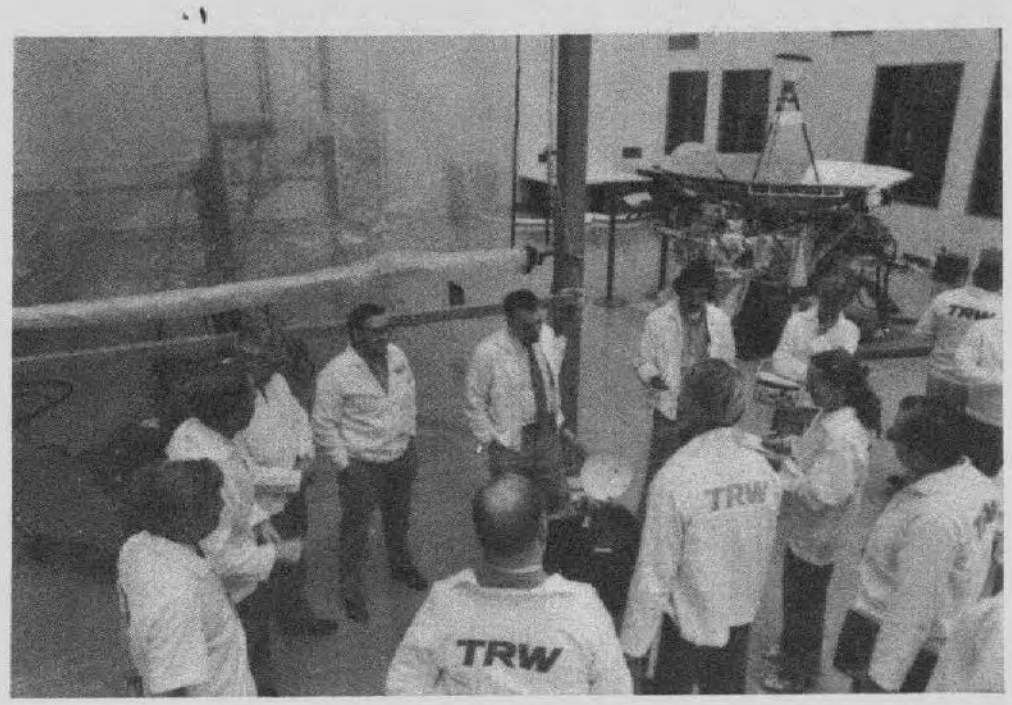


PIONEER EXPERIMENTS... undergo magnetic acceptance tests in 1965 under the watchful eye of Ernest J. Iufer, head of the Ames Magnetic Standards Laboratory.

A Look at Pioneer Pre-Launch Activities . . .



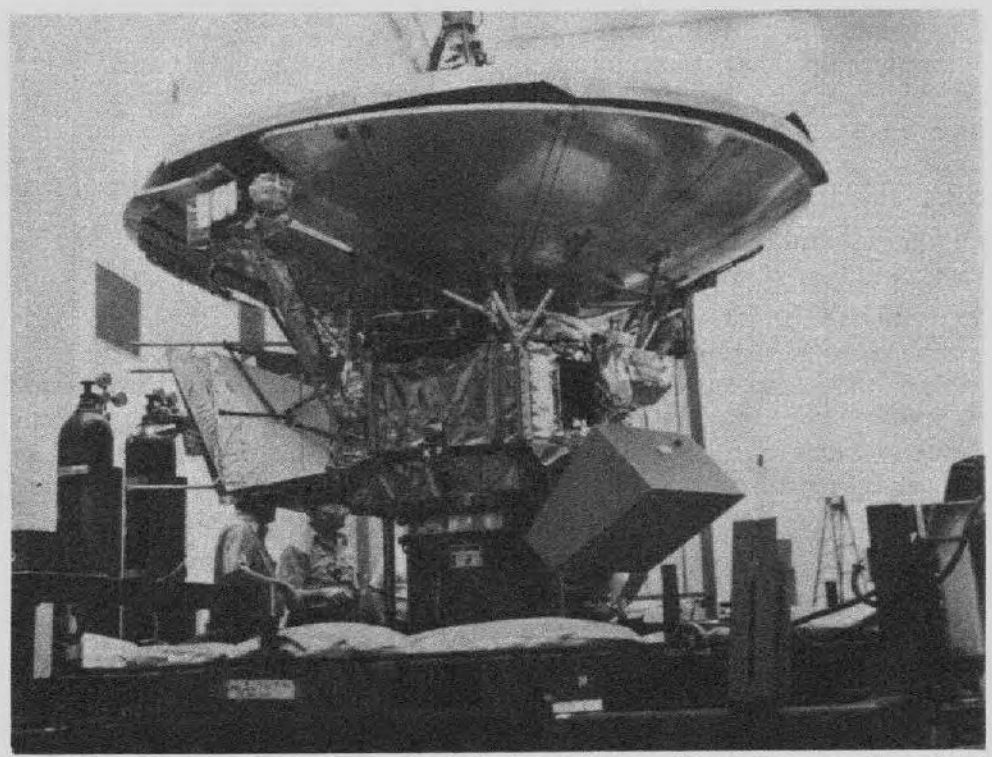
UNLOADING PIONEER F . . . from the Mini Guppy aircraft on the Skid Strip just a few miles from the launch site at Cape Kennedy.



PIONEER PRESS CONFERENCE . . . at Cape Kennedy.

Ed. Note:

A hard-working Pioneer Team is spending long hours preparing for the launch of Pioneer F. In an effort to capture, to a small degree, the scope of the mission the next few pages depict some of the activity.



PIONEER F . . . is unloaded from the In-Plant Transport at Cape Kennedy.

LAUNCH OPERATIONS

In the final weeks before launch of Pioneer-Jupiter on Feb. 27, a dedicated Pioneer team headed by Charles E. Hall, Project Manager, are hard at work on final preparations.

Activities extend throughout the worldwide tracking network stations operated by the Jet Propulsion Laboratory, Pasadena; the launch area at Cape Kennedy, Mission Control at JPL, and the Mission Analysis Area here at Ames, the latter two headed by Robert R. Nunamaker, Flight Operations Manager.

Spacecraft Manager Ralph R. Holtzclaw, Launch Vehicle and Operations Manager, Robert U. Hofstetter, and Experiment Manager Joseph E. Lepetich, are coordinating and directing each phase of their operations at the Cape, where Mr. Hall, as Mission Director, will join them for the countdown and launch of the spacecraft.

Mission events include: liftoff, passage through the Earth's shadow, acquisition of the spacecraft by the Deep Space Network (DSN) and first orientation to point the spacecraft antenna toward the Earth.

When the spacecraft is separated from the launch vehicle, mission control will be turned over to Mr. Nunamaker at JPL who will then become the Flight Director.

After several months, if spacecraft operation has become routine, control personnel will move from the Pioneer Control at JPL, Pasadena, to the Pioneer Mission Analysis Area at Ames. Pioneer Conrol is at Pasadena during critical phases of the mission because of the greater computer and display capability there, and the DSN facility's ability to support many systems analysts.

During early parts of the mission command, tracking, and data return will be primarily by the DSN's 26-meter (85-foot) antennas located at 120 degree intervals around the Earth, at Goldstone, California, Madrid, Spain; and Canberra, Australia.

The Unmanned Launch Operations (ULO) Directorate at the John F. Kennedy Space Center is responsible for the preparation and launch of unmanned spacecraft from Florida.

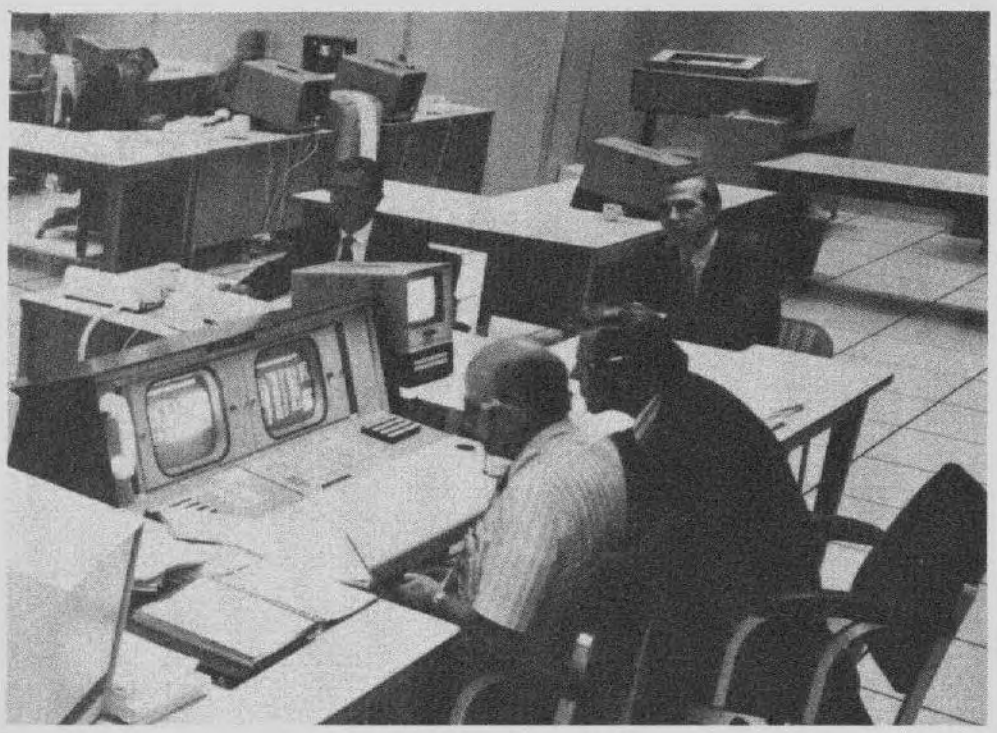
The Pioneer-Jupiter spacecraft was delivered to the Cape from TRW Systems in early January and placed in the spacecraft checkout area for final verification tests.

In mid-February Pioneer F was mated on the Atlas-Centaur launch vehicle and readiness procedures continued.

Preparing for the Pioneer F launch at the Cape with Ralph Holtzclaw, Spacecraft Manager, are members of his staff George Nothwang, George James, and Jane Wilbur; Benny Chin and David Lozier of Launch Vehicle and Operations; and Richard Twarowski of Experiments.

TESTING AN EXPERIMENT PACKAGE . . . on Pioneer F in Hangar AO at Cape Kennedy are (l to r) Hugh Sloway, Project Quality Management Office, TRW Systems and Joseph E. Lepetich, Pioneer Experiments Manager.

LAUNCH COMPLEX 36A . . . at Cape Kennedy, site of Pioneer F launch. Experiments Manager Joseph E. Lepetich and John R. Mulkern of the Ames Reliability and Quality Assurance Branch will be on duty here during the last manned checkouts of the spacecraft before launch.



SPACECRAFT PERFORMANCE ANALYSIS TEAM . . .operates in this area of the Space Flight Development Laboratory, Deep Space Network Headquarters, JPL Pasadena. The Pioneer SPA Team preparing for the Pioneer F launch includes (from right around the console) Norman F. Martin and John G. Miller, Ames Pioneer Flight Operations; Albert H. Hofmann, Chief, Pioneer Support, Spacecraft Development Lab, JPL; and Pioneer Deep Space Network Manager Alfred J. Siegmeth, JPL.

PIONEER MISSION CONTROL . . . the hub of the Pioneer Mission Support Area (PMSA) at Deep Space Network Headquarters, JPL Pasadena. From this location Pioneer Control and spacecraft operations will be carried out by Flight Operations Manager Robert R. Nunamaker (left of center) of Ames, and his team. Reading clockwise they are Earl Levin, Ames; William E. Damon, Bendix; Gilbert A. Schroeder and Thomas L. Bridges, both of Ames. Data displays provide flight information and the button controls provide world-wide voice communications. The telephone to the right of the Flight Director is a private line to Pioneer Mission Director Charles E. Hall at Cape Kennedy.

Pioneer Control "Goes West" After Cape Kennedy Launch

Twenty minutes after launch the Deep Space Station at Johannesburg, South Africa, will receive the first data from the spacecraft. At that point the spacecraft will be commanded to in-orbit configuration. The scientific experiments will be turned on one at a time, checked, and the performance analyzed according to pre-launch predictions to assure that each will in no way affect the "health" of the spacecraft.

MISSION ANALYSIS

Control of this operation will be at Ames in the Pioneer Mission Analysis Area. Manfred Wirth and Richard Fimmel of Flight Operations will be working here with the Experiments group: Edward Tischler, William Hightower, Thomas Wong, Alvin Wilhelmi and Dennis Porter, and the principal investigators for the experiments or their designated representative.

"The main advantage of operating from the JPL Mission Control" said Mr. Nunamaker during a recent interview, "are the large computers and back-up facilities available. We can execute commands to the spacecraft at a moment's notice if corrections are necessary. Decisions must be made immediately in the early launch phase -- during the long cruise mode nothing will change very fast."

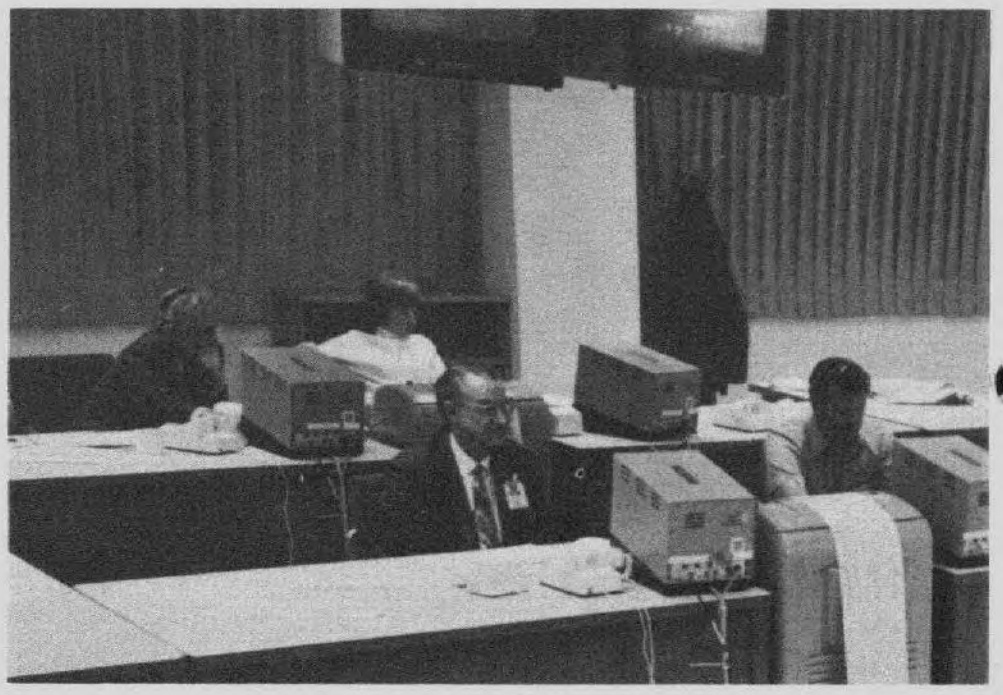
Three hours after launch the spacecraft will be turned around and the high gain antenna pointed toward Earth. "For the next seven days," Mr. Nunamaker continued, "we will perform calibration maneuvers to determine if spacecraft insertion tallies with ground tests."

Then he explained, "The first mid-course correction will take place four days after launch. This is necessary because the launch vehicle can't make a perfect boost. Propulsion maneuvers will be performed to speed or slow the Pioneer toward the planetary target to accomplish mission objectives."

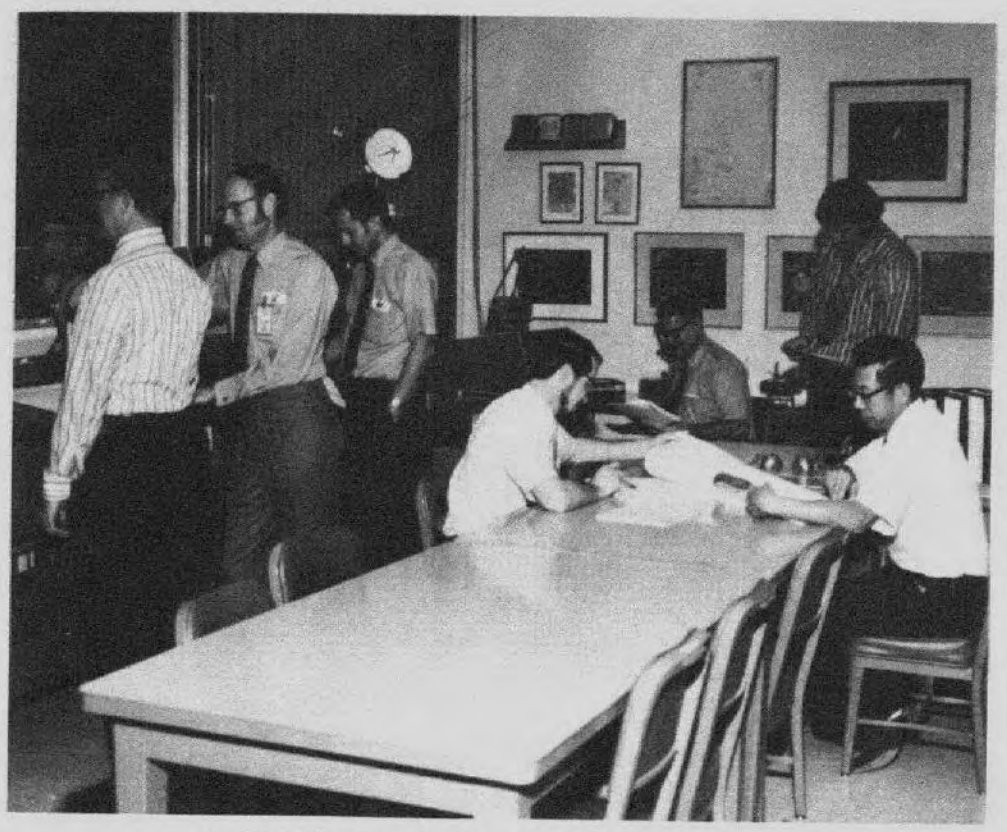
MISSION CONTROL

Manning the Mission Control Operations at JPL with Mr. Nunamaker will be Thomas Bridges, Gilbert Schroeder, John Dyer, Earl Levin, Eugene Rosen, Donald McKeller, and Hallie Funhouser. Howard F. Matthews, Chief of the Systems Engineering Division, will also be at JPL during critical phases of the launch operations. The Ames Spacecraft Analysis Team at JPL will include Norman Martin, Arvid Natwick, Theodore Weber, William Garden, Robert Corridan, Eugene Jesse, Joseph Frank, Lewis Dickerson, George Schimmel, John Miller and Ruben Ramos. Members of the Flight Path Analysis Team are David Lozier, James Phillips, Richard Johnson and John Cowley.

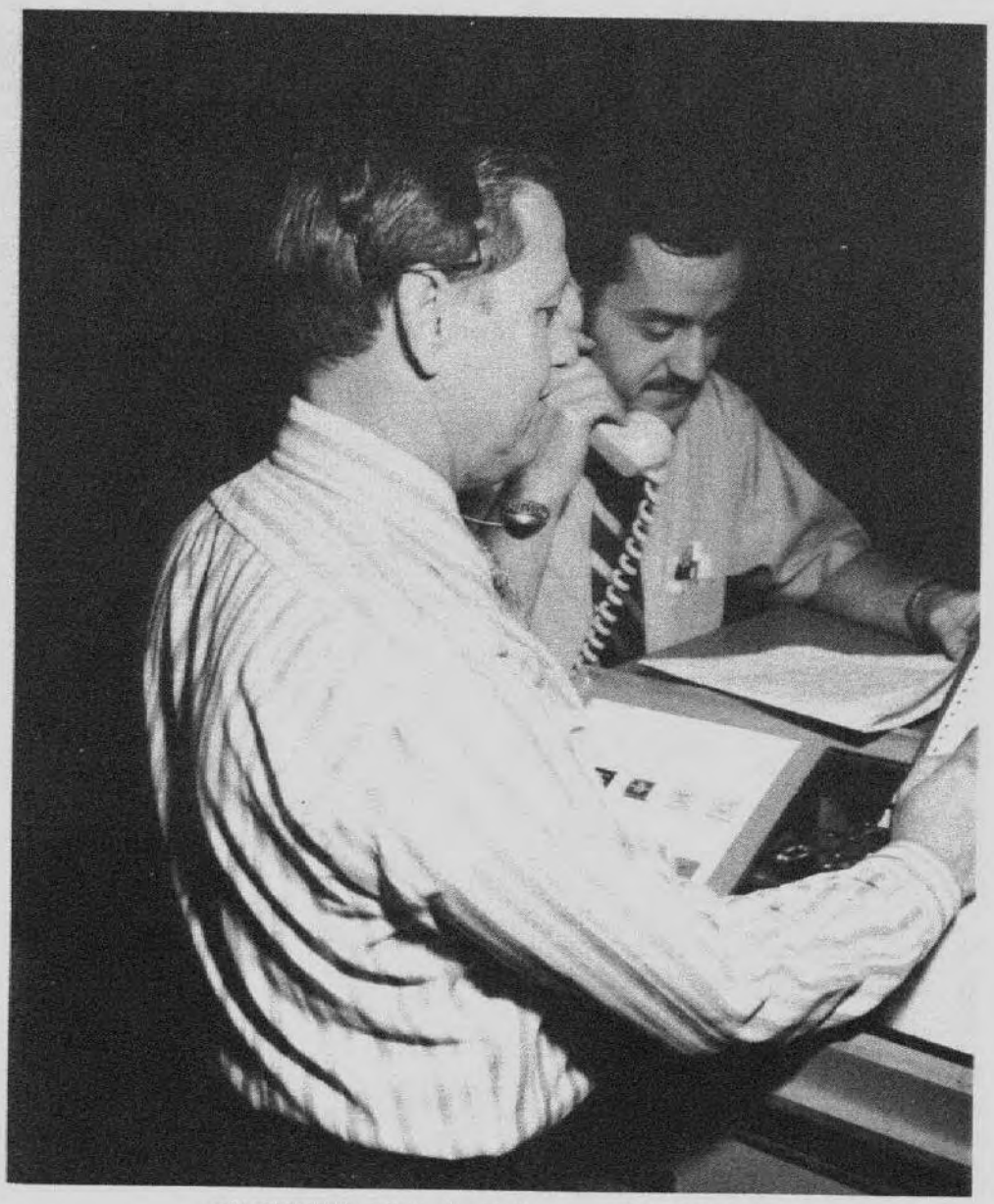
After approximately 30 days into the mission, control of the spacecraft will be transferred from JPL to Ames and will remain here under the direction of the cruise phase organization, largely supported by Bendix Field Engineering Corporation personnel, until the final critical encounter. At Christmastime 1973 the entire crew will be back at JPL Mission Control.



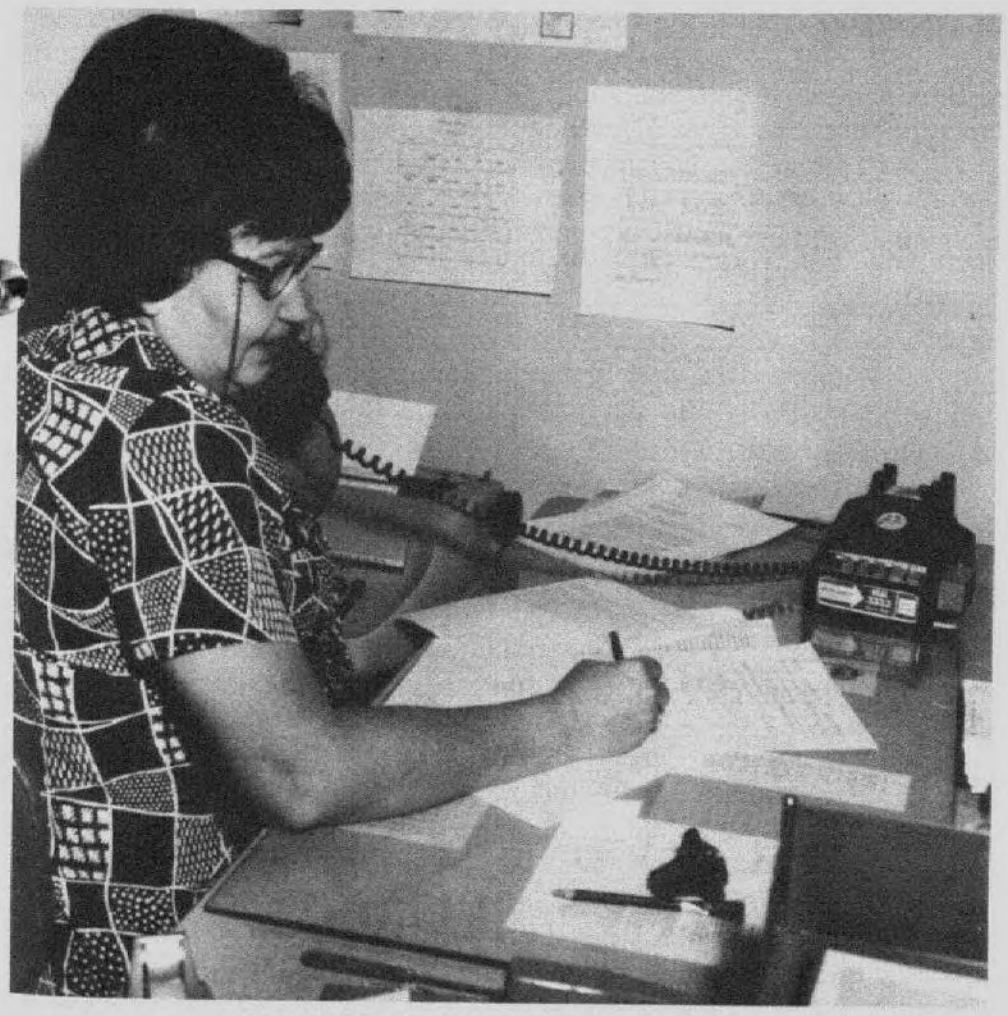
PIONEER SPACECRAFT PERFORMANCE . . . of subsystems and components will be analyzed and evaluated from this area by the Spacecraft Performance Analysis Team. Seated at the data readout consoles are (front, l to r) Eugene Jesse, Ames Pioneer Spacecraft; Herbert Barton, Bendix; (rear, l to r) Joseph L. Frank, Ames Pioneer Spacecraft; and Taffy S. Tondro, Bendix.



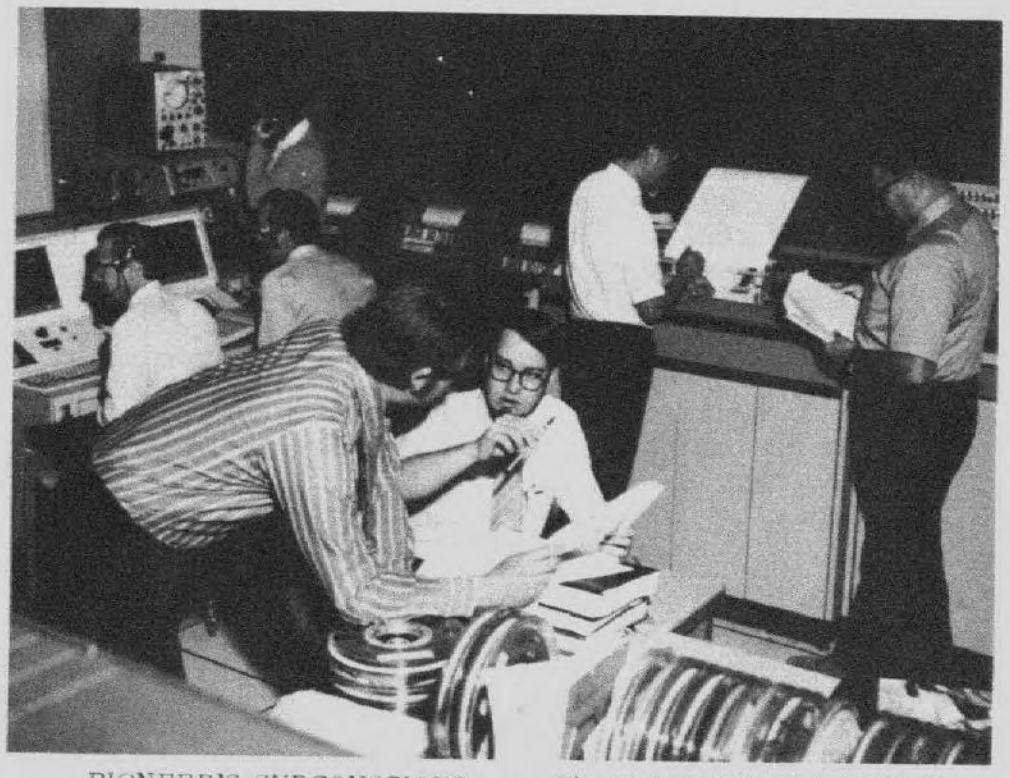
A MEETING OF THE MINDS . . . In the Science Data Area, pictured above during a pre-launch test, Ames scientists and engineers will go over experiment data with principal investigators and their co-investigators. Standing at the monitoring screens are (l to r) Science Instrument Specialists Dennis Porter, William D. Hightower, Alvin J. Wilhelmi; and seated in the foreground are, Edward Tischler (left) and Thomas Wong (right), all of Experiments. Seated in background is Richard O. Fimmel, Spacecraft Science Chief; standing is Robert R. Nunamaker, Flight Operations Manager.



CHECKING THE FACTS . . . Dennis L. Porter (left) and Alvin J. Wilhelmi, Science Instrument Specialists, go over data at the Sigma V computer during pre-launch tests. The Sigma V, which will be used to monitor the mission's thirteen experiments, is capable of adding 400,000 bits per second and can print 20 lines of data per second.



PROJECT SECRETARY . . . Eva Somer has been with Project Pioneer since it was transferred to Ames in 1962. When asked about her position as secretary to Charles F. Hall, Project Manager, she says simply, "I love it." Here, she takes the daily status report call from Ralph Holtzclaw, Spacecraft Manager at the Cape.



PIONEER'S SUBCONSCIOUS . . . The Pioneer Mission Analysis Area (PMAA), located in Bldg. 244, is where the performance or "health" of Pioneer's instruments will be monitored throughout the long mission. In position during a readiness test are (seated left) Manfred N. Wirth, PMAA Chief, Larry C. Van der Veen and Allan L. Burford (standing at phone), Bendix Corp. Standing at the Sigma V computer are (l to r), Thomas Wong, Experiments, and Richard O. Fimmel, Spacecraft Science Chief. Pictured in foreground reviewing data are Robert A. Nunamaker (left), Flight Operations Manager, and Edward Tischler (right), Experiments.

Pioneer F Experiments and Principal Investigators

MAGNETOMETER-will map the interplanetary magnetic field beyond the orbit of Mars, Jupiter's magnetic fields, and the modulation of Jupiter's magnetic fields by it inner moons.

PLASMA ANALYZER-will map the density and mechanisms of the solar wind (ions and electrons flowing out from the Sun) beyond the orbit of Mars; will determine solar wind interactions with Jupiter, including the planet's bow shock wave; and will look for the boundary at which the solar wind and solar atmosphere (the heliosphere) end and interstellar space begins.

CHARGED PARTICLE INSTRUMENT, COSMIC RAY TELESCOPE-These two experiments will map beyond the orbit of Mars the density, speed, direction, and mechanisms of cosmic rays (atomic nuclei) coming from the Sun and Galaxy. These instruments can distinguish whether the particles are nuclei of one or more of the ten lightest elements (helium, carbon, oxygen, etc.) and which one. They also will observe the interaction of charged particles (protons and electrons) with Jupiter and within Jupiter's radiation belts.

GEIGER TUBE TELESCOPE, TRAPPED RADIATION DETECTION-These two experiments will attempt to learn the contents and mechanisms of Jupiter's radiation belts by measuring the intensities, energies, and distribution of energetic electrons and protons in the belts, and will study Jupiter's huge, periodic radio signals.

ASTEROID-METEOROID DETECTOR-consists of four optical telescopes which can detect asteroids and meteoroids as small as 1/100,000th gram by measuring sunlight reflected from them. The instrument can measure particle concentrations, size, velocities, and direction. This will begin the first survey of meteoroid and cometary matter, and its source, beyond the orbit of Mars.

METEOROID DETECTOR-consists of 216 penetration cells attached to the spacecraft exterior. The cells measure impacts of particles from 1/100 millionth to 1/trillionth of a gram to gain information on concentrations of interplanetary particles.

CELESTIAL MECHANICS-Experimenters use precision Doppler tracking of the Pioneer radio signals to improve calculations on: the mass of Jupiter, character of the Jovian gravity field, mass of Jupiter's 12 moons, Earth's orbit, and other solar system data.

ULTRAVIOLET PHOTOMETER-will determine the density of neutral hydrogen in interplanetary space, will attempt to find the limits of the heliosphere by measurements of hydrogen distribution, will measure the hydrogen-helium ratio in Jupiter's upper and lower atmospheres, will look for Jovian auroral activity near both poles, and for phenomena resulting from passages of the moon, Io. Measurements of light in the far ultraviolet given off by hydrogen and helium will provide data to study these phenomena.

INFRARED RADIOMETER-will measure infrared radiation to find Jupiter's emissions of thermal energy, and its temperature distribution. These data will help tell how much internal energy Jupiter radiates, temperature of the dark hemisphere, location of hot or cold spots in the outer atmosphere, whether there is a polar ice cap of frozen methane, and the hydrogen-helium ratio in the atmosphere.

Imaging Photo Polarimeter	Dr. Thomas Gehrels University of Arizona
Helium Vector Magntometer	Dr. Edward J. Smith Jet Propulsion Laboratory
Plasma Analyzer	Dr. John H. Wolfe NASA-Ames Research Center
Charged Particle Instrument	Dr. John A. Simpson University of Chicago
Geiger-Tube Telescope	Dr. James A. Van Allen University of Iowa
Cosmic Ray Telescope	Dr. Frank B. McDonald NASA-Goddard Space Flight Center
Trapped Radiation Detector	Dr. R. Walker Fillius University of California at San Diego
Ultraviolet Photometer	Dr. Darrell L. Judge University of Southern California
Infrared Radiometer	Dr. Guido Munch California Institute of Technology
Asteroid-Meteoroid Detector	Dr. Robert K. Soberman General Electric Company
Meteoroid Detector	William H. Kinard NASA-Langley Research Center
The spacecraft radio transmitter used for S-Band occultation experiment.	Dr. Arvydas J. Kliore Jet Propulsion Laboratory
The spacecraft and the Deep Space Network Doppler radar used for celestial mechanics experiment.	Dr. John D. Anderson Jet Propulsion Laboratory

OCCULTATION EXPERIMENT-will measure effects of Jupiter's atmosphere on the Pioneer radio signals as the spacecraft disappears behind the planet and reappears again. These changes will show the refractive index of the planet's atmosphere, add to knowledge of its hydrogen-helium ratio, and show electron density in the ionosphere.

IMAGING PHOTOPOLARIMETER-will measure intensities and polarization of visible light. Its measurements of reflected light (zodiacal light) will be used to calculate the amount, distribution, and origin (from asteroids and comets) of interplanetary dust. At Jupiter, experimenters will use the data to attempt to find the structure and composition of the Jovian clouds and atmosphere, data on the planet's thermal balance, and to retrieve close-up pictures. The instrument also will attempt to collect data on Jupiter's little-known moons.

PRINCIPAL INVESTIGATOR . . . for the Geiger-Tube Telescope Experiment to be flown on Pioneer F and G is space physicist Dr. James A. Van Allen, University of Iowa, shown in his laboratory with the experiment package.

SCIENTIFIC EXPLORATION . . . on Pioneer F will be carried out on a totally new scale. Thirteen scientific experiments are expected to provide massive amounts of new knowledge about Jupiter and the outer solar system and our galaxy. Joseph E. Lepetich (far right), Pioneer Experiments Manager, outlines the mission for Principal Investigators (l to r) Dr. John D. Anderson, Jet Propulsion Laboratory, Celestial Mechanics Experiment; Dr. Arvydas J. Kliore, Jet Propulsion Laboratory, S-Band Occultation Experiment; Dr. R. Walker Fillius, University of California at San Diego, Trapped Radiation Detector Experiment; Dr. John H. Wolfe, Ames Project Pioneer Scientist, who will have a plasma analyzer experiment on the spacecraft and Joseph E. Lepetich, Experiments Manager for Pioneer.

Camera Device To Photograph Jupiter

The Imaging Photopolarimeter scientific instrument will take ten pictures of Jupiter in the last 20 hours before closest approach to the planet (periapsis).

Resolution of the pictures should be better than that from the best Earth telescopes, and the pictures will be taken from viewing angles impossible to get from Earth. At least one will show Jupiter's terminator (the line between sunlit and dark hemispheres), which is never seen from the Earth. This should show heights and shapes of cloud regions.

Pictures will be taken in both red and blue light, and these will be superimposed, providing "color" pictures of the planet in red and blue.

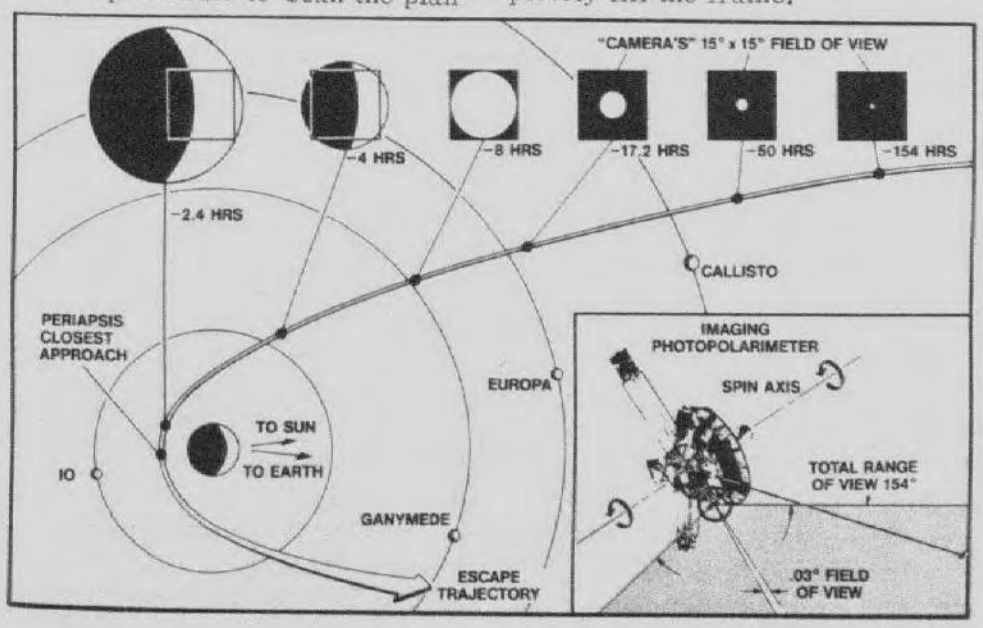
The instrument uses a photoelectric sensor which measures changes in light intensity, much like the light sensor for a television camera. But unlike a TV camera it will employ the five rpm spin of the spacecraft to scan the planet in narrow strips .03 degrees wide.

This electric camera system will complete the scans for a picture in from 25 to about 100 minutes, depending on distance from the planet. In about 100 minutes instrument will be able to cover about a 15 degree by 15 degree field of view.

Scan data will be converted to digital form on the spacecraft and radioed to Earth by telemetry. Engineers then will build up the pictures, using various computer techniques.

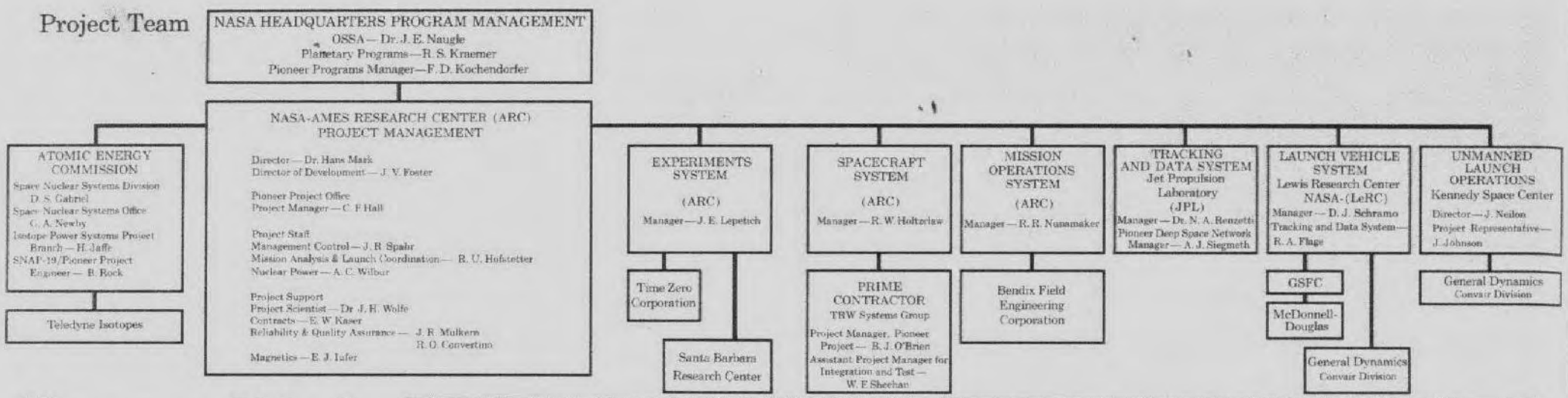
The "camera" will begin taking pictures of Jupiter at about 800,000 miles away. At this point, the full disc of the planet will fill only about four percent of a 15-degree-by-15-degree field of view.

The planet will steadily occupy more and more of the view-frame, until at about 350,00 miles six hours from periapsis, Jupiter will completely fill the frame.



PIONEER JUPITER MISSION PLANS . . . hold the attention of several Principal Investigators who will have experiments on Pioneer F. From left are Dr. Darrell L. Judge, University of Southern California, Ultraviolet Photometer Experiment; Dr. Guido Munch, California Institute of Technology, Infrared Radiometer Experiment; Dr. Thomas Gehrels, University of Arizona, Imaging Photopolarimeter Experiment; and Dr. Edward J. Smith, Jet Propulsion Laboratory, Helium Vector Magnetometer Experiment.

Project Team



Pioneer -- This Is What It Looks Like

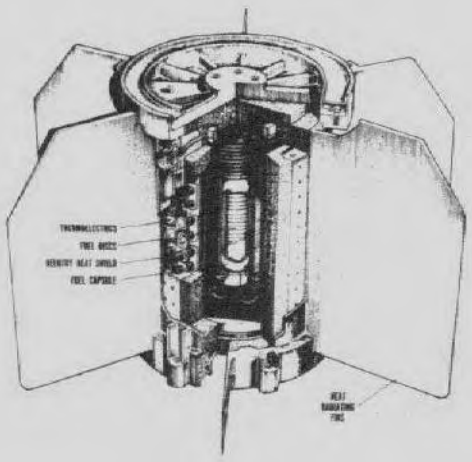
Pioneer Jupiter is the first spacecraft designed to travel into the outer solar system and operate effectively there, possible for as long as seven years and as far from the Sun as 1.5 billion miles.

For this mission, the spacecraft must have extreme reliability, be very light weight, have a communications system for extreme distances, and employ a non-solar power source.

The spacecraft is a "spinner" and an "Earth pointer". Spinner means it is stabilized in space like a gyroscope by its five rpm rotation, and that its scientific instruments scan a full circle five times a minute. Designers chose spin stabilization for its simplicity and effectiveness.

Since the orbit planes of the Earth and Jupiter coincide to about one degree, the spacecraft will be in or near the Earth's orbit plane (the ecliptic) throughout its flight.

DEEP SPACE STATION MANAGERS... from NASA's world-wide Deep Space Network (DSN), met at Ames recently to discuss the forthcoming Pioneer F mission to Jupiter with Charles Hall (standing, left), Pioneer Project Manager, and Robert Nunamaker (standing, right), Pioneer Mission Operations System Manager. Mr. Hall briefed the group on the final preparations for the launch and talked about the vital communications system on the spacecraft which will provide the two-way link between the Earth and the spacecraft. With facilities located at 120-degree intervals around the Earth, NASA's DSN will be able to support the spacecraft continuously on its two-year flight to Jupiter. Taking part in the informal conference were (seated l to r) station managers Jose Urech, Cerebos, Spain, and Douglas Hogg, Johannesburg, South Africa; DSN Manager for Pioneer at JPL, Alfred Siegmeth; station managers Donald Cocks, Womera, Australia, and Frank Northey, Ballima, Australia; Richard Mallis, DSN central control at JPL; and Jose Fernandez, station manager at Robledo de Chavela, Spain. Mike Dinn, manager of the Weemala station in Australia was unable to attend the briefing.



SNAP 19/PIONEER RADIOISOTOPE THERMOELECTRIC GENERATOR

Because solar energy at Jupiter is only four percent of energy received at the Earth and grows steadily weaker beyond the planet, designers selected a nuclear power source over solar cells. The radioisotope thermoelectric generators (RTG's) are similar to those used to power the Nimbus satellites. These units turn heat from their nuclear power source into electricity and can provide power for seven years or more.

Launch energy requirements to reach Jupiter are far higher than for a Mars mission, so the spacecraft had to be light. Pioneer F weighs only 570 pounds. This includes 65 pounds of scientific instruments, and 60 pounds of propellant for attitude changes and mid-course corrections.

SPACECRAFT DESCRIPTION

The spacecraft fits within the ten-foot diameter shroud of the Atlas-Centaur launch vehicle with booms retracted, and with its dish antenna facing forward (upward). The Earth-facing antenna is designated the forward end of the spacecraft. Pioneer F is 9.5 feet long, measuring from its farthest forward component, the medium-gain antenna horn, to its farthest rearward point, the tip of the aft-facing omni-antenna. Exclusive of booms, its widest crosswise dimension is the nine-foot diameter of the dish antenna.

COMMUNICATIONS

The vital communications system of the Pioneer mission provides for two-way communication between the Earth and the spacecraft. For reliability, this system is fully redundant.

The spacecraft system consists of high-gain, medium-gain, and low-gain antennas, used for both sending and receiving. All data sent from the spacecraft is transmitted through a Telemetry Coding System which doubles the data transmission rate over an uncoded system of the spacecraft communication link. The system was developed and implemented by a group of Ames research scientists headed by Dr. Dale R. Lumb, Spacecraft Data Systems Branch, principal investigator. Members of the team with Dr. Lumb were Terry Grant, Henry Lum, Jr., Ruben Ramos and Larry B. Hofman.

In preparation for the forthcoming Pioneer-Jupiter mission Mr. Ramos has been responsible for the communication interface between the spacecraft and the Deep Space Network specifications and tests.

The astrogram
Room 134
Admin. Mgt. Building
Phone 2385

The Astrogram is an official publication of the Ames Research Center, National Aeronautics and Space Administration, Moffett Field, California, and is published bi-weekly in the interest of Ames employees.

Editor . . . . . Dot Evans
Reporters . . . . . NASA Employees

Deadline for contributions:
Thursday between publication dates