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New crew interfaces standardized

By Billie Deason

A new NASA-wide standard for designing crew interfaces promises greater efficiences both on Earth and in space, officials say.

Since the beginning of the space program, each NASA Center has established its own man-systems standards for development of spacecraft hardware. None of these standards has ever been a mandatory part of a contract to build a spacecraft.

But that situation is changing as a result of a collaboration of individuals from JSC and the Marshall Space Flight Center on the development of an agency-wide set of standards for the design of spacecraft crew interfaces. Crew interfaces include all systems, controls, tools, hardware and parts of the spacecraft that the crew uses.

JSC's Man-Systems Division and Marshall employees working in the design of man-systems joined forces in late 1985 to propose development of an agency-wide standard for crew interface systems. The Chief Engineer's Office at Headquarters has given the go-ahead to compile a set of standards, called NASA STD 3000, that defines man-systems engineering requirements for all systems that flight crews use. The effort was jointly funded by Headquarters' Office of Space Flight (Code M) and the

(Continued on page 2)

Evidence of JSC's new policy limiting smoking in public areas sits in a stairwell of Bldg. 1. The new guidelines, which prohibit smoking in public areas and shared offices, necessitated the recent removal of the ashtrays.

New STS-26 launch target is June 1988; exact date later

June 1988 is the new target date for the next Space Shuttle launch, NASA Administrator Dr. James C. Fletcher announced Wednesday. The exact date will be selected by the Administrator based upon the results of expanded testing of Shuttle systems, revised launch crew procedures and actual hardware deliveries.

Current plans are for two additional flights in 1988 and seven flights in 1989. Adm. Richard H. Truly, NASA Associate Administrator for Space Flight, said necessary adjustments to the Shuttle manifest published in October 1986 will be worked out over the next few months.

"Safely returning the Space Shuttle to flight is NASA's highest priority," Dr. Fletcher said.

"Our revised plan for Space Shuttle recovery is ambitious and assumes that we will successfully complete our test and processing objectives. I know I can count on the whole NASA team — and, of course, I include our contractor partners — to move out enthusiastically toward this new goal."

The new target date reflects the decision, announced in April, to perform two major systems tests prior to flight.

These tests are a "wet" countdown demonstration test, in which the external tank is filled with fuel for a simulated launch countdown, and a flight readiness firing in which the three main engines are fired for about 20 seconds.

The tests, which will be conducted approximately six weeks prior to launch, will provide engineering data to evaluate various systems modifications and provide an opportunity to exercise launch and mission control teams and revised procedures.

The plan also permits acquisition of new fabrication tooling to improve the tolerance on the redesigned solid rocket motor insulation J-seal.

"The crew is pleased with NASA's timely action in selecting a new target date and we fully support the new schedule," said STS-26 Commander Rick Hauck.

"We recognize the wisdom of incorporating the wet countdown demonstration and flight readiness firing into the schedule. A great deal of work remains to be done before we return to flight and we are encouraged by the progress being made toward that goal."

Electrical transient caused AC-67 loss

An electrical transient, caused by a triggered lightning flash, was the most probable cause of the loss of the Atlas/Centaur-67 on March 26.

Those were the findings of the Accident Investigation Board chaired by Jon R. Busse, Director of the Office of Flight Assurance, Goddard Space Flight Center.

In a report May 11 to Rear Admiral Richard H. Truly, Associate Administrator for Space Flight, the investigation board reported that the launch was made in violation of the launch commit criteria associated with weather.

"The most probable cause of the mission failure was launching the AC-67 vehicle into atmospheric conditions conducive to triggered lightning and in violation of the established criteria used to avoid potential electrical hazards," the board said.

The board made recommendations concerning weather criteria, the launch decison process and future launch vehicle operations.

One of the technical challenges to the board, Busse said, was to find the mechanism by which the lightning reached the digital computer unit (DCU) and how that equipment was affected. Busse said the investigation board determined that the triggered lightning strike on the nose fairing found several paths to the ground bus network and the DCU.

Both the wiring from the booster external equipment pod and the nose fairing accelermometers provided pathways. Once the voltage surge entered the DCU, it altered a single word in the DCU memory associated with the Atlas engine yaw commands.

As a result, the board made a number of observations and recommendations for future launch vehicle design including reducing the susceptibility of control and electrical systems to external electrical interference and increased redundancy of critical electrical systems.

The board also found that an existing weather criteria, one dealing with the depth of middle layer clouds when a freezing level is present, had been violated. It also recommended further tightening of the weather criteria in general.

"The criteria should be revised to take into consideration the additional knowledge and measurement techniques of lightning phenomena that have been developed since the present expendable launch vehicle (ELV) criteria were established. The Shuttle and ELV weather criteria should converge where practical."

The board said the electric field mill system, which indicates the potential for lightning, should be transitioned to operational status.

To permit the continuation of ELV launches while the weather criteria are being evaluated, the board recommended that field mill data and a mandatory weather aircraft be added to the existing list of launch constraints. Air Force weather aircraft were grounded the day of the AC-67 launch due to bad weather.

The board further suggested that the only time the requirement for a weather aircraft be waived is when a cloud-free line of sight exists for the vehicle flight path.

In presenting the report, Busse said that no one person in the launch team should be singled out for the failure. He said one of the board findings was that before the launch, there were a significant number of indications that, generally, the weather was unfavorable and that, specifically, there was a lightning hazard. "Yet the real import of these indications escaped the launch team because of imprecise communications, lack of awareness or both," the report said.

The investigation board report will be reviewed by various offices at NASA Headquarters before it is accepted in its final form.

Ten JSC inventors honored at luncheon

Ten JSC inventors were honored at a luncheon May 6 for their efforts which led to the granting of two patents in 1986.

"It has been said that JSC and NASA as a whole have lost their technological edge. But you here today are evidence that JSC does have talented, creative people," said Patent Counsel Ed Fein, whose office sponsored the luncheon.

"The message is clear: The management of JSC really does appreciate its inventors, and does take notice of your efforts," Fein said.

Organizers of the luncheon said they hope to make the honor ceremony an annual event to highlight JSC's pride in its inventors.

The honorees were Timothy E. Pelischek, William C. Schneider, Reginald B. Berka, Herbert C. Kavanaugh, Kornel Nagy, Richard C. Parish, John A. Schliesing, Paul D. Smith, Frederick J. Stebbins and Clarence J. Wesselski.

Pelischek's was honored for his design of a foldable, self erecting joint with space station applications. The design, U.S. patent number 4,615,637, originated during the "skunk works" days of the initial Space Station design effort at JSC as part of the Delta configuration.

The joint was designed for use

(Continued on page 2)

The ten JSC employees honored for their patents pose for a group photo during the award luncheon May 6.

Bulletin Board

Employee rebadging effort continues

The new NASA Civil Service badges will continue to be issued through May 28, according to JSC Security Officer Thomas W. Dunn. "The badges are a standard NASA format which does not identify specific centers," he said. "The security clearance of the bearer is determined by the background color of the employee's photograph." The color codes are red for secret or above clearance, blue for confidential clearance and white for no clearance, Dunn said. Both the new and old badges will be valid until May 29, when the old badges will no longer be accepted. Employees who miss rebadging in their respective buildings should go to Bldg. 100 after May 28.

Drivers reminded to douse headlights

JSC Security has requested that drivers be reminded that when entering the center at night they should turn off their headlights at least 100 feet from the gate. Entering the gate with only parking lights on prevents glare and helps officers properly identify vehicles.

Station progress is Lunch and Learn topic

Clarke Covington, Manager of the Space Station Projects Office, will discuss recent developments in the program during a Lunch and Learn presentation May 26. The session, sponsored by the Space Systems Technical Committee, will begin at 11:30 a.m. in the Bldg. 3 Cafeteria. For more information, call Andre Sylvester at x31537.

NARFE to meet June 2

The NASA Area Chapter of the National Association of Retired Federal Employees will hold a dinner meeting at 6 p.m. June 2. The meeting will take place at the Harris County Park Bldg., Clear Lake Park, on NASA Road One. All retirees and those planning retirement are invited to attend. For more information, call Phil Hinton at 334-2455 or Burney Goodwin at 326-2494.

FIBER-TEX issues call for papers

A call for papers has been issued for FIBER-TEX 87, a conference on advanced engineering fibers and textile structures for composities. The conference, to be held Nov. 3 to 5 at the Hyatt Recency Hotel in Greenville, South Carolina, is being jointly sponsored by NASA and the Advanced Engineering Fibers Laboratory at Clemson Unive sity. Sessions will cover areas such as composite structures and produc'on methods, future applications, structural fabric production machinery, composite matrix materials and fiber and whisker production methods. A one-half page abstract should be submitted for acceptance prior to June 30. Accepted papers will be notified by July 17. Abstracts should be sent to Dan D. Edie, Advanced Engineering Fibers Laboratory, Earle Hall, Clemson University, Clemson, SC. The ZIP Code is 29634-0909.

Space Port Houston membership drive underway

A membership drive is underway for Space Port Houston, a non-profit educational organization being organized for the purpose of sponsoring a space training camp for young people. Volunteers are needed to participate in fund raising and other organizational activities. For more information, contact the Junior Astronaut Corps of America, 403 NASA Road One, Suite 360, Webster, TX 77598, or call 778-4183.

Blood pressure screenings to be offered

As part of National High Blood Pressure Month, the JSC Clinic will offer free screenings from June 1 to 5. The screenings will be offered at the following times and places: June 1, 8:30 a.m. to noon, Bldg. 1, for personnel from Bldgs. 1, 2, 3 and 100; June 1, 1 to 3 p.m., Bldg. 7A, for personnel from Bldgs. 4, 5, 7, 29 and 35; June 2, 8:30 a.m. to noon, Bldg. 30, for personnel from Bldgs. 12 and 30; June 2, 1 to 2:30 p.m., Bldg. 16, for personnel from Bldgs. 13 and 15; June 2, 2:30 to 4 p.m., Bldg. 17, for personnel from Bldgs. 17 and 18; June 3, 8:30 to 9:30 a.m., Bldg. 32, for personnel from Bldgs. 24, 25, 32, 32A, 33, 36, 41 and 49; June 3, 10 to 11 a.m., Bldg. 37, for personnel from Bldgs. 31 and 37; June 3, 1 to 2 p.m., Bldg. 44, for employees in Bldg. 44; June 3, 2:30 to 3:30 p.m., Bldg. 14, for employees in Bldg. 14; June 4, 8:30 to 10 a.m., Bldg. 276, for all Ellington employees; June 4, 10:30 a.m. to noon, Bldg. 325, for personnel in all of the 300-series buildings; June 4, 1 to 2:30 p.m., Bldg. 419, for personnel in all 400-series buildings; June 5, 8:30 a.m. to noon, Bldg. 45, for personnel in Bldgs. 45 and 48; June 5, 1 to 2 p.m., Bldg. 9, for Bldg. 9 employees; June 5, 2:30 to 3:30 p.m., Bldg. 227, for personnel in all 200-series buildings. The Clinic also will offer screenings daily from 10 a.m. to noon and from 2 to 4 p.m. for employees of Bldgs. 8, 10 and 11.

Gilruth Center News

Call x30304 for more information

Moon Walk softball tournament — Men's open C and women's open softball tournament will be conducted June 13-14. Entry fee is $95. Registration deadline is June 10.

SCUBA — The next NAUI-certified scuba course begins June 8. For details, call the Rec Center.

Weight safety — This is a required course for those employees wishing to use the Rec Center weight room. The class will be held June 3 and 18 from 8 to 9:30 p.m.

Defensive driving — Learn to drive safely and qualify for a 10% reduction in auto insurance rates. All-day Saturday class meets June 20.

Physical fitness — The next 12-week course of the JSC Physical Fitness Program will be held July 6 to Sept. 25 from 6:30 to 7:30 a.m. Monday, Wednesday and Friday. All NASA and contractor employees and dependents are eligible upon completion of an acceptable physical exam and a maximal treadmill stress test. Call the Rec Center for more information.

Karate — The next four-week Karate class starts June 1 and will meet Mondays and Wednesdays from 7 to 8 p.m. Cost is $25.

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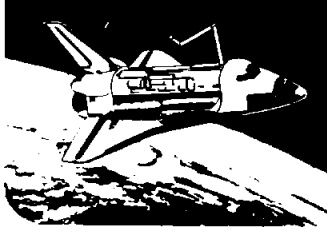

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Martha L. Kramer

Nina E. Lamb

Elizabeth W. Pieberhofer

Doris J. Roberts

Secretaries receive accolades

Four JSC employees recently earned the Marilyn J. Bockting Secretarial Excellence Award for outstanding performance. Martha L. Kramer, Nina E. Lamb, Elizabeth W. Pieberhofer and Doris J. Roberts each received a plaque and $500 in recognition of their services.

Kramer is branch secretary for the Flight Training Branch of the MOD Training Division. She acts as personal secretary for the branch chief and chief secretary for the branch. Her duties include making secretarial work assignments, maintaining schedules, receiving calls and visitors, preparing correspondence and maintaining files. She was specifically cited for a "can-do" attitude that draws her organization's staff together. Following the 51-L accident, Kramer worked extra hours to ensure that all appropriate training material from the flight was gathered, cataloged and impounded. She also prepared several briefings for the Presidential Commission investigating the accident, and several of her charts appeared unchanged in the Commission's published report.

Lamb is secretary for the Flight Production Office and the manager of the Manifest and Performance Office. During the past year, she has helped prepare numerous presentations and letters to Headquarters, Congressional committees and other high-ranking officials on short deadlines. She is recognized as a word processing and personal computer expert in the office, and as a leader in using automated data bases for tracking correspondence and action items. Her positive attitude and cooperation in dealing with problems created by a major reorganization have helped keep the office functioning smoothly.

Pieberhofer is secretary for the Technical Resources Management Office in the Data Processing Systems Division. She prepares letters, reports, purchase requests, contractor evaluations, presentations and briefings to all levels of JSC and contractor management. She has distinguished herself by accepting with enthusiasm added responsibilities associated with administering a cooperative agreement between JSC and the University of Houston Clear Lake (UHCL). The additional duties include maintaining a status log for research activity documents and program change requests, and serving as a central mail drop for correspondence between JSC and UHCL.

Roberts is secretary to the deputy director of Mission Support, and provides support to the director and directorate office. She was specifically recognized for her ability to understand and use word processors, mainframe and personal computers and a variety of electronic communication methods in her work as a trip planner, scheduler, mail handler, action tracker, typist and editor. Her ability to find inconsistencies and errors in presentations and documents has raised the quality of many of the directorate's work products, and her stamina, patience and clear thinking have made her someone to depend on in tight situations.

Inventions keep JSC technically healthy

(Continued from page 1)

with the tetratruss frame of the Delta configuration, which required that most of the tubing making up the framework be folded in the payload bay of an Orbiter for transport to low Earth orbit.

The novelty of the design is in its use of an over-center, four-bar linkage having two springs to provide energy to deploy and tightly lock the mechanism over center to provide a slop-free joint.

The second patent, for which the other nine employees were honored, was for the triangular space station, also known as the Delta configuration. The Delta was one of the final three designs considered nine employees were honored, was by the Skunk Works before the Power Tower was ultimately chosen as the reference configuration. Later, during Phase B, the Dual Keel configuration was chosen as the baseline Station design.

The framework of the Delta design is formed from three tetrahedral trusses which can be fabricated on the ground, collapsed into bundles and deployed on orbit.

Advantages of the Delta design a include large stiff area upon which construction, satellite servicing and other station tasks could be carried out, a center of mass internal to the structure which would decrease the dymanic sensitivity of the station, and stiff supporting structures for large solar panels and radiators.

Each inventor was presented with a plaque bearing a metal etching of the cover sheet of their respective patents.

The plaques were presented by Daniel A. Nebrig, Executive Assistant to JSC Director Aaron Cohen. Nebrig, who was acting in Cohen's stead when the Director was unexpectedly called out of town on business, said, "Dr. Cohen very much wanted to be here today, and asked me to express how much he values the contributions all of you have made to the technical health and well being of the center. Dr. Cohen said he sees this ceremony as a milestone of truth that technological excellence is alive and well at JSC."

Nebrig also thanked the inventors' wives, many of whom were present, for "putting up with your husbands in their times of inventive fervor."

The luncheon was held in the upstairs dining room at the Gilruth Recreation Center.

Standard will improve crew efficiency

(Continued from page 1)

Office of Space Station (Code S).

Under a competitive contract, Boeing Aerospace reviewed all known documents related to crew interfaces with systems, a total of over 300 documents. From those, Boeing collected relevant data representing all major interfaces of astronauts with systems. Data were then divided into sub-system categories.

A government-industry advisory group was organized representing all NASA centers, DOD, the FAA, all major aerospace contractors and academia. The 60-member group held four one-week meetings throughout the program to guide the standard's development. Ultimately, the advisory group reviewed every word that went into the final standard.

Standards Manager Clete Booher of JSC's Man-Systems Division, said, "I was pleasantly surprised how quickly the group coalesced in agreement on the level of information that would be included in the document."

Volume I is the parent document and contains all generic requirements. All information in the document is coded into an interactive computer data base according to key words. A user might request, for example, engineering requirements for the microgravity environment of near-Earth orbit, or for multiple gravity forces such as those encountered during launch and reentry.

Volume II contains all of the appendices, including a user's guide for the data base. Users may access the entire data base using an IBM PC AT or XT utilizing R Base 5000 software.

Volume III, still in development, will be a pocket guide condensation of Volume I. The pocket guide will feature charts, graphs and data for engineers and designers to use in the field.

Volume IV, the first in a series of program-specific standards derived from Volume I, is dedicated to Space Station crew interfaces. The only man-systems standard ever adopted by a program as a mandatory part of a contract, Volume IV is part of the common content of the Space Station RFP for all work packages. Compliance with Volume IV standards is required for all contractors involved in the Space Station program.

To enhance the standard's use, a 34-minute videotape is available to users. Called a "tremendous teaching tool" by Booher, the videotape includes footage of on-orbit scenes from Gemini through Shuttle missions. A time display across the bottom of the screen gives systems developers a first-hand look at why the crew interface standards are necessary.

Dr. James Lewis, JSC Man-Systems Division's Manager for Space Station, said, "The standards provide a direct way to help us enable the crew to work more efficiently in space. Crew productivity will be enhanced. Whether working in one of the international modules or their own quarters, the interfaces with equipment will be similar in all parts of the Station."

Agency-wide use of the standard should generate cost savings, particularly since contractor participation will be consistent in all contracts. "It really means you get less engineering and programmatic overhead while getting more crew productivity for your on-orbit cost," Lewis said.

Lewis and Booher have already conducted briefings on the document at JSC, Marshall, Headquarters, Goddard, Lewis and Ames. Briefings also are planned for Langley and Kennedy. The Lewis Center plans to use the document and its development methodology as a model for a similar document in other disciplines.

Booher sees "lots of enthusiasm across industry and government for the standard." The Society of Automotive Engineers (SAE) plans to adopt NASA Standard 3000 as its first space standard. "This standard can be a pathfinder for all other systems areas to develop the same type of agency-wide standards," Lewis said.

Lewis summed up the joint JSC-MSFC accomplishment by saying, "If ever there were a bible for a secular system, this is it!"

Chili challenges

The chili was hot, but the weather was not during the 9th Annual Mission Operations Directorate Chili Cook-off. That's why the only — well, almost — burns people complained of were in their mouths.

Twenty-eight teams and an estimated 600 tasters participated in the May 16 cook-off and related games at the Lunar Planetary Institute. Winning teams were:

Best Chili — Two-Hump Chili, 1st; Up-The-Creek, 2nd; Bay Area Rodeo Foundation and Red Baron, tie for 3rd. People's Choice Chili — Slight Activities and 12th-Man Chili, tie for 1st; Public Affairs Office (PAO), 3rd. Showmanship — Bayou Brewers, 1st; PAO, 2nd; Texas Crude, 3rd; Slight Activities and Crocodile Dundeke, honorable mention.

Scenes included, clockwise from right: a game involving a blindfold, three members of the Bayou Brewers team and "Mr. Syringe"; the entrance of the Texas Crude team's Crude McKenzie and his entourage; "Manna" White in a Slight Activities skit; an "eat-off" to settle a dispute over the Jalapeno-eating title; the Slight Activities team building a pyramid; and two cooks concocting their beefy brew.

Photos by Dana Balke and Mike Scheib

Mars sample return details emerge

Studies focus on mission profile, engineering challenges

Design details and mission parameters are still emerging for the proposed Mars Sample Return Mission as teams at JSC and the Jet Propulsion Laboratory continue their conceptual studies.

A mission to Mars using a robotic rover to traverse the planet's surface and a lander to return surface and sub-surface samples to Earth is one of several advanced program options under review by NASA. The sample return mission also has been recommended by the Solar System Exploration Committee of the NASA Advisory Council.

The committee stipulated that the mission should be undertaken before the year 2000. Such a mission would provide a wealth of scientific information about Mars and increase the understanding of the origin and evolution of all terrestrial planets, including Earth.

Studies of a Mars Sample Return mission have been ongoing for seven years. The focus has been on an all-U.S. mission in which this country would provide all the major elements. That approach remains a high priority goal, but NASA also has recently considered a mission which could involve one or more international partners.

Currently there is a joint study being conducted by JPL and JSC, and including Science Applications International Corp. (SAIC), to examine the possible concept for a U.S. unmanned mission in the mid to late 1990s. This mission would be a step toward an eventual manned mission to Mars in the next century.

Industrial firms will participate through contracts with both centers.

The overall concept involves flying a vehicle to Mars that will be initially placed into Mars orbit. A lander will separate from the rest of the vehicle and descend through the atmosphere to the surface. That lander payload would include a rover that would move over the Martian landscape, selecting scientifically significant rock and soil samples amounting to a few kilograms.

After about one year later, the rover would return to the lander and transfer the collected samples to a small rocket that would lift them back into Mars orbit. There, the sample package would rendezvous with the original orbiter which would then launch the sample-containing vehicle back to Earth.

The team is studying the technique of aerocapture to use the thin Martian atmosphere to brake the arriving spacecraft into orbit around the planet at the end of a 300-day voyage from Earth. This decreases the weight of the whole vehicle below that required if retro rockets would be used. Atmospheric drag from the 17,000 MPH approach into the Martian atmosphere would dissipate excess speed to decelerate and "capture" the vehicle into an an elliptical orbit of Mars.

Accurate guidance would steer the spacecraft into the Martian atmosphere at an altitude of 110 miles above the surface.

Mars' atmosphere is almost entirely carbon dioxide with a surface pressure less than one one-hundredth that of Earth's atmosphere—about the same density as air 31 miles above Earth.

Descent through the Mars atmosphere to an automated, intact landing presents a major technical challenge to lander designers. After separation from the orbiter and a deorbit rocket burn, the entry guidance system would use the entry aeroshell's aerodynamic lift to aim at a selected landing site.

Following a parachute deceleration on the way to the surface, retro rockets would be ignited and the lander's guidance system would automatically sense and avoid hazardous terrain. Television pictures of such hazards could take as long as 20 minutes to reach JPL's planetary flight control center, and evasive maneuver commands would take another 20 minutes to reach the lander — too late to maneuver around or over a hazard, hence the lander must be capable of performing this function on its own.

The spacecraft in Mars orbit could support the surface operations in several ways. It could provide imaging for a landing site survey and subsequently provide imaging of an area ahead of the rover to aid in planning its path. An orbiter also would serve as a telecommunications relay link between the rover and Earth. This would greatly extend the rover's operations over each day when not in view of Earth and serve as a backup to the direct Earth link.

The rover would, however, have the capability to communicate directly with an earth-based operator sending commands and receiving data. The current study of the Mars rover has considered a design concept that includes a stereo camera vision system, sensors, a computer brain, controlled manipulators and a drill system for acquiring samples.

The current design concept for a roving vehicle would have a mass of no more than 3,300 pounds and could take a variety of configurations. One of those includes three two-wheeled cabs connected by flexible ties which would permit pitch, yaw and roll motions. The three-foot diameter wheels and the flexible connection would permit climbing obstacles of more than three feet, climb grades of about 30 degrees on packed ground and about 20 degrees on loose soil or sand. The front cab would contain the surface sample science, including the drill mechanism and robot arms.

The middle cab would contain the communications, power conditioning and storage, control and navigation subsystems. The stereo vision system for navigation would be mounted on a mast with three degrees of freedom, with the base of the mast able to rotate in azimuth and elevation while the camera head could nod. The rover would be steered by counter rotation of the two end cabs.The third of the three cabs would carry a radioisotope thermoelectric generator, (RTG) with average power of 280 watts.

Two telerobotic methods were considered in the design concept. The first is the Computer-Aided Remote Driving (CARD) method. It relies on images acquired by the rover's camera system to designate an extended path in excess of 800 feet long using Earth-based image analysis and computation techniques.

A fail-safe laser range finder would measure the distance between the rover and any obstacles not previously considered and planned for. It is expected that the rover could traverse at an average speed of more than one kilometer per day with this technique.

Another technique is semiautonomous and allows longer range traverses during a single command cycle using high-resolution images from an orbiter. An operator on Earth could plan traverses of up to a few kilometers in one day.

All the rover design proposals reflect fundamental guidelines consistent with reasonable extrapolations of current technology. The study group has emphasized, however, that the current concept as described is not considered a rover mission baseline design. Rather a wide range of concepts will be studied at NASA centers, universities and in private industry.

Once the rover has completed a 300-day quest for widely dispersed surface samples and has reached a rendezvous with the return vehicle, the sample container would be transferred to the ascent vehicle for liftoff to Mars orbit and rendezvous with the orbiter. Then another transfer would pass the sample canister to the Earth return vehicle attached to the orbiter.

The task team will study several combinations of liquid and solid fuel ascent vehicle propulsion and techniques for Mars orbit rendezvous with the orbiter, all with related trade-offs between weight and performance.

After its 10-month return to the Earth, the vehicle will approach at 2.5 miles per second, but will speed up to 8 miles per second, or about 28,800 MPH, as it nears Earth. At that point, a solid retrorocket or aerobraking maneuver would place the Earth return spacecraft into an elliptical orbit. By comparison, Apollo command modules returning from the Moon entered the atmosphere at 25,000 MPH.

Current plans are to rendezvous the Earth return spacecraft with the Space Station for quarantine and analysis of the Mars sample cargo prior to return to Earth.

The rocky surfaced Mars as photographed from the Viking Lander 2 at its Utopia Planitia landing site.

Lichen or not, Mars studies may benefit

The study of lichens in Antarctica may provide clues to the continuing search—and debate —over the existence of microbial life on Mars.

A professor and graduate student's research, supported by grants from NASA and the National Science Foundation, suggests that the method by which lichens grow and live and the traces they leave in Antarctic rocks when they die might be clues in the search for any evidence of life on Mars.

Dr. E. Imre Friedmann, a professor at Florida State University, and Dr. Rebecca Weed, a graduate student at the University of Maine, outlined in a published paper that fungi and algae, which form symbiotic lichen associations, grow in the porous sandstone rocks of the Ross Desert of Antarctica and are representative of the simple forms of early life. This may have developed in what is believed to be the more Earth-like climate earlier in the evolution of Mars. Friedmann and Weed also said that evidence of the presence of water during the early history of Mars raises the possibility that primitive lifeforms might have developed.

If such forms of life were present during conditions of loss of atmosphere, water and the general cooling of the planet, these organisms may have with drawn into porous rocks. The rocks would have represented the last habitable niche in a deteriorating Martian environment as they do in the Antarctic today.

Under these conditions, lichens leave trace fossils of their existence and much of Mars' surface structure is believed to be intact over the geologic time period under consideration.

Friedmann and Weed further suggest that the search for these fossil types is a legitimate goal for the future exploration of Mars.

The sandstone found in Antarctica seems well suited for preserving a fossil record of microorganisms because of the way the rock is weathered by both the microorganisms living inside the rock and the weathering processes affecting the rock from non-biologic sources such as winds and hot and cold temperatures.

The Antarctic lichens exist on the very edge of their ability to remain alive. The delicate balance of factors include temperature, moisture and the preserving abilities of the siliceous crust formation inside the rock itself. If these conditions fall outside the stress limits of the lichen, it dies and the further biologic weathering of the rock ceases.

The lichen is metabolically active for only a few hundred hours a year and has a very slow growth rate. Once the biological activity is interrupted, the non-biologic processes take over and more quartz rind is developed. The mosaic of rind and biologically leached rock are preserved as a trace fossil of past microbial activity. This cycle can be initiated countless times for a single rock as new lichen colonize the same rock.

Minimum ages for such trace fossils can be determined from the ages of the quartz rinds. Calibration of the rind with other sandstone boulders from a geologic area of known age place the age of the trace fossils at between 70,000 and from 2 to 4 million years old.

Scientists air view that Pluto may have atmosphere

Evidence that Pluto has an atmosphere may add new stature to the planet that gets no respect.

Variously described as an asteroid masquerading as a planet, or a burnt-out cometary core captured by the gravitational pull of the Sun, Pluto has been a mysterious object since its discovery in 1930.

But the new evidence indicating that a significant atmosphere surrounds distant Pluto may enhance the planet's standing.

Scientists at NASA's Jet Propulsion Laboratory (JPL), reported in the British science journal Nature last week that a significant methane atmosphere may surround Pluto.

The new Pluto findings are based on results from the Infrared Astronomical Satellite (IRAS) and extensive observations through telescopes on Earth taken over the past three years.

JPL astronomers Edward F. Tedesco, Glenn J. Veeder and R. Scott Dunbar, and University of Arizona astronomer Larry A. Lebofsky reported that Pluto's overall temperature, as measured by IRAS twice in 1983, shows the planet to be very different from an asteroid or one of the icy moons of Jupiter or Saturn. The scientists said that Pluto's thermal characteristics support the suggestion that Pluto has a significant methane atmosphere.

Previous studies of Pluto found evidence of a tenuous methane atmosphere. The new studies, however, indicate that Pluto's atmosphere may be much more extensive.

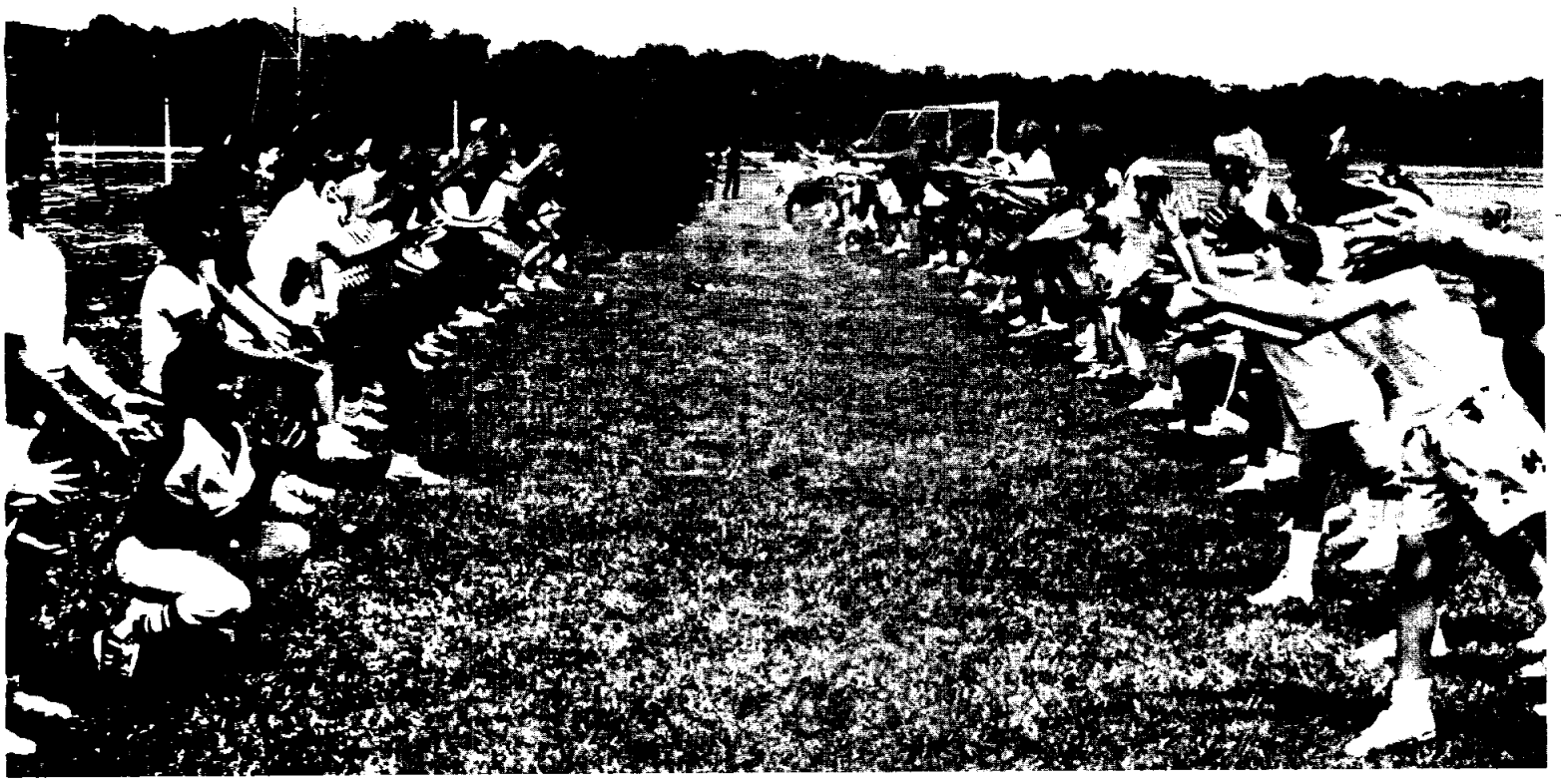
The results reported in Nature also refine the poorly known diameters of Pluto and its moon, Charon, to about 1,370 miles for Pluto and about 800 miles for Charon, each with an uncertainty of 100 miles. (Earth's Moon is about 1,538 miles in diameter.)

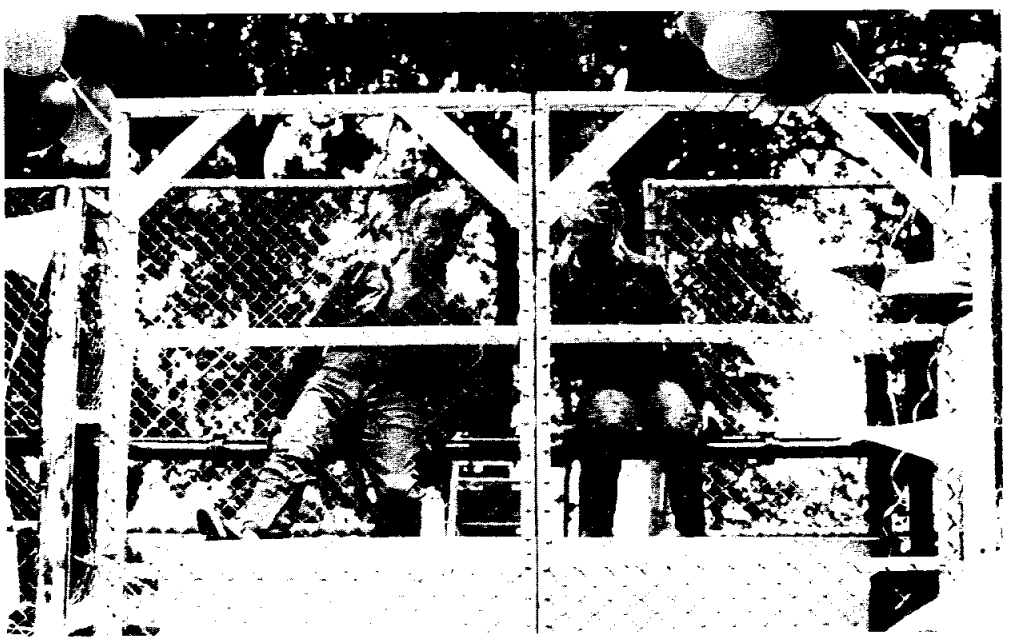
Very little is known about Pluto, which orbits the Sun every 248 years at an average distance of 4 billion miles. The planet, the smallest in the Solar System, was discovered in 1930 by astronomer Clyde Tombaugh at the Lowell Observatory. Charon was discovered in 1978 by James Christy of the U.S. Naval Observatory.

Pluto is the only solid-surfaced planet in the outer Solar System compared with Jupiter, Saturn, Uranus and Neptune, all gas giants.

A number of Pluto's characteristics have caused astronomers to question whether it deserves to be called a planet. For example, Pluto has an elliptical and sharply tilted orbit—one more suited to a minor planet or asteroid. It's orbit is so skewed relative to the other planets that it actually crosses Neptune's orbital path. Pluto has been inside Neptune's orbit since 1980 and will remain there until 1999 when it again moves back to its place as outermost planet from the Sun.

Pluto's relatively small size and theorized ice and rock composition makes it a likely leftover from the formation of the solar system or perhaps a moon that escaped from Neptune's gravitational grasp. But the fact that Pluto has a moon of its own, and now, apparently a substantial atmosphere, strongly bolsters its standing as a planet.





Picnic pride

Anyone who didn't have fun at the 1987 "JSC Proud" Picnic probably wasn't trying.

An estimated 2,900 employees and their family members got their fills of food, fun, music and excitement during the May 2 extravaganza at Gilruth Recreation Center, said Glenda Lancon, this year's picnic chairman.

Picnickers competed in egg tossing, water balloon tossing, horseshoe throwing, obstacle course running, bingo and "Almost Anything Goes" games. They enjoyed performances that ranged from magic to music and included square dancing, Hawaiian fire dancing, sky diving. For the children there were carnival rides, video games and a visit by the Astroworld cartoon characters.

Photos by Jana Walker, Rosemary de los Santos and Dale Martin

Roundup Swap Shop

All Swap Shop ads must be submitted on a JSC Form 1452. The forms may be obtained from the Forms Office. Deadline for submitting ads is 5 p.m. the first Wednesday after the date of publication. Send ads to Roundup, AP3, or deliver them to the Newsroom, Bldg. 2 Annex, Room 147. No phone in ads will be taken.

Property & Rentals

Lease/purchase: Miramar, Seabrook 5-2-2, fenced, corner lot, FPL, custom bookshelves, $68,000 or $650/mo. 479-1004.

Sale: Forest Bend 2BR townhouse, quiet neighborhood, miniblinds, ex. cond., $31,900. Glen, x36541 or 486-0462.

Rent: Lake Livingston on Bethey Creek cabin, sleeps 6-plus, bathroom, kitchen, pier, A/C, porch swing. 482-3824.

Lease: Condo, 2BR, 2 baths, 940 sq. ft., W/D conn., fan, appliances, pools, playground, low deposit, $330/mo. 280-9822.

Lease: Condo, 1BR, security gates, microwave, refrig., FPL, lake view, cable, W/D, $300/mo., $200 deposit. 554-6892.

Sale/trade: 2 adjoining lots on Lake Livingston, tennis courts, pool, clubhouse, rec. facilities, $7,500/ea., will trade one or both for beach property or boat of equal value. Linda, x30041 or 422-5123.

Rent: Galveston Gulf-front condo, Victorian complex, furnished, sleeps 6, weekend or weekly rates. 280-8644.

Lease: League City, The Landing 3-1.5-1, fenced, miniblinds, $450/mo., $350 deposit. 486-9811.

Lease: El Dorado Way 2BR condo, W/D, FPL, downstairs, end unit, $375/mo., 1 yr. lease. Danny Taylor, 326-5754.

Lease: League City, Countryside 3-2-2, fenced, FPL, miniblinds, $525/mo. plus deposit. 486-9811.

Sale: Camino South 3-2-2D, both formals, $72,500. 483-7027 or 488-0217.

Rent: Mobile home, 14 x 80-ft., 3BR, 2 bath, FPL, wet bar, W/D, fenced, screened patio, near bay. 559-2925.

Sale/lease: Camino South, 3-2-2A, 1,850 sq. ft., DR, den w/FPL, rec room, remodeled, $75,000 or $550/mo. Tom, x38162 or 280-0689.

Sale/lease: LaPorte townhouse, adjacent to golf course, 2-1.5-2, pool, tennis, $38,500 or $425/mo. 471-3425.

Lease: CLC Baywind II condo, 1BR, drapes, new carpet, FPLs, appliances, W/D, tennis, pool, $298. 488-5019.

Sale: 4-2-2, carpet, fenced, atrium w/waterfall, miniblinds, near shopping, schools, hospital, no money down, assumable loan. Ethel or Debbie, x36148 or 481-9438.

Sale: Lakeside lot near I-45 and Sawdust Rd., paved streets, assume payments. Lori, x35294 or 668-3277.

Sale: Bayridge League City 3-2-2, assumable, 1,300 sq. ft., landscaped, deck, $58,400. 334-4361.

Lease: Condo, 2-1-2, W/D connections, fans, icemaker, miniblinds, storage, cable TV, new paint, floors, no pets, near NASA. 488-0719.

Lease: Lake Livingston waterfront house, 3-2, sleeps 8, fully furnished, pier, fishing, skiing, swimming, weekend or weekly rates. 482-1582.

CLC 1BR condo, fan, new paint, drapes, FPL, appliances, tennis, exercise room, 2 wks. free. Jim Briley, 282-1880 or 488-7901.

Lease: West Galveston Island beach house, 3-2, furnished, day, week, month. Ed Shumilak, x37686 or 482-7723.

Lease: Condo on Clear Lake, 24-hr. security, pool, tennis, 2-1, $400 plus utilities. 480-5583 or 482-7156.

Sale: LaPorte 3-1.5-2 house, no approval 9.5% assumable loan, alum. siding, new paint, remodeled kitchnen, near Underwood/Spencer. 930-9348.

Sale: Custom-built 3,100-sq.-ft. house across from water, large wooded lot, 4-2.5-2, open floorplan, many decorator features, $149,000. Jerry, x38922 or 474-4310.

Sale/lease: Nassau Bay, 2,200-sq-ft. townhouse, 3-2-2, new carpet, paint, large garage, deck, atrium, 20-ft. FPL, $109,000 or $890/mo. Jerry, x38922 or 474-4310.

Sale/rent: Galveston Island condo, 2 BR, pool, tennis, 72nd and Seawall, 2 day min. Clements Jr., 474-2622.

Cars & Trucks

'73 Plymouth Fury, 76K mi., rebuilt A/C, new battery, no rust, good tires, some dents, $950. Bill, 488-0003.

'84 Pontiac Fiero SE, A/C, AM/FM/cassette, 47K mi., white w/brown interior, $5,900. Rick, x32695 or 559-2735.

'74 Triumph Daytona 500, 2.7K mi., garaged, BO. Jim, 280-2249.

'78 Mazda GLC, 4 spd., A/C, new tires, starter, battery, seat covers, needs minor body work, $500. Frank, 282-3858.

'84 Jetta, 35K mi., black, tinted windows, ex. cond., 5 spd., all gauges, $5,500. Plauche, x39034 or 474-2660.

'82 Camaro Z28 Coupe, auto., V8, A/C, all power, cruise, T-top, AM/FM/cassette, white, blue velour interior, 57K mi., ex. cond., $6,000. George, 483-1467 or 937-7648.

'81 Olds Cutlass Supreme Brougham, dark brown, tan vinyl roof, tan vinyl seats, PS, PW, PL, PS, PB, A/C, stereo, ex. cond., 75K mi., $3,100. Woody, x32709 or 532-3408.

'83 Buick LeSabre, loaded, ex. cond. Scott, x39156 or 488-3118.

'85 Chevy Cavalier, low miles, ex. dark metallic blue, 4 dr. sedan. Scott, x39156 or 488-3118.

'52 Studebaker dump truck, 1 ton, steel bed, runs, $1,400 OBO. Glen, x36541 or 486-0462.

'84 Ford van, customized by Milburn's, loaded, .302, auto. w/overdrive, one owner, 37K mi., no rattles, $9,500 OBO. Richard, x33743 or 474-9334.

'67 Mustang Classic, 289 V8, 3 spd., new paint, new air shocks, mags, AM/FM/stereo, rebuilt carb., new plugs, wires, good tires, A/C, $3,395. x38169 or 482-8496.

'81 Cadillac Fleetwood Brougham, 4 dr., loaded, 49K mi., black, loan value $5,500. 481-1363 or x30160.

'83 Camaro Berlinetta, ex. cond., many options, $6,000 OBO. 482-6027.

'82 Olds 98 Regency, 4 dr., ex. cond., loaded, $5,500 OBO. 482-6027.

'77 Ford Supercab pickup, .351 Cleveland VC8, 78K mi. on truck, 2K mi.on engine, auto., air, good paint, 5 radials, camper top, $2,900. Dave Walker, x32754 or 474-5315.

'76 Toyota Corolla, 2 dr. sedan, runs well, $695. 554-6173.

'84 Ford Ranger S, 4 cyl., 4 spd., 54K mi., $3,200 OBO. Chuck, 326-1628.

'69 Ford Galaxy, 2 dr., A/C, runs well, good cond., two owners, $700 OBO. Lisa, 855-6079.

'80 Ford Mustang Ghia, ex. cond., gray w/red interior, AM/FM/cassette, V4, A/C, $1,800 OBO. 524-0048.

'76 Trimuph TR7, ex. running cond., white w/black interior, AM/FM/.cassette, V6, $1,900 OBO. 524-0048.

'78 Pontiac Astre, small wagon, runs well, regular gas, good MPG, maintenance records, manuals, $750 OBO. Jim, 280-7426.

'81 Datsun 310 GX hatchback, 4 cyl., 5 spd., 57K mi., AM/FM/cassette, new tires, dependable, $1,600. 481-1382.

'80 Ford Fairmont station wagon, good cond., $850. 532-4237.

'76 VW van, 7 passenger, custom interior, good cond., $1,000. Lane, x30524 or 334-4608.

'83 Escort station wagon, 43K mi., A/C, PS, PB, 4 spd., AM/FM/cassette, $2,450. Bob, 282-4381 or 554-2250.

'73 MG Midget, good mechanical cond., $1,850. Gary, x34231 or 486-9620

'79 280ZX sports coupe, 5 spd., A/C, removable sunroof, tinted windows, back and side louvers, LeBra, new clutch, brakes, tires, AM/FM cassette, 64K mi., slight body damage, $4,000 OBO. Kay, x34826 or 331-3379.

'78 Camaro, A/C, PS, PB, AT, tilt wheel, chrome custom wheels, clean, $1,800 OBO. Bill Wood, x33838 or 554-2283.

Boats & Planes

'84 Baja 164SS, 115hp Johnson, galvanized Sportsman trailer, garaged, 50mph, ex. cond., $4,500. Barry, x30845 or 538-1563.

'78 Renken outboard 15-ft. fiberglass boat, walk-thru windshield, Little Dilley trailer, no motor. $600 OBO. x31559.

Glasstron bass/ski boat, 115hp, garaged, $5,800 OBO. Hector, x37027 or 488-0217.

Windsurfing sail and boom, 6.2 sq. m., Mistral Pinhead sail, $40, 7-ft. boom, $40, $70/pr. Ron, x32756.

25-ft. Boston Whaler Outrage, twin 140hp, VHF, Loran, Lowrance, canvas top, dual axle Sportsman trailer. Lori, x35294 or 668-3277.

14-ft. Laser sailboat, Dilly trailer, good cond., $1,650 OBO. 488-4173.

19-ft. Mallard sailboat, on trailer, stored at Seabreeze Sailing Center, $1,800. Ralph, x34979 or 428-7787.

18-ft. AMF Trac Catamaran, galvanized trailer, $3,850. 333-3056.

Kayak and accessories, $250. 996-1624.

Free Sail sailboard, $450. x36514.

18-ft. Riveria, 110hp Johnson, galvanized trailer, 1 yr. old, $7,000. 941-3516.

Cycles

'79 Honda 750 motorcycle, runs, not well, BO. Schultz, x36493.

Bridgestone 27-in. men's 10-spd bicycle, lt. blue, good cond., new tires, $50. Gail, x33456.

'79 Honda CX500 Custom, shaft drive, fairing, hard saddle bags, luggage carrier, good cond., dependable, $800 OBO. Rich, x36900.

16-in. child's bike, training wheels, $10. Dave, x32750 or 333-4852.

Mongoose Custom BMX 20-in. bicycle, custom frame and rims, $95. David, 488-3966.

Audiovisual & Computers

Apple IIe, 128K, 2 drives, modem, software, $900. Gordon, x30518 or 486-4403.

OS-9 for Radio Shack color computer models I or II, never used, includes guide, $30. Doc Pepper, 282-3130.

Commodore 1525E dot matrix printer, '83 model, ex. cond., $100 OBO. Al, x34784 or 482-5190.

Everex 10mb hard drive, controller card, IBM, Compaq or compatibles, $175 OBO. T White, 474-2214.

IBM PC Jr., 256K, NEC amber monitor, Panasonic printer Model KX P1091, carrying case, adapter cable, software, $550., Harnage, 333-2560 or 481-2335.

HP digital cassette Drive for HP-41C w/HP-IL Interface Module, ex. cond., $500 OBO. Carlos, x38879 or 554-7727.

C-64 Commodore software: Multiplan, $18; Simons Basic, $12; Sideways, $18; Batteries Unlimited Mail-List, $6; Heswriter 64, $14; Practifile, $9; Gridrunner, $4. 481-0468.

C-128 Commodore software: timeworks Partner, $24; Timeworks Data Manager, $24; Superbase 128, $24; for computer, printer, monitor, disk drive, $4/ea.; joy stick, $14. 481-0468.

Commodore 1526 printer, needs new print head, $50. Samouce, x35053.

Heathkit 5 mHz single trace oscilloscope kit, new in box, $150. Joe, x31597 or 996-1667.

JVC belt-drive turntable, Rega "cult" cartridge, $65; Radio Shack 7-band equalizer, $30; Radio Shack VCR video enhancer, $30; Radio Shack VCR audio enhancer-synthesizer, $25. Musgrove, 488-3966.

Apple IIe, 128K, 80 col. text card, double disk drive, software, $750. Ken, x35463 or 996-0618.

CDC 360K floppy disk drive, full HT, 1 yr. old, $60; 135W XT power supply, couple mos. old, $70. Charlie, x34647.

Intel 330 computer system, iSBS 86/30, three 8-in. DS/DD floppies and 32MB hard drive, 896K RAM w/8087 and iSBS 534, 4 additional serial ports, languages and utilities, Hazeltine Espirit terminal, C.Itoh 467 terminal (8 color, 640 x 480 4027 and VT100 comp., was $24,000, now $2,000. 488-4453.

XT Compatible computer clone, one 360K floppy and 12MB hard drive, 640K RAM, 6 pack clone card, software, printer coprocessor card, mono card, CRT, software, $850. 488-4453.

IBM Displaywriter, Textpack 4 and 6, Reportpack, IBM 5218 Quality Printer, 50 diskettes, 5 ribbons, 3 print wheels, books, $5,000. De Lynn, 331-6822.

AT&T 6300, mono, 640K RAM, 1 floppy, 31 MB hard disk, manuals, printer, stand, paper, surge protector, software, etc., $1,750 OBO. Tim, 484-8191.

Apple McIntosh computer w/Imagewriter, $1,500, 482-0935.

Apple software, Bankstreet writer, $15. 481-0468.

Radio Shack VHF 4-channel crystal-controlled pocket scanner, AC adapter, DC cigarette lighter adapter, 8 local police crystals, all $65. Frank, x34752.

Commodore Amiga A1000 computer, 512K, monitor, Okidata Okimate 20 color printer, software, ex. cond., $1,100. Joe, x31597 or 996-1667.

Apple IIC computer, mono monitor, software, $750 OBO; 2nd drive, Imagewriter printer, BO. Duane or Joann 482-4949.

HP digital cassette driver for HP-41C w/HP-IL interface module, ex. cond., was $675, now $550. Carlos, x38879 or 554-7727.

TI 99/4A computer, extended Basic, games. 488-2822.

Household

Loveseat in earthtones, ex. cond., $75; coffee table, $25. 488-4890 or x32933.

Amana Radarange microwave, large, ex. cond., $150. Jan, x32262.

Puff chair, tan, ex. cond., $30. 944-6457 or x38961.

Contemporary biege sectional sofa w/sleeper, 5 pieces, good cond., $700 OBO. Gail, x33456.

Extra-long 4-section couch, 2 matching chairs, good cond., $150 OBO. Linda, x39658 or 486-6873.

King-sized waterbed, almost new, motionless mattress, 2-shelf wooden headboard, 6 drawers, $300 OBO. x32786 or 280-0122.

Wood storage cabinet, 6 x 4 x 2-ft., shelves, double doors, $45. 332-0492.

Philippine wicker set, 7 pieces, lounge chair, king, queen, princess chairs, oval table, 3 flower planters, natural cane color, $550 OBO. 482-7616 or x36918.

Antique, circa 1900, 4-pc. Royal Doulton bowl, pitcher set, white w/ping, green design, $150; 3-pc. English set, circa 1880, white w/blue-green design, $125. 554-2665 after 1 p.m.

Wooden dinette set, 2 chairs, $50; small desk, $25; corner end table, $15; all for $75. Alan, 334-5478 or x32554.

Office desk, 32 x 60, solid oak, $200. Thompson, 332-2229.

Punch bowl, 2 ladels, 24 cups, $30; silver and glass coffee server, $15. Thompson, 332-2229.

King-sized waterbed, natural wood finish, headboard bookcase, pedestal w/drawers, motionless mattress, Ernie Smith, x36893 or 485-2287.

Photographic

Vivitar T4 auto camera adapter for Pentax, $10. Samouce, x35053.

Olympus OM-25 35mm SLR, 50mm f/1.8 lens, cable release, filter, never used, $200. Joe, x31597 or 996-1667.

Pets & Livestock

Free cat, gray, declawed, neutered, all shots current, indoor pet. 488-1217.

Free kittens, 8 wks. old, solids, stripes, plaids. Dianne, 474-9334.

Musical Instruments

Electric guitar, amplifier, $150. 996-1624.

Electronic keyboards, not MIDI, stage set-up, Micro-Moog for "fat" bass, Moog-Prodigy for solos, Oberheim Ob-SX strings, horns, polyphonic sounds, Krumar Tocatta B-3 leslie combination sound, Krumar 3-tier stand, $1,500. Mark, x30160 or 643-4726.

Guitar, Gibson model J-50 deluxe, 6 string, metal strong, dreadnought style, ex. cond., tone, $500. Ernie Smith, x36893 or 485-2282.

Buffet Clarinet, ex. cond., was $1,500, now $500; Signet Clarinet, ex. cond., $175. Barbara, 282-3318 or 331-5346.

Classical guitar, good cond., ex. tone, $80. Plauche, x39034 or 474-2660.

Wanted

Want non-smoker to share 3-2-2 house in Heritage Park behind Baybrook Mall, own room and bath, $225/mo. plus utilities. Ken, x35463 or 996-0618.

Want to lease Cherokee 6-class or Arrow-class aircraft for Bay Area Aero Club, based at Houston Gulf. Rick, x32695 or 559-2735.

Want inexpensive sewing table to support average-sized portable. Kathy, x39029.

Want old slide rules for educational project, will accept donation or pay small fee for used working slide rules. Mike, x33636.

Want non-smoking car-pooler from Spring High School to JSC, 7 a.m. to 3:30 p.m. Patnesky, x38636, Pana Amin, x32459 or Roy Parker, x38233.

Want ride for blind person to and from work, 8 a.m. to 4:45 p.m., Monday thru Friday, live in Bay Glenn subdivision, 14607 Oak Chase Dr., work at Computer Sciences, 16511 Space Center Blvd. 486-7673.

Want band members, keyboardist looking for serious musicians who won't depend on band financially, would consider joining existing band, have studio time available. Alan, 282-3968 or 334-7814.

Want 4-5BR house within 15 mi. of JSC, will assume loan, refinance or trade for Florida/New Mexico properties. Tony, 338-2336.

Want NASA employees for Superstar team, need female billiards, ping pong, bowling, male football receiver, basketball player w/3-point shot. 554-2665.

Miscellaneous

Work bench, 3 x 4 x 2-ft., vise, $40. 332-0492

Water conditioner for entire house; wire wheel covers for '79 Monte Carlo; cowboy boots, size 10; Farah boy's suit, size 16. Ethel, x36148.

Prom formals, evening dresses, sized 8, 9 and 10, $75 to $200. Barbara, 282-3318 or 331-5346.

2 Goodyear Viva tires, P175/75 R13, $10; swivel desk chair, $5; exerciser bike stand, $5; 5-ft. Christmas tree w/stand, $5. 554-2665 after 1 p.m.

Racing go-cart, Invader chassis, 2-cycle, 100cc engine, stand, starter, spare parts, $450. David, x33858.

VW parts, engines, transmissions, camper interior, body parts, electrical, etc., $500 OBO takes all. x38673.

Ceramics "Sitter" kiln, 18 x 20-in., $350; antique smoking stand, $45; oak lap desk, $45. 485-4995.

Shotgun, Remington 1100, 12-guage, mod., vent rib, ex. cond., $250 OBO. 474-2585.

22-in. K&S Rotary lawnmower, catcher, 3.5hp Briggs $ Stratton engine, $60 OBO. 482-9168.

Kenmore vacuum cleaner, canister type, self-adjusting, power agitator, 1.5 yrs. old, all attachments, $125. 482-9168.

Baby items, bumper pads for crib, $5; Graco mechanical swing, $15; baby girl clothes, 0-6 mos., all ex. cond. Carla, x30181.

Garage Sale: May 30-31, 502 S. Austin No. 1, next to Webster City Hall, 10 a.m.-5 p.m. 554-6949.

Back issues of "Ski" and "Skiing" magazines, pick up. Schultz, x36493.

Members Only lined gray jacket, boy's size 12, never worn, was $50, now $20; tea-length prom dress, size 3, silver bodice, *white net, silver skirt, $50.* x38961 or 944-6457.

Sun shade louvers, fits '83-'85 Toyota Celica hatchback, $100 OBO; tool box for Toyota pickup, $25; rear shocks for '77 Buick LeSabre, $15. Bob, x31599 or 472-2163.

TV stand, $10. Lorraine, 480-3377.

Bulkhead anchors, 7/8-in. diameter x 20-ft., 8-in. auger, $11/ea. OBO. 488-0288.

Bulkhead tie rod, 3/4-in diameter x 5-ft., 10-in. of thread, hot dipped galvanized, $5/ea. OBO. 488-0288.

Shop manuals for all '75, '76 and some later Ford, Lincoln, Mercury passenger cars, 5-vol. set, $25. John, x31056.

Encyclopedia Americana, more than 30 yrs. old, $25; long-range television antenna, $25. John, x31056.

A/C compressor unit, 4 ton, used 8 mos., $400; 15-ft. x 20-in. Formica bar top, $50. 554-2908.

U.S. Mint sets, dated 1971-1980, 19 sets for $50. 482-8827.

U.S. proof sets, dated 1971-1974, 16 sets for $60. 482-8827.

10HP Sears riding lawnmower, 6 speeds, 32-in. deck, 1 yr. old, ex. cond., $650. Bonnie, x34407 or 930-9348.

Cookin' in the Cafeteria

Week of May 25 — 29, 1987

Monday — Memorial Day Holiday.

Tuesday — Split Pea Soup; Salisbury Steak, Shrimp Creole, Fried Chicken (Special); Mixed Vegetables, Beets, Whipped Potatoes.

Wednesday — Seafood Gumbo; Fried Catfish w/Hush Puppies, Braised Beef Rib, BBQ Plate, Wieners & Beans, Shrimp Salad, Stuffed Bell Pepper (Special); Corn O'Brian, Rice, Italian Green Beans.

Thursday — Chicken Noodle Soup; Beef Stroganoff, Turkey & Dressing, BBQ Smoked Link (Special); Lima Beans, Buttered Squash, Spanish Rice.

Friday — Seafood Gumbo; Broiled Turbot, Liver & Onions, Fried Shrimp, Meat Sauce & Spaghetti (Special) Green Beans, Buttered Broccoli, Whipped Potatoes.

Week of June 1 — 5, 1987

Monday — Beef & Barley Soup; Beef Chop Suey, Breaded Veal Cutlet w/Cream Gravy, Grilled Ham Steak, Wieners w/Baked Beans (Special); Buttered Rice, Brussels Sprouts, Whipped Potatoes. Standard Daily Items: Roast Beef, Baked Ham, Fried Chicken, Fried Fish, Chopped Sirloin. Selection of Salads, Sandwiches and Pies.

Tuesday — Celery Soup; Fried Shrimp, Pork Chop w/Applesauce, Turkey a la King, Pepper Steak (Special); Au Gratin Potatoes, Breaded Squash, Buttered Spinach.

Wednesday — Seafood Gumbo; Fried Catfish w/Hush Puppies, Braised Beef Ribs, Mexican Dinner (Special); Spanish Rice, Ranch Beans, Buttered Peas.

Thursday — Green Split Pea Soup; Corned Beef w/Cabbage & New Potatoes, Chicken & Dumplings, Tamales w/Chili, Hamburger Steak w/Onion Gravy (Special); Navy Beans, Buttered Cabbage, Green Beans.

Friday — Seafood Gumbo; Deviled Crabs, Broiled Halibut, Liver & Onions, BBQ Link (Special); Buttered Corn, Green Beans, New Potatoes.