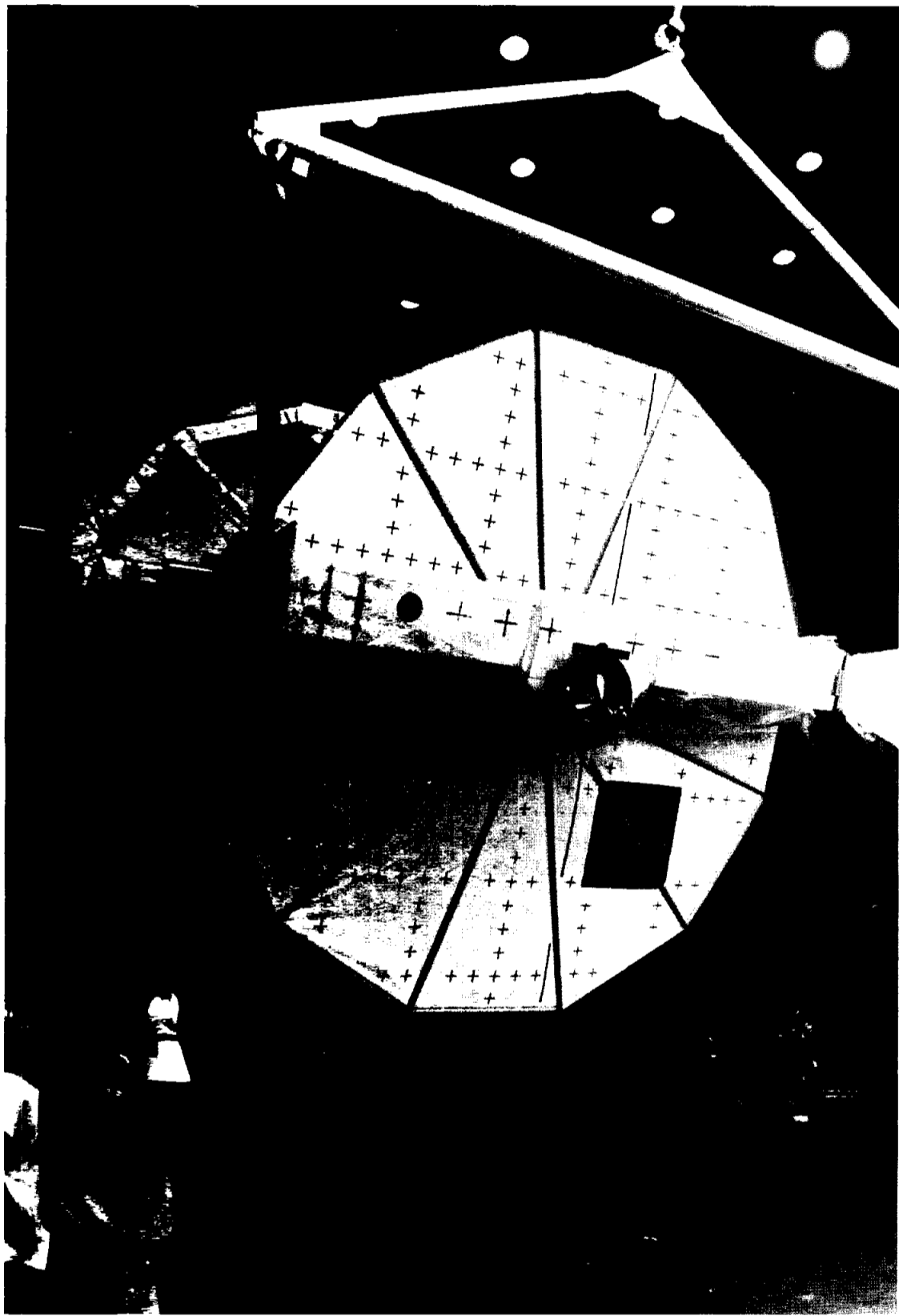


Arm exercise

PFTA is next step in RMS operations



The Payload Flight Test Article, shown suspended in the photo above, undergoes weight and balance tests here prior to shipment to the Cape last month for the STS-8 mission.

The next step in Shuttle robot arm operations begins next month on STS-8, when crew members test a 7,460-pound JSC payload.

The Payload Flight Test Article, a dumbbell-shaped payload designed to simulate the larger cargos scheduled for later flights, will be put through two sequences of eight test objectives each on flight days three and four, and should give mission planners a better idea of how the remote manipulator arm responds under various conditions.

JSC is looking at the robot arm's ability to place a payload in space with two inches and one degree of accuracy relative to the Orbiter's axis. The tests will also demonstrate the ability to deploy and berth full volume payloads without direct view of the attachment trunnions.

The PFTA is 15 feet long and 12.5 feet across, and will simulate full-volume cylindrical payloads such as the Long Duration Exposure Facility, now scheduled for deployment next year. The PFTA has four longeron attachments and one keel attachment, a first for Shuttle payloads.

Tests will include a nominal berth and unberth with two different grapple fixtures on the payload, using the arm in its full six degrees of freedom maneuvering capability. The two grapple fixtures will allow researchers to see how the arm reacts to different mass properties and arm geometries, since one fixture is closer to the PFTA's center of gravity than the other.

A second test, a direct drive unberth and berth, will use the arm in a degraded mode, where it can be moved one joint at a time only. The test will also call for the crew to use only visual

cues during the procedure, to simulate the loss of RMS positional data inside the cabin.

Other tests will examine how the arm responds to Orbiter vernier and primary flight control system thruster firings. The reverse will also be studied, as the loaded arm movements are plotted against reactions of the Challenger while it is in a free drift mode.

Researchers will also examine the results of an auto sequence test, in which the arm moves in a preprogrammed manner identical to auto sequence maneuvers on STS-4 and STS-7. The only difference on this flight will be the added weight of the PFTA.

The PFTA will be carried between the INSAT satellite and the Developmental Flight Instrumentation pallet, also a JSC payload, while it is in the payload bay.

Beggs predicts approval for space station plans

Administrator James M. Beggs said Monday NASA will give the President a proposal for a space station project within a year and hopes to have it operational by 1992.

Beggs' remarks came during the Space Station Symposium earlier this week in Arlington, Va. Several hundred representatives from government, industry, foreign nations and the military were there to finalize ideas in preparation for NASA's formal space station proposal. Beggs said the Agency hopes to get start up money from Congress in the Fiscal Year 1985 budget.

NASA's Space Station Task Force has so far developed 48 space science and applications missions, 31 commercial missions and 30 technology developments which could be performed on a space platform.

Presidential Science Advisor George Keyworth last week said NASA should prepare a "grand vision" for the future which could include a space station, more lunar exploration and more ambitious manned spaceflight projects.

Keyworth, interviewed in Science magazine, said, "I think the country should take a major thrust in space very seriously. We've shown that the Space Shuttle works and is reliable. We have the technology

to build a space station. It is only an intermediate step in a more ambitious long-range goal of exploring the solar system."

Keyworth compared such a proposal to President Kennedy's lunar landing initiative in 1961, saying that challenge to the nation was "a brilliant stroke."

Beggs said he hopes to have an approved space station plan in the next year. "I think we will have an approved program in a really short period of time, if not the end of this year then the first half of next year," he said.

"Without a space station," Beggs said, "I can envision a much different world several years from now. If the United States does not take this step, we will lose our preeminence in space. The Soviets will not stop, the Europeans will not stop and the Japanese won't stop. There would be no impact at first, but in five years we would begin to fall back, and in 10 to 15 years, we would regret that we didn't take that next logical step."

The agency, he said, "Has a grand design that has existed since the early Apollo days. It is a step-by-step plan that proceeds from the Shuttle in low Earth orbit, to transfer vehicles to carry people to geosynchronous orbit, to a scientific base on the Moon and further planetary expeditions, and perhaps manned trips to Mars."

On station

Back from the brink, TDRS-A is in its proper orbit

After 58 days of delicate maneuvers, a NASA-industry team succeeded in placing the first Tracking and Data Relay Satellite into its proper geosynchronous orbit June 29, using what a TRW official called "the world's smallest orbital injection engines."

When TDRS-A finally separated from a malfunctioning booster and stabilized itself April 5 after undergoing a 30 rpm tumble, engineers were still faced with one of the most demanding challenges in the history of satellite operations. TDRS-A was in a lopsided 13,574 x 21,970 statute mile orbit, almost 9,000 miles shy of its planned circular orbit.

Over the next 58 days, experts from NASA, Spacecom and TRW executed a series of burns using tiny one-pound stabilization thrusters, with nozzles about the size of a thimble, to boost the 5,000-pound spacecraft some 8,662 miles farther into space, an exercise never before attempted. Thruster firings of various durations began in May, with the last coming June 29 on the command of NASA Administrator James Beggs to the White Sands control facility during ceremonies to mark the achievement. The 44 hours of firings made up for the loss of about 15,000 pounds of thrust during the failed orbital injection sequence during the morning hours of April 5.

With the activation of an Earth-lock mode on TDRS and the successful beginning of a communications system checkout last week, the satellite is nearing readiness for tests with Landsat 4 in late July

and with the Orbiter *Challenger* during STS-8 in August.

A series of four detailed test objectives and flight test objectives will be performed with the TDRS on flight days three, four and five during the mission, although regular air-to-ground communication through the satellite will commence as soon as *Challenger* passes Dakar on the first orbit. The Orbiter will communicate with TDRS on the S and Ku-bands, and coverage will be about 40 minutes during each rev, in addition to regular ground station communication elsewhere around the globe. Coverage through TDRS begins at about the mid-Pacific Ocean region and ends about where Indian Ocean Station coverage begins on the east coast of Africa.

The process of checking out the communications system was slowed over the July Fourth weekend, however, when a ground software problem developed at the White Sands Ground Terminal. The problem is associated with processing data from the spacecraft and was not considered serious at *Roundup* press time.

Up to that point, engineers had successfully activated both the Ku and S-band systems on TDRS-A with good results. Two 60-foot antennas at White Sands were also successfully checked out for their capability to track the satellite.

"This has been a long, hard siege," Beggs said, "but it paid off. The effort of the TDRS team represents some of the best in American skill and ingenuity."

(Continued on page 2)

Space News Briefs

JSC to test computer language

A new computer language designed to replace thousands now used by military and aerospace computers is being evaluated jointly by scientists and software linguists at JSC and the University of Houston/Clear Lake. The language, named Ada in honor of an English woman who programmed the first known calculating machine in the 1830s, was designed by the Department of Defense to replace more than 2,000 software dialects now used in permanently-installed, embedded computers. JSC was selected as NASA's Ada test site to evaluate the language under a joint NASA/DOD agreement. The Center is being assisted by the University of Houston's High Technology Laboratory in the effort. If Ada becomes the universal aerospace computer language, interaction between the thousands of military and aerospace computers will become less complex, more interchangeable and could reduce costly duplicate programming. The evaluation will proceed here for about two years.

El Chichon clouds less acidic than thought

The first total measurement of sulfur dioxide content in a volcanic cloud has indicated a much lower amount than estimated, and is helping scientists take the guesswork out of forecasting volcanic effects on climate. The El Chichon volcano in Mexico, which erupted in March and April 1982, was thought to have dumped as much as 50 million tons of sulfur dioxide into the stratosphere. But measurements conducted by Arlin Krueger of the Goddard Space Flight Center using the Total Ozone Mapping Spectrometer aboard Nimbus 7 indicate a much smaller amount of sulfur dioxide, on the order of only 3.3 million tons. Sulfur dioxide is converted to sulfuric acid droplets in the stratosphere, which stay aloft for months or years and can reflect sunlight skyward, cooling the atmosphere below. Knowing the exact amount of sulfur dioxide released by El Chichon will allow scientists to determine how much sulfuric acid was produced and further refine their estimates of climatic impact.

First commercial payload specialist named

Charles D. Walker, an engineer at the McDonnell Douglas Astronautics Co. in St. Louis, will be the first payload specialist to represent a commercial project when he flies with the electrophoresis processing device on STS-12. The Continuous Flow Electrophoresis processing device on STS-12. The Continuous Flow Electrophoresis System, which has flown three times on the Shuttle as part of a joint NASA/McDonnell Douglas/Johnson & Johnson project, will be reconfigured to run 24 hours a day during STS-12. The goal is to produce sufficient material for clinical testing. Walker has been involved with the Electrophoresis Operations in Space project since its inception in 1978. He is the chief test engineer for the project with responsibility for space flight testing and evaluation, and has trained the NASA astronauts who have operated the device on past flights. Walker is an Indiana native and received his bachelor of science in aeronautical and astronautical engineering from Purdue University in 1971.

ESA signs Ariane contracts

The European Space Agency and Arianespace, the commercial consortium which markets the Ariane rocket, have signed two separate contracts for the launch of four satellites, including the European Large Telecommunications Satellite, recently christened Olympus. The new contracts guarantee production of the Ariane at least through launch of L24 mission. Olympus, a large telecommunications platform, will be launched on an Ariane 3, an uprated version of the original rocket, in late 1986. The second contract covers the launch of three weather satellites under the European Meteosat Program in 1987, 1988 and 1990.

Ames studies living in space

Humans who spend their lives in space might live longer than they would on Earth, but they could lose the use of major bones and muscles, according to a report out of the Ames Research Center. Researchers at Ames have found that the effects of exposure to micro-gravity are very similar to the effects of aging seen in Earth-bound humans and animals. But they have also concluded that human aging might actually be slowed by 10 to 15 percent because of a reduction in metabolic rates. Humans in space have experienced an increase in blood pressure and a decrease in cardiac output and respiratory capacity; a decrease in grip strength, body weight and muscle mass; loss of bone minerals and a decreased urinary output of hormones from the adrenal cortex. These changes so far have been reversible, but the effects of spending years in space are as yet unknown, the study says. Researchers Dr. Jaime Miquel and Dr. Angelos Economos also looked at how the body works to counteract gravity on Earth. About one third of the calories ingested energy to work against the effects of gravity, such as the heart pumping blood "uphill" to the brain. Without gravity, humans should require less calories, they said, and this would reduce metabolic rates. This lowered rate would tend to slow the time-dependent disorganization of cells and organs, the physiological decline we call aging.

Bulletin Board

Blood drive scheduled in August

The second JSC blood drive for 1983 is scheduled to run from 8:30 a.m. to 3 p.m. August 16 and August 18 at the Gilruth Recreation Center. For appointments to give blood, please call Bob Jones, x6251; Jim McBride, x6226; or Helon Crawford, x5238.

"Space Voyage" set for tonight

"Space Voyage Night," one of the highlights of the annual Spaceweek celebration, is set to begin tonight at 7:30 p.m. in the Bldg. 2 Auditorium. The Spaceweek events have been underway this week at JSC, in the Houston area and in 100 cities around the country. Immediately following the space films this evening, stargazers will be able to gather outside the auditorium to peer at the planets and stars through telescopes during the JSC Astronomical Society star party. During the weekend, a cockpit mockup of a Shuttle Orbiter will be on display in Bldg. 9A Saturday and Sunday in an event sponsored by the Civil Air Patrol. On Sunday, the AIAA will sponsor "Flying Fantasies," featuring hot air balloons, radio controlled airplanes and sky divers, in the rocket park at JSC. A model rocket launch will also be held at the Rocket Park Sunday afternoon. From 1 to 5 p.m., the Association of Computing Machinery will sponsor a picnic at the Gilruth Center with live music.



Safety representatives from the divisions within the Research and Engineering Directorate are shown with coffee mugs marking over one million man hours without a lost time accident.

Special recognition was given recently to three organizations at JSC for their impressive safety records in 1982. The Research and Engineering Directorate, the Space and Life Sciences Directorate and the Space Shuttle Orbiter Projects Office all were honored with award plaques as part of a new annual safety program. Several factors were considered in determining the organizations honored, including civil service lost time and recordable accidents, contractor lost time accidents, response to identified safety problems, internal promotion of safety awareness and hazard recognition and risk management. Of the three groups, Research and Engineering was chosen by the Safety Office as the grand



Ralph Gonzalez

People

award leader. The Directorate boasts a record of 1,601,157 man hours without a lost time accident, and all employees of R & E were presented with coffee mugs to mark the achievement.

Rafael Gonzalez of the National Space Transportation Systems Program Office was recently honored with the Mexican American Engineering Society's medal of honor for his work in the field of management at JSC. The medal represents the highest award given annually by the MAES. The Society works to promote science and technology to young people and to honor Mexican Americans in the fields of science, engineering and humanitarian service.

Eleven longtime employees of Lockheed Engineering and Management Services Co. were honored recently for their long service to the space program. They all were part of the original group transferred to Houston twenty years ago in 1963 by Lockheed to support NASA. Honorees were presented

with engraved desk sets by Company President Robert Young Jr. Those receiving awards were: Hugh Douglas, Clyde Haddick, Ed Riley, Joe Robinson, Alvin Roelse, Lyle Rudy, Bev Steadman, Bob Steger, Jack Story, Van Williams and Charles Jeffress.

Marty Kirkland, an engineering supervisor for Taft Broadcasting, was presented a check for \$100 recently in recognition of a design which was printed in a NASA Tech Brief. The design was for an audio distribution and monitoring circuit. The check was presented by Photographic Technology Division Chief Paul Penrod. Taft contracts to JSC for a variety of video and audio mission-related duties.



Marty Kirkland

Cookin' in the Cafeteria

Week of July 25 - 29, 1983

Monday: French Onion Soup; Beef Chop Suey, Polish Sausage w/German Potato Salad, Breaded Veal Cutlet (Special); Okra & Tomatoes, Green Peas. Standard Daily Items: Roast Beef, Baked Ham, Fried Chicken, Fried Fish, Chopped Sirloin. Selection of Salads, Sandwiches and Pies.

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, Weiners & 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 August 1 - 5, 1983

Monday: Beef & Barley Soup; Beef Chop Suey, Breaded Veal Cutlet w/Cream gravy, Grilled Ham Steak, Weiners 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, Chinese 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/Chilli, 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.

On station

(Continued from page 1)

Firings during the correction procedure typically used six thrusters. Four were used to control stability while two were used to push the spacecraft. Goddard Space Flight Center Director Noel W. Hinners said his calculations showed the thrusters got "about 85 miles per gallon," and he noted they were "made in the USA" by TRW, which also built the spacecraft.

TDRS-A is now in a 22,234 x 22,237 statute-mile orbit with a period of 23 hours and 56 minutes and an inclination of .02 degrees. A final trim on the orbit will be made during the planned drift movement from 67 degrees west longitude to the permanent location at 41 degrees west longitude this fall.

After the tests with Landsat 4 and STS-8, the satellite will provide major support to the STS-9

Spacelab mission in October. It is the first of three satellites to make up the TDRSS network. The second TDRS, originally scheduled for launch on STS-8, has been postponed pending correction of the problem with the Inertial Upper Stage booster. If the problem can be corrected in time, NASA tenta-

tively plans to launch TDRS-B on STS-12 in March, 1984. The second satellite will be positioned at 171 degrees west longitude over the Pacific. The third TDRS satellite, an in-orbit spare, will be located at 79 degrees west longitude over the Pacific off the coast of South America.

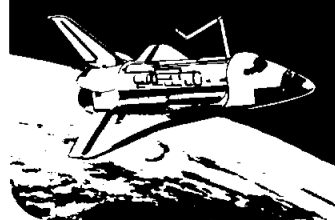
NASA
Lyndon B. Johnson Space Center

Space News Roundup

The *Roundup* is an official publication of the National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Texas, and is published every other Friday by the Public Affairs Office for all space center employees. *Roundup* deadline is the first Wednesday after publication.

Editor

Brian Welch



I, Robot

GANEF proves an economical testbed for laser rendezvous

Harry Erwin's laser-docking choo-choo train may be headed for the roundhouse, a victim of progress and a slick, one-armed robot named GANEF.

It was Erwin, head of JSC's Microwave and Laser Section, who introduced a toy train in 1980 as an inexpensive solution to perfecting rendezvous and docking for future spacecraft.

Its engine had a tall smoke stack that sported a bicycle reflector, necessary to return a laser beam. It was the best and cheapest way to test a laser system's ability to measure speed and distance between two moving targets, and the test was successful.

But a train follows a track, moving forward and back, and the next step was to find a maneuverable device to play the role of an angled target — one that could move in more directions, at any angle, and toward the source of the laser, reflecting the beam back to its source. Enter GANEF.

Erwin, who delights in simplicity, studied mission simulators and then decided on a do-it-yourself robot and persuaded NASA procurement to furnish a Heathkit for little more than the cost of an electric typewriter.

Erwin's staff assembled the robot, adding dexterity, maneuverability, improved diction, vocabulary and computer memory.

They named him GANEF, which stands for Ground Actuated Non-parallel Experimental Fetcher.

Less than three feet tall, GANEF rolls silently on electronic command from his corner niche, telescopic arm at rest. Three fist-size retroreflectors adorn his chest plate, replacing the single bike reflector that guided the train. GANEF's sing-song raspy voice announces, "Ready!" and the laser docking test begins.

As may some day occur in space, a pencil-thin infrared laser begins a "rasterscan," its harmless narrow beam methodically slashing the air until it locates and locks on to a target retroreflector on GANEF's chest.

The beam then seeks out the two additional reflectors, measuring distance and angle in fractions of a second to determine position and attitude.

GANEF is playing the role of a satellite, lining up by laser to be guided along the same plane toward the docking mechanism. The angle and distance of the three retroreflectors enter the guidance and navigation computer. Motors, responding to computer guidance, keep GANEF on track. A computer provides a continuous readout of distance and closing speeds accurate to a centimeter.

"We are perfecting a fully-automatic close-in docking space technique never done before," Erwin said.

Among the most difficult and necessary maneuvers in space is the "soft dock," Erwin said. That is a procedure in which a vehicle pulls in close, but does not make contact since a 5,000-pound satellite could be disoriented by the inertia of a docking 200,000-pound Shuttle orbiter.

Unlike Apollo command and lunar modules which banged together to connect, Erwin is aiming for a soft dock.

Erwin predicts free-flying robots and satellites will carry the laser docking and sensing innovation to dock with other high flying satellites, or while returning from high orbits to rendezvous and dock with Shuttle, which cannot achieve 22,000-mile stationary orbit.

"Laser sensing will become the eyes of the robots," said Erwin. "And with fiber optics, we can even provide GANEF with the sense of touch." — *Dave Alter*

Harry Erwin, head of JSC's Microwave and Laser Section, activates GANEF to begin tests of a laser beam system for rendezvous and docking techniques. GANEF is holding a triangle fitted with three reflectors which the laser beam is able to lock on with and measure speed, distance and angles between two targets.



Balloon meet to celebrate anniversaries

A score of hot air balloons, the vehicles of the 18th Century's first aviators, will fly past a Saturn V rocket, the vehicle of the 20th Century's moon-walking astronauts, as disparate images from the world of flight help celebrate a special year in air and space.

The Bicentennial Balloon Meet '83, to be held at JSC August 13 and 14, will help commemorate the dual anniversaries of the first man-

ned flight in 1783 and 25 years of space exploration. The meet also will benefit the United Cerebral Palsy campaign.

JSC Director Gerald Griffin called the balloon meet a fitting tribute to human innovation and ingenuity, linking 200 years of progress in aviation to the 25th anniversary of U.S. space exploration. "We hope the event will provide a visual reminder of how the first tentative

steps into a new realm with new technology have led us to unimagined progress for the benefit of mankind," he said.

Between 50 and 100 balloonists will take to the skies in three ascensions from the 550-acre field adjacent to the Rocket Park at JSC. America's official balloon for the 200th anniversary of manned flight, the "Freedom," will participate in the event.

The U.S. Congress has designated 1983 as the Air and Space Bicentennial, marking man's first flight in a hot air balloon in France in November, 1783. President Ronald Reagan and Vice President George Bush are honorary chairmen of the U.S. Air and Space Bicentennial Committee, which has sanctioned the JSC meet as an official bicentennial event.

Sponsors plan three balloon launches during the weekend, two

on Saturday at dawn and dusk and one at dawn Sunday. Balloon entries will be sponsored by local and national corporations and individuals, with proceeds from entry fees benefitting United Cerebral Palsy. U-Tote'M, a national contributor to the campaign, will spearhead fundraising activities. Individual balloonists enter at a nominal fee and may carry a sponsor's banner. Sponsorships range from \$250 to \$2,500.

NASA scholarship winners announced

Two \$1,500 scholarships were awarded recently — one to the son of a JSC employee — by the newly created NASA College Scholarship Fund, Inc.

Paul A. Schliesing, son of John A. Schliesing, Structures Division, Research and Engineering Directorate at JSC, was one winner picked from 397 applications NASA-wide.

James Pendergraft of Newport News, VA was the other winner. His father, Odis Pendergraft, works in the Transonic Aerodynamics Division, Aeronautics Directorate, at the Langley Research Center.

The \$1,500 scholarships are renewable annually up to a total of \$6,000. The scholarship program

began this year following a grant by author James Michener from some of the proceeds garnered by his latest book, *Space*.

Members of the Scholarship Committee and the Selection Board said they were "extremely impressed with the quality of the applicants." Many of those 397 who applied were in the top five percent of their classes; most scored 1,300 or better out of a maximum 1,600 on their SAT tests; and many had grade point averages above 4.0 on a 4.0 scale due to taking honors courses and being involved in outside activities.

Applicants represented each of the NASA centers, with JSC having the highest percentage, 18.89%.

Langley had 18.64% of the applicants and Lewis had 16.12%.

Both winners graduated with honors in May from their respective high schools and both intend to pursue degrees in science and technology in college.

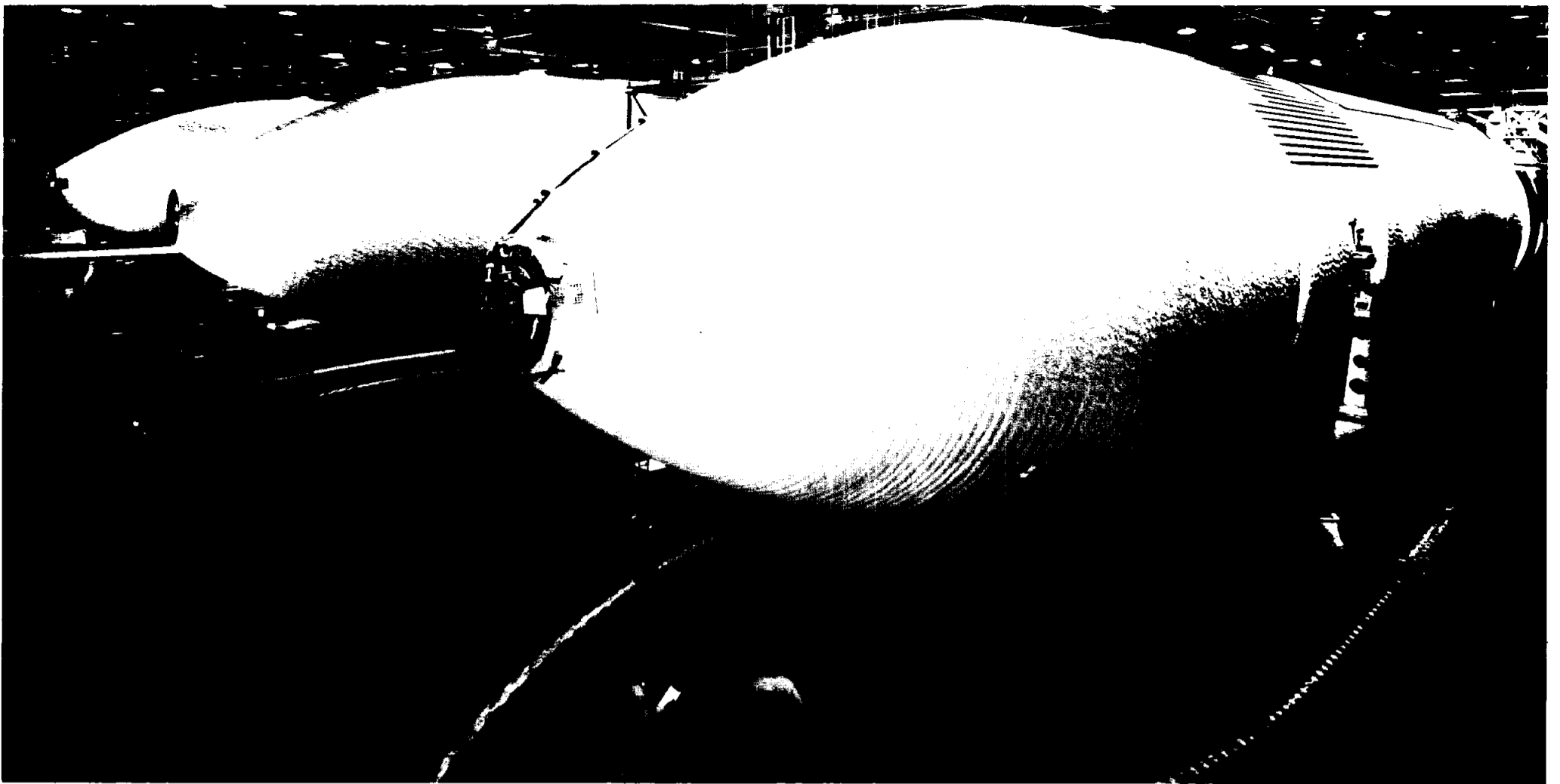
Schliesing graduated as valedictorian from Clear Lake High, first in a class of 713 with a grade point average of 4.0. During secondary school he was nominated each year by the faculty as a candidate for the top 15 students. He was a member of the National Honor Society for four years; winner of a first place award at the Greater Houston Science Fair; President of the Junior Engineering Technical Society and a winner of

two merit scholarships. He intends to attend Texas A&M and plans to pursue science and math as his major field of study.

Pendergraft graduated from Peninsula Catholic High School second in a class of 42 with a grade point average of 3.95. He was on the honor roll for five years during secondary school; won awards in math, French, chemistry and religion; was President of the National Honor Society at his school; served as editor and artist on the yearbook staff and was President of the Chess Club. He was accepted to the Massachusetts Institute of Technology, the Hulman Institute of Technology and Virginia Polytechnic Institute.

He is leaning toward VPI and plans to study computer engineering.

The Scholarship Committee will seek additional applicants next year as the scholarship award grows into an annual offering. The NASA College Scholarship Fund, Inc., a private foundation, received a favorable ruling from the Internal Revenue Service in June and is now listed as a tax exempt organization under Section 503(c) (3) of the IRS Code. This means donors may deduct contributions to the fund on their tax return, and that bequests, legacies, or gifts are deductible for Federal estate and gift tax purposes if they meet the applicable provisions of the code. For more information, contact Wally Grimes or Dr. Mike Duke.



Three Shuttle external tanks, destined to fly on missions 11, 12 and 13, are shown here in a hangar at the Michoud Assembly Facility in Louisiana. This is the first time that as many as three tanks have been in final assembly simultaneously, a prelude to future increases in yearly production goals. The 526,000-gallon tanks are built for NASA by the Michoud Division of Martin Marietta Aerospace.

Roundup Swap Shop

Ads must be under 20 words total per person, double spaced, and typed or printed. Deadline for submitting or cancelling ads is 5 p.m. the first Wednesday after publication. Send ads to AP 3 Roundup, or deliver them to the Newsroom, Building 2 annex. No phone-in ads will be taken. Swap Shop is open to JSC federal and on-site contractor employees for non-commercial personal ads.

Property & Rentals

For sale/lease: Sterling Knoll/CLC Wescon 3-2-2, new paint, fenced, mini-blinds, wet-bar, clean, never leased, \$595/mo plus deposit. Call Bo, 486-5621 (evenings).

For lease by owner: Beach condo assumption, never rented. Rental service available, \$9,000 equity. Consider partial 2nd lien. Call 488-3377 after 4:30.

For lease: Forest Bend, 4-2-2A, mural, mini-blinds, storm windows, fenced, \$550/mo. plus deposit. Call Carolyn, x3486 or 280-0021.

For Lease: New Middlebrook, 3-2-2, 7 min. from site, fenced, fireplace, ceiling fans. Call 486-0343.

For Lease: Baywind II condo, 1 BR/1 BA, corner fireplace, W/D, ice maker, tennis & pools, \$350/mo. plus \$250 deposit. Call Jim Feibelman, x3466 or 333-2877.

For Sale: University Trace Condo, 2-2-2, fireplace, wet bar, fenced patio, mini-blinds, W/D & refrig, well kept & assumable. Call 482-1228 after 6 p.m.

For Sale: El Dorado Trace condo, 2-2, ideal location, poolside, ceiling fan, appliances, walkup from green area. \$48,500 (negotiable). Call Dan Mangieri (days), 757-2395 or (nights) 488-5471.

For Lease: League City/Countryside new 4-2-2, on large cul-de-sac lot, near pool, park, tennis. Call Tim, x2276 or 488-6167.

For Lease: 10 acres, Alvin area, fenced, on paved road — horses/cattle. Call Damewood, 482-5572.

For Sale: Timeshare, Holly Lake Ranch, 1 week, RCI exchange privileges. Call 944-5786 after 5 p.m.

For Lease: Wedgewood, 2 story, 3-2.5-2, near Baybrook Mall, fireplace, both formal, \$525/mo. plus deposit. Call 486-9562.

For Rent: Galveston gulf-front condo. Low intro. rates, fully equipped & brand new, large pool & tennis courts. Call Nussman, 488-7762.

For Rent: League City, nice 3 BR, C/A, fenced yard. Call Ray, x4500 or 554-4119.

For Rent: Galveston/Jamaica Beach 4-2, sleeps 8, C/A, city utilities, swimming/boating, \$375 week. Call D. Smith, x2001 or 337-3970 (some weekends).

For Rent: Galveston By-The-Sea condo, 2 BR, furnished apartment for rent by day (2 minimum) weeks or month. Call Clements, 474-2622.

Cars & Trucks

1981 Citation, 4 door, V-6, AC, PB, PS, cruise control, AM/FM stereo, 30K miles, perfect condition. Below market value, \$4195. Call 332-2291.

1981 Citation, 4 door, V-6, AC, PB, PS, cruise control, AM/FM stereo, 31K miles, perfect condition. Below market value silver/maroon, \$4195. Call 332-2291.

Motorhome for rent, sleeps six, generator, AC, refrig., stove, shower,

bath, \$380/wk. plus 14 cents/mile. Call 486-9144.

1980 Olds Omega, 6 cyl., AC, vinyl roof, sunroof, cruise, AM/FM/Tape, 38K miles, new transmission, \$4000. Call Norris, x5495 or 488-2276.

1974 Mazda pickup, non-rotary engine, runs well, new battery. Call Ray, x5250 or 554-2908 after 6 p.m.

1981 Monte Carlo, PS/PB, AM/FM, AC, tilt/cruise, 32K miles, exceptionally clean. Call Ray, x5250 or 554-2908 after 6 p.m.

1975 LTD Brougham, 4 door, AC, AM/FM, cruise, new tires & brakes, \$1600. Call 941-4455.

1976 Chevy van parts, hood, rt. frt. door, rear doors, wheels & tires, bumper, taillights. Call Anderson, x7204 or 485-3025.

1976 Trans Am, PW, PS, electric door locks, runs good, \$2500. Call Frank, x5425 or 332-7383.

1971 Audi 100LS, clean, needs some brake work, \$450, Call 474-2906 after 6 p.m.

1977 Chevy Impala, 4 dr, new tires, one owner, excellent condition, \$1850. Call Glenn, x3695 or 480-0071.

1929 A-Model & 1959 Ford Fairlane 500. Call Cotton, x1122 or 471-5964 after 4:30 p.m.

1973 240-Z, mint condition, 64K miles, race body style, Imron paint, mags, \$4900/best offer. Call Joe, 488-0658.

1982 Blazer Silverado, 2WD/blue & white, power, air, tilt, cruise, stereo, fully loaded, \$10,500. Call Abston, 488-4296.

1981 Toyota pickup, 17K, diesel, bed liner, cover, mags w/radials, buckets, manuals, log, and much more, \$6795. Call R. Underhill, x2138 or 334-1303 after 4 p.m.

1972 Ford Courier P/V tailgate, two white spoke wheels w/usable tires mounted, \$25. Call Art, x2673 or 332-3153 (evenings).

1976 Buick Century, V6, \$850. Call Jack Brown, x3594 or 488-0433.

Cycles

1973 Kawasaki 175; 1973 Honda 75, make offer; 1976 Yam. 750, crashbar windshield, cruise, new tires & tune-up, \$1500; 1980 Honda 400 custom, 4,000 miles like new, \$1000. Call Frank, x5425 or 332-7383.

1977 Suzuki GS550 RC Header, S&W shocks, 30,000 miles, \$900. Call 333-6517.

1970 Honda 750, running when stored 3 yrs ago, full fairing, trunk, crash bars, helmets, etc., \$250. Call Sebastian, x3541.

26" Bicycle (Rockwood) 3 sp, new tire, new seat, good condition, \$60. Sears "Tourister" 3 sp bicycle, new \$180, ridden twice, \$125. Call R. Underhill, x2138 or 334-1303 after 4 p.m.

Audiovisual & Computers

SS-50 Bus 16K static memory boards manufactured by Digital Research Com-

puters and a Southwest Technical Products Corp. DC-3 double sided 5 1/4 inch floppy disk controller. Best offer. Call Tom Harmon, at x3511 or 480-6075 after 5:30 p.m.

Zenith Z-110-22 color computer, 2-320K drives both 8 & 16 bit processors, 128K memory, original cost \$4250 - sale price \$2900. lots of software. Call Fil, x3188 or 480-6109.

64K Ram T.R.S. 80 color computer with great selection of software. Call Clint Hall, x7428 or 480-6029.

AR-3 speakers, Scott receiver, Lab-80 turntable. Call A1, 486-9220.

AM/FM stereo receiver, Heathkit, 30 watts/channel, \$35. Call 488-1028.

Wanted

Steady ride to NASA, Bldg. 4 from Fairwind Apts on Space Center Blvd. Hours are 7:30 a.m. to 4 p.m. Willing to pay for gas. Need ride starting July 18. Call Deb, x5451.

Want to share ride from Clear Lake area to HCC - Health Careers during fall and spring. Call Rommel Martinez, x3869

Need one car pool partner. Carpool between S. Main at I-610 and NASA. Call Bob Patil, x6484 between 7 a.m. to 4 p.m.

Want to join carpool from 610 and Scott area to NASA, 8 to 4:30 shift. Call Angela, x3358 or x3350.

Want someone to drive a Datsun B-210+ to Huntsville, AL (or to Birmingham) ASAP. Car is in top shape. Call M. Hughes, 333-2287.

Want roommate to share 3-2-2 in Seabrook, \$250, 1/3 utilities, car pool possible. Call Allen, x2613 or 474-3648 after 5 p.m.

Want 2 roommates to share a 2 BR/2 BA furnished apartment with 2 co-ops. Rent \$165 + elec. w/\$100 deposit. Closest apart. complex to NASA and UHCLC. Lease length is flexible. Call James, x5073, or Chuck, x3071.

Want to babysit. Responsible 18 year old seeks to babysit children, homes, or pets. Available days, nights, weekends. Call Steve, 488-3354 or 480-4159.

Want a conscientious non-smoker to care for an unfurnished 3 BR house in Friendswood until house is sold. Very low rent. Call Jeff, x7429 or 483-7429.

Pets

Free puppies - 3/4 Saint Bernard & 1/4 Doberman. 5 weeks old. Call Gloria, x2031.

Free 7 month old puppies. 1/2 Chow 1/2 Labrador, black female, golden brown male. Call Ed, 480-1225 before 4:30 p.m.

West Highland White Terriers, 24 AKC Champion Line, two females, 6 week beauties, shots, \$375. Call John Jurgensen, x2504 or 488-8583.

Musical Instruments

Conn Constellation Cornet, excellent condition, no dents, 1st and 3rd valve

triggers, 2 mutes, leather hand grip; new \$375, asking \$190. Call Mike, x5592.

Drums - Tama (Imperial Star), ten piece trap set, \$1350. Call 481-2854 after 6 p.m.

Boats & Planes

Dinghy, 9 ft. aluminum Grumman, \$150. Call Alter, x5111. 16' Prindle Cat, 1981, better than new. Race-rigged or pleasure, perfect white hulls w/blue & white sails, \$3500. Call Michael, x3881.

For rent: Piper Lance - 6 place, 160 knots, full IFR, club seating, \$85/hr. wet. Call Damewood, 471-1675.

Household

Solid cherry bedroom suite, victorian couch and chair, oriental coffee table, antiques. Call 486-9220.

Dining room table and six chairs, antique green, \$95. Call 332-5892.

Queen mattress set, clean, excellent condition, \$75. Call Beth, x5581 or 554-2908 after 6 p.m.

Wood carved entry doors, 36" x 80" ea. Will sell singly (\$50) or as a set (\$100). Call Beth, x5581 or 554-2908 after 6 p.m.

Waterbed, king size, beautiful cherry-wood, complete w/pads & 6 drawers, \$500 or trade for children's bedroom suite. Call Kitty, 488-2500.

42" round dining table, 4 red velour chairs, chrome legs, excellent condition, \$100. Call Michael, x5576 or 484-7527 after 5 p.m.

3 p.c. living room set, velour burgundy, glass chrome coffee table and 2 end tables. All for \$250. Call Tam, x4949 or 534-3376.

Miscellaneous

Huffy riding mower. Excellent condition, \$400 firm. Call 333-2717 (evenings).

Forest Park/Lawndale, six burial spaces, beautiful location, \$2195. Call 488-1028.

Rohn Tower - top section #25AG-3 w/rotator mtg plate AS25G & base plate BPC-25G. All list for \$150 - sell for \$50. New Mobile mount for ICOM 22AT. New Simpsons model 390 volt-amp-wattmeter appliance tester - \$50. Call A. Girala, x3833 or 921-7212.

Diamond solitaire ring 1/3 karat, \$400. Call Dan, 480-4108 or 480-7054 (evenings).

FREE - landscaping rocks, small to medium sized. Call Cindy, x7236.

Robot SSTV monitor, \$150. Heath Apache TX & Mohawk RX, both \$150; MFJ Keyer & Ham Key, New \$60; Transoceanic, \$40. Call 481-5412.

Escort radar receiver, \$150. Call J. L. Day, x4731 or 664-9472 (evenings).

Wards multi-purpose utility trailer, 1000 lb gross weight, never assembled, \$170. Call Don, x4801 or 554-6894.

Decorator candlestick telephone, like new, plug-in jack, ivory color, only \$85. Call 488-4788.

Gilruth Center News

Call x3594 for more information

Hotshot — Come join the fun in this competition based on a one-minute display of basketball skills. The event will begin at 1 p.m. July 30 with a registration fee of \$2 per person. The deadline is July 26. Call the Rec Center for details.

Ladies self-defense — It's not too late to sign up for this 13-week course, where the basics of self-defense will be taught beginning Aug. 2. The class meets Tuesdays and Thursdays from 5:15 to 6:45 p.m. at a cost of \$35 per person.

Softball tournament — Registration is now underway for the next tournament, to be held Aug. 19, 20 and 21. The cost is \$65 per team and is limited to 24 teams, first come, first serve.

Children's dinner theatre — Back by popular demand, our next production will be "Nuts About Peanuts," a play preceded by lunch and dessert. The cost is \$2 per child and tickets are available in the Bldg. 11 Exchange Store. The lunch begins at 11:30 and the play concludes at 1:30.

Ballroom dance — Learn the fine art of dance in this class for intermediates beginning Aug. 4. Class time is 8 to 9 p.m. and the duration is eight weeks. The cost is \$25 per person.

Defensive driving — Learn to drive safely and qualify for a 10 percent reduction in your auto insurance rates through this class, which runs from 8 a.m. to 5 p.m. Aug. 20. The cost is \$20 per person and space is limited.

Ladies exercise — Come stretch with the gang for \$12 per person in this continuing Rec Center class.

Race — Some openings still exist for the July 23 Rendezvous Space Run, a five-kilometer race with T-shirts going to the first 500 runners. The cost is \$16 per person.