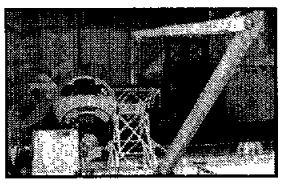
NASA
National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, Texas

Trophy winner

Former astronaut Tom Stafford is this year's winner of the National Space Trophy. Story on Page 4.



Fond farewell

Astronauts who operate the shuttle's robot arm lost an old friend last month, but gained a new one last week. Story on Page 3.

Space News Roundup

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Accident points out need for caution at crosswalks

By Kelly Humphries

JSC's Test, Operations and Institutional Safety Branch is reminding all drivers and pedestrians to use caution at crosswalks after an accident earlier this month that injured a Lockheed employee.

The employee, Isaac Sewell Jr., suffered a dislocated shoulder and a bruised arm about 6:15 p.m. Jan. 7 when he was hit by a car while in a crosswalk on Second Street just north of Bldg. 17.

The car was traveling north on Second in the left lane, and there was another car in the right lane that had stopped for the pedestrian. When Sewell stepped out from behind the car in the right lane, the other driver saw him but was unable to stop in time.

"This incident underscores the need for great caution around crosswalks on the part of both drivers and pedestrians," said Dan Clem of the Safety Branch. "It is especially critical to be careful at night, since JSC has a federal mandate to conserve energy and not all crosswalks are well-lit."

Clem offered some hints for drivers and pedestrians. Drivers should:

- Observe posted speed limits at all times and slow when in highly populated areas, at night or in bad weather.
- Check the entire walkway and surrounding walkways when approaching a crosswalk to make sure that are no pedestrians are heading your way. Do this well in advance of the crosswalk so you have time to stop.
- Double-check the crosswalk to be sure no one else has entered before moving on.
- Always assume that a pedestrian is crossing if you see a car slowing or stopped at a crosswalk.
- Be patient around crosswalks and stop early for pedestrians.
- Remember that pedestrians have the right-of-way at JSC crosswalks.

A pedestrian should be sure:

- Not to assume that cars will stop for you, and take responsibility for your own safety.
- To look for oncoming cars when approaching a street. Cross only when you are sure that drivers see you and are beginning to stop.
- To be especially careful at night because it is harder for drivers to see you. If possible, walk a little farther to a well-lit crosswalk. If your job requires you to work after dark every day, consider carrying a small flashlight.

NASA looks for senior executives

NASA is offering a revised Senior Executive Service Candidate Development Program as part of its effort to be ready when a large number of senior executives become eligible for retirement in January 1994.

Applications are being accepted nationwide through Feb. 12 of this year for the first group of candidates. To be eligible, candidates must have at least one year of experience in a senior position at the GS or GM-14 level or above, or equivalent experience, but they don't need to be current civil service employees. The program is expected to seek candidates annually.

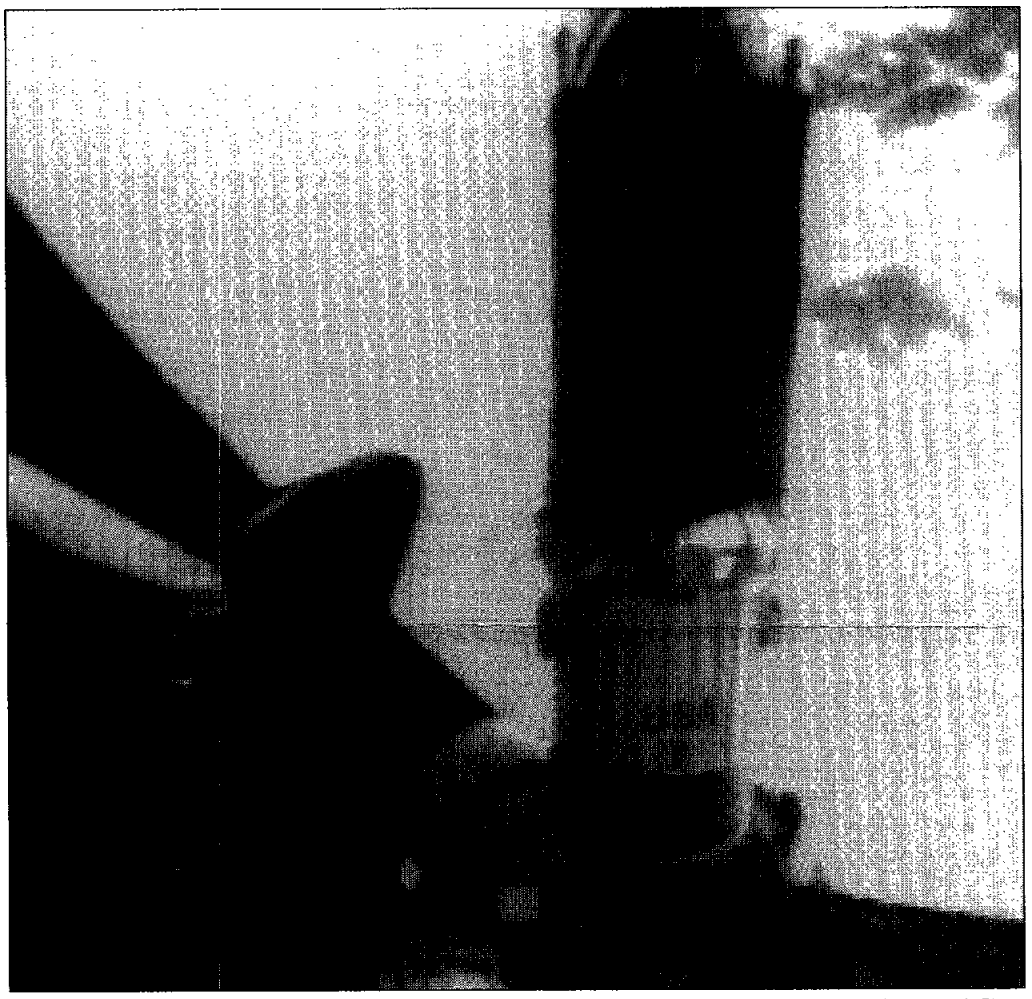
One important point is that program completion doesn't guarantee selection for an SES position in NASA, said Curtis Collins of JSC's Human Resources Office. However, program certification does allow candidates to be given an SES appointment immediately without further announcement of a position.

The purpose of the program is to develop a cadre of highly qualified men and women who represent the diversity of the work force to fill NASA SES positions, which are expected to be primarily in engineering and science. The training program will develop the skills necessary to perform in SES positions, orient participants to NASA organization and operation at the executive level and to broaden understanding of NASA programs, missions and issues.

Each center will evaluate candidates and separate them into "best qualified" and "qualified" categories. The agency's Executive Resource Board will make the final selections.

After selection, candidates will be assigned mentors to help them through the year-long training pro-

Please see **JSC**, Page 4



NASA Electronic Photo

Tracking and Data Relay Satellite-F rises slowly out of *Endeavour*'s payload bay Wednesday, about six hours after a 7:59 a.m. CST launch from Kennedy Space Center's Launch Pad 39B. The inertial upper stage attached to the bottom of the satellite was fired twice a little later to boost it into geosynchronous orbit. TDRS-F will be kept in a "ready reserve" status, available to be activated should one of its sister communications satellites become inoperative.

Endeavour crew lofts new TDRS

The crew of the Space Shuttle *Endeavour* accomplished its primary STS-54 task shortly after launch Wednesday and moved onto scientific and operational investigations of the cosmos, space physics and space biology.

Mission Specialist Mario Runco flipped the switch to deploy Tracking and Data Relay Satellite-F and its inertial upper stage booster at 2:12 p.m. CST.

"There she goes," said Runco.

"Not a sound," observed Mission Specialist Susan Helms, who worked with Runco to check out the fifth orbiting communications relay station in the NASA system.

"We have deployed the IUS/TDRS," Runco added as the satellite drifted away from *Endeavour*. "With a nudge from the IUS, TDRS-F will soon be on station standing by to provide continued worldwide communications and relay of scientific data from our satellites which seek to expand man's knowledge of the universe."

Commander John Casper then eased *Endeavour* away from the spacecraft before firing the orbiter's engines to move to a safe distance for the IUS's first rocket motor burn.

Following two successful booster firings, TDRS-F rose to its geosynchronous perch above the Marshall

Please see **STS-54**, Page 4

Panel says NASA needs to transfer technology better

While NASA enjoys a good reputation for transferring technology to industry, major improvements must be made in the way technology is transferred, according to a report released by NASA Administrator Daniel S. Goldin.

"NASA has the reputation of being the leader in technology transfer, but this position has eroded," Goldin said. "Our successes are modest compared to the amount of technology we generate.

"Our attitude that the transfer of our valuable technology will 'just happen' is no longer acceptable. It must be actively sought and given the highest priority," Goldin said.

The report of the Special Initiatives Team on Technology Transfer contains a series of findings and recommendations for changing NASA's culture to facilitate technology transfer, including:

- No comprehensive written document exists that explains the formal processes for technology transfer;
- Processes for technology transfer within NASA are too slow to meet industry's needs;
- Technology is not sufficiently developed to reduce technical risk to industry due to the costs and mission objectives;
- Employees, managers and contractors all too often do not believe technology transfer is part of their job;
- There is little or no infrastructure

Please see **STUDY**, Page 4

'Superpressure' balloon set aloft

NASA-sponsored university group studies ozone in stratosphere

A NASA-sponsored university group successfully launched its new "superpressure" high-altitude research balloon Tuesday morning and recovered its payload in Louisiana a day later.

The balloon began rising from the South Shore Harbor Resort and Convention Center in League City at 7:53 a.m.

Dr. Jim Wilson, director of the Texas Space Grant Consortium, which participated in the effort sponsored by NASA's National Space Grant College and Fellowship Program Office, said the flight was a success although the balloon failed to reach its planned altitude.

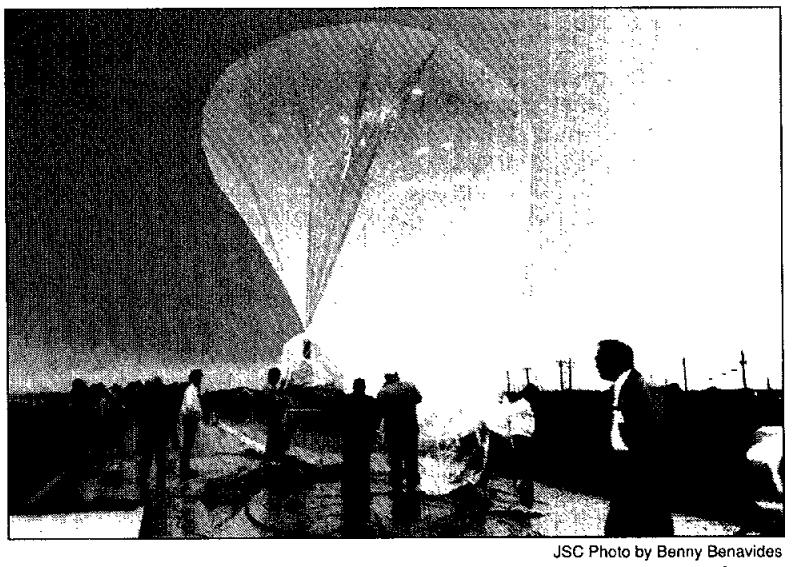
The flight inaugurated a cooperative program to measure ozone distribution and wind parameters in the Earth's stratosphere.

Throughout the day-long flight, teams of amateur radio operators in Texas and Louisiana tracked the balloons project, before sending the command to parachute its 50-pound gondola back to Earth for recovery and reuse.

The balloon was supposed to have risen to 110,000 feet, but only reached about 85,000 feet and did not catch the strong jet stream air currents as planned. Wilson said the instrument package was recovered but that there was no immediate word on the quality of data returned.

The instrument package was designed and built by a volunteer team of space grant students and faculty from Utah State University's Space Dynamics Laboratory and from the Bridgeland Amateur Radio Club in the Cacha Valley of northern Utah.

The balloon is a revolutionary "superpressure" design manufactured by Winzen International of San Antonio and Sulphur Springs, Texas. It is fabricated of Nylon film thinner than a human hair and is designed to stay aloft continuously for a year or more.



JSC Photo by Benny Benavides

Members of a NASA-sponsored university team prepare to release a high-altitude research balloon Tuesday morning.

JSC

Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Gift Store from 10 a.m.-2 p.m. weekdays. For more information, call x35350 or x30990.

EAA Houston Livestock Show and Rodeo Performances (Astrodome); $9, limit 4 tickets.

EAA Guys and Dolls (2 p.m. Jan. 24, Jones Hall): $30, limit 4 tickets.

Houston Livestock Show and Rodeo Carnival Ride Tickets — Forty ticket sheet available for $12, half price. Order tickets until Feb. 1. Tickets available for pick up in mid-January.

Space Center Houston — Discount tickets: adult, $7.50; child (3-11) $4.50; commemorative: $8.75.

Metro tickets — Passes, books and single tickets available.

Movie discounts — General Cinema, $4; AMC Theater, $3.75; Loews Theater, $4.

Entertainment '93 and Gold C coupon books, stamps, Walt Disney Club memberships also available.

JSC

Gilruth Center News

Sign up policy — All classes and athletic activities are first come, first served. Sign up in person at the Gilruth Center and show a badge or EAA membership card. Classes tend to fill up four weeks in advance. For more information, call x30304.

EAA badges — Dependents and spouses may apply for photo identification badges from 6:30-9 p.m. Monday through Friday. Dependents must be between 16 and 23 years old.

Defensive driving — Course is offered from 8 a.m.-4:30 p.m. Feb. 6. Cost is $19.

Weight Safety — Required course for employees wishing to use the Gilruth weight room is offered from 8-9:30 p.m. Jan. 21. Pre-registration is required; cost is $5.

Aerobics — High/low-impact classes meet from 5:15-6:15 p.m. Tuesdays and Thursdays. Cost is $32 for eight weeks.

Exercise — Low-impact class meets from 5:15-6:15 p.m. Mondays and Wednesdays. Cost is $24 for eight weeks.

Bench aerobics — Class meets from 5:15-6:15 p.m. Mondays and Wednesdays. Cost is $32 for eight weeks; participants must provide their own benches.

Aikido — Martial arts class meets Tuesdays from 6:15-8 p.m. Cost is $15 per month.

Fitness program — Health Related Fitness Program includes medical examination screening, 12-week individually prescribed exercise program. Call Larry Weir, x30301.

Intercenter Run shirts are still available at Gilruth.

JSC

Dates & Data

Today

Cafeteria menu — Special: Italian cutlet. Entrees: braised beef ribs, chicken a la king, enchiladas with chili. Soup: cream of broccoli. Vegetables: navy beans, Brussels sprouts, whipped potatoes.

Tuesday

Blood drive — Krug and Johnson Engineering will host a blood drive from 8:30-11 a.m. Jan. 19 in the parking lot at 1290 Hercules. For more information, call Beth Brumley, 488-5970, or Lane Bowen, 480-8101.

Cafeteria menu — Special: stuffed cabbage. Entrees: turkey and dressing, round steak with hash browns. Soup: beef and barley. Vegetables: corn cobbette, okra and tomatoes, French beans.

Wednesday

TQM seminar — The first Centerwide TQM Brownbag Seminar will be at noon Jan. 20 in Bldg. 12, Rms. 254 and 256. SR&QA Deputy Director Gary Johnson will discuss "JSC's Benchmarking Implementation Plan." For more information, call Don Simanton, x39519.

Toastmasters meet — The Spaceland Toastmasters Club will meet at 7:15 a.m. Jan. 20 in the Bldg. 3 cafeteria. For more information, call Darrell Boyd at x36803.

Cafeteria menu — Special: pepper steak. Entrees: catfish with hush puppies, roast pork with dressing. Soup: seafood gumbo. Vegetables: broccoli, macaroni and cheese, stewed tomatoes.

Thursday

Blood drive — Barrios Technology will host a blood drive from 8:30-11:30 a.m. Jan. 21 in the parking lot at 1331 Gemini. For more information, call Tom Hanson, 283-5696.

Cafeteria menu — Special: chicken fried steak. Entrees: beef tacos, barbecue ham steak, Hungarian goulash. Soup: turkey and vegetable. Vegetables: spinach, pinto beans, beets.

Friday

Cafeteria menu — Special: tuna and noodle casserole. Entrees: liver and onions, deviled crabs, roast beef with dressing. Soup: seafood gumbo. Vegetables: whipped potatoes, peas, cauliflower.

Jan. 25

Cafeteria menu — Special: breaded cutlet. Entrees: beef chop suey, Polish sausage with potato salad. Soup: French onion. Vegetables: okra and tomatoes, green peas.

Jan. 27

Freedom Fighters meet — The Space Station *Freedom* Fighters will meet at noon and 5 p.m. Jan. 27 in the second floor auditorium of the McDonnell Douglas Tower, Space Center Blvd. and Bay Area Blvd. For more information, call David Cochran at 482-7005.

Jan. 28

AIAA meets — The American Institute of Aeronautics and Astronautics Houston Section will meet at 5:30 p.m. Jan. 28 at the Gilruth Center. Robert Thompson, vice president of Houston Operations for McDonnell Douglas Aerospace, will discuss "Key Decisions in Aerospace History." Dinner cost is $9 for members, $10 for non-members and $8 for students. Deadline for dinner reservations is noon Jan. 24; call x31350, 333-6064, 283-4214 or 282-3160.

SOLE meets — The Houston Chapter of the Society of Logistics Engineers will present a review of the 5th Space Station Logistics Symposium papers at 5:30 p.m. Jan. 28 at the South Shore Harbour Country Club. Dinner is $8; for reservations call 283-1096, 333-6710, 283-5693, x33584, or x33661.

Feb. 2

Lunch and learn — The American Institute of Aeronautics and Astronautics Automation and Robotics Technical Committee will meet at 11:30 a.m. Feb. 2 in Gilruth Center Rm. 206. Dr. Nazareth Bedrossian of Draper Laboratories will discuss "Control of an Underactuated Two-Link Manipulator." For more information, call Zafar Taqvi at 333-6544.

Lunch and learn — The American Institute of Aeronautics and Astronautics Space Imaging and Astronaut Observations Technical Committee will meet at noon Feb. 2 in Bldg. 31, Rm. 129. Dr. Karl Henize will discuss "Image Processing for Orbital Debris Analysis." For more information, call Kam Lulla at x35159, or Michael Snyder, x35171.

Feb. 15

Call for papers — The 1993 Conference on Intelligent Computer-Aided Training and Virtual Environment Technology has issued a call for abstracts due by Feb. 15. Send abstracts of up to 250 words to R. Bowen Loftin, PT4. For exhibits information, call Don Myers, 283-3821. For information, call x39071.

JSC

Swap Shop

Swap Shop ads are accepted from current and retired NASA civil service employees and on-site contractor employees. Each ad must be submitted on a separate full-sized, revised JSC Form 1452. Deadline is 5 p.m. every Friday, two weeks before the desired date of publication. Ads may be run only once. Send ads to Roundup Swap Shop, Code AP3, or deliver them to the deposit box outside Rm. 147 in Bldg. 2. No phone or fax ads accepted.

Property

Sale: Crystal Beach lots on Bolivar, 4 lots avail, $2K/ea. 921-7212.

Lease: Friendswood/Forest Bend, 3-2-2, formal dining, ceiling fan, FPL, fenced, refrig, gar door opener, no pets, $695/mo. 482-6609.

Sale: LaPorte, 3-2.5-2, 2-story, cath ceilings, formal dining, hot tub, lg deck, $65.5K. 283-5858 or 470-8330.

Lease: Webster, 2-2, carport, W/D, FPL, ceiling fans, lg closets, no pets, $550/mo. + dep. 485-6021.

Sale/Rent: Baywind II condo, 1-1, W/D, refrig w/icemaker, new paint, dishwasher. Steve, 244-7474 or 486-8047.

Sale: Meadowgreen, 2-story, 1 BR up, gameroom, courtyard, storm shutters, new paint in, wood/new-vinyl floors, landscaping, oversized lot, $108K. Janet, x35295 or Randy Barr, 333-1700.

Sale: Harbour Park, 4-2.5-2D, 2440 sq ft, master dn, ceramic tile kitchen, landscaping, $129K. 334-3083.

Sale: Lake Livingston lot, 140 x 80, trees, pool, boat ramp, was $2.4K, sell for best offer over $500. 488-5445.

Sale: Lake Livingston, 2 lots, $5K. James, x36666 or 487-5730.

Cars & Trucks

'86.5 Nissan 4 x 4 hardbody PU, Kingcab, AM/FM/cass, blk, $6.5K; '59 Chevy PU for restoration or parts. 334-2335.

'77 Grand Prix, new eng ('91), new trans ('90), new radiator, starter, alternator, master cyl, brakes, $895 OBO. David, 282-3827 or 554-5514.

'91 Camaro RS, wht, stereo, cass, air, auto, $9K negotiable. 487-2383.

'79 Oklahoma Jeep, looks and runs good, $3.7K OBO. Tim, 489-7286.

'90 Ford Probe, blue, gray int, new tires/brakes, good cond, $7.2K OBO. Kim, x38408 or 585-4657.

'85 CJ7 Laredo, AC, PS, $5.5K; blk desk w/bookcase, $85; 4 motorcycle helmets, BO; Nissan hub caps, BO. 474-4742.

'87 LaBaron, 4 DR, all pwr, cc, AC, new ft tires, 73K mi; good cond, $3.7K. 283-1229 or 333-7685.

'79 Ford Granada, high miles, good cond, $850. George, x30434 or 480-2645.

'86 Nissan Stanza Wagon, blue, lots of storage, 4 DR, $3K. 996-5191.

'68 Mustang, 289 V8, auto, PS, factory AC, good cond, $4.7K. 334-5067.

'78 Volvo 264 GL, 6 cyl, auto, less than 100K mi, one owner, sunroof, FM stereo, PW, AC, good cond, $1850. Gary, 283-5781 or 480-9716.

'90 Mazda Protege, 4 DR, PW/PL, 1800 cc motor, manual trans, assume loan at JSC Credit Union, $298/mo. or $7.5K. x32949.

'67 Ford PU, hi miles, homely, rungs good, util vehicle, $800 OBO. x38893.

'85 Pontiac Trans Am, loaded, t-tops, ignition kill sec sys, orig factory eng, 70K mi, ex cond, $6.5K OBO. Chris Knight, 332-5629.

'66 Ford Mustang Conv, 289, auto, mech and int restoration complete, red w/blk int/top, $8750. 480-5404.

'87 Honda Accord LXi, blue, 5 spd, AC, cruise, tilt, elec sunroof, one owner, good cond, $4K OBO. Gloria, x31891 or 538-2283.

'84 Chev Caprice, 4 DR, pwr windows, AC, AM/FM/cass, good cond, $2.4K. Allan, 472-7526.

Boats & Planes

Half interest in IFR P-35 Beech Bonanza, $15K. Steve, 244-9625.

Cycles

'70 Honda SL 350, new tires, runs good, $400. 332-0330.

Audiovisual & Computers

Apple II GS, mouse, stereo spkrs, software, $800; 286 PC motherboard, $80; Yamaha Clavinova upright kybd, $700. Ken, 280-2239 or 576-2372.

Nintendo, 2 cartridge, Mario 3, $50. 480-2973 or 333-6225.

Apple Macintosh SE/30 w/Radius 19" 2 page display, 40 MB HD, 5 MB RAM, loaded, $3.5K; SE/30, $2.5K; monitor, card, $1.1K; NEC laser printer, postscript, $1.3K. 480-9848.

Peavey Vegas 400 amp, 210 watt output, $450 OBO. Jeff, 283-4175 or 451-0361.

Photographic

Meade 6" f/8 telescope w/motor drive, 9 and 25mm modified Achromatic eyepieces, 7 mm Erfle eyepiece, 2x telenegative amp, Nebular filter, adaptor for Canon 35mm, $550 OBO. Jeff, 283-4175 or 451-0361.

Household

Kg sz waterbed, complete, 12 drawer pedestal, semi-motion, mirrored/shelved hdbd, $250 OBO. 474-9262.

Persian carpet, 100% silk, handmade, 3.5 x 5.5, $4K OBO; Persian carpet, wool w/silk flowers, handmade, 10 x 12, $3.5K OBO. 488-0345.

Wanted

Want Nordic track x-country skii exerciser. 334-2335.

Want parts for '85 Corolla, GTS, RWD, manual trans, rear end. Mike, x38169 or 482-8496.

Want to rent 3-4 BR house or TH, CA/H, 2 car attached gar, monitored sec sys, $1K/mo., CL, NASA or Friendswood area. Jim, x32722 or 726-0653.

Miscellaneous

Engagement ring, 1/2 ct. marquise dia w/3 baguette gems on either side, was $1K, now $900. Pete, x38614 or 332-6755.

Lg metal office desk, good cond, $40; 3 jaw lathe chuck, 6" dia, 1-1/2 x 8 thread bore, $85; coolant pump w/1/4 HP motor, $30; Ringo Ranger 2 meter antenna ARX-2B 134-164 MHz, $40. 921-7212.

2 Womens coats, 1 full length leather, maroon, sz 12, $50; sz 12 mid-length violet winter coat, $20. 474-9262.

Golf clubs, Tour Model III, 1-SW, $15.95/club, metal woods, 1, 3, or 5 wood, $35/club. David, 554-5514.

Acura copper beryllium irons, 3 thru PW, Northwester driver, 3 wood w/bag, $125; Precision made irons, 3 thru PW, Nexxus grips, was $190, now $145. 479-3353.

Shop manual for '81 Chevy lt duty trucks, $10; service guide, elec, vacuum troubleshooting, elec schematics for '86 Aerostar, $15. Ed, x31452 or 486-4002.

5 alum wheels, 12" wide by 16.5" dia, 8 lug, ex cond, was $700, now $250. 283-1834 or 332-4807.

'89 Crate 120c stereo chorus guitar amp, 2 channels, reverb 120 watts RMS, good cond, $300. Dan, 335-5957 or 286-2436.

Golf clubs, 2-9 iron, wedge, bag, cart, cord grips, copper faces, $65. x35258 or 482-0374.

Valley tow bar, $35; 2 padded swivel chairs, yellow, $50; 8' yellow floral print couch, $100; 2 gable mount attic exhaust fans, $60. Dick Meyer, 283-5306 or 333-2476.

Carrier 3-ton compressor/condenser unit, professionally disconnected, good cond., $100; oak for firewood, needs splitting, felled last fall, can deliver, make offer. x49878.

Aquarium, oceanic 26 gal 36" l x 17" h x 13" w, w/beveled front corners, mirrored back, finished wood stand w/storage cabinet, aerator setup, bottom gravel, therostatic water heater, filtration sys, artificial plants, ricks, cleaning access, chemicals, food, was $500, now $150 OBO. Cathy, 280-0754.

Four 4' x 18" concrete culverts, $100; 2 four way traffic lts, one for parts, one to restore, extra lenses, ex cond, $100; ping pong tbl, regulation sz, fold up type, all access, $75. Mike, x34318 or 559-1457.

Grundig stereo, $125; contemp sofa, $175; French Prov sofa/loveseat, $375; contemp sofa/loveseat yellow/ivory plaid, $275, ex. cond. 532-2228.

Triumph TR3 parts, body, brake, eng parts, chrome trim. Dick Meyer, 283-5306 or 333-2476.

Elec typewriter, Brother CE-50, w/computer interface unit, IF-50, extra type wheels, print ribbon, corr tape, $125 OBO; Portable elec typewriter, Brother EP-20 w/AC pwr supply, extra ribbon cartridges, $60 OBO; Smith-Corona manual typewriter, $15 OBO. Cathy, 280-0754.

Ladies Lange ski boots, sz 6.5, $40. x38402 or 337-3977.

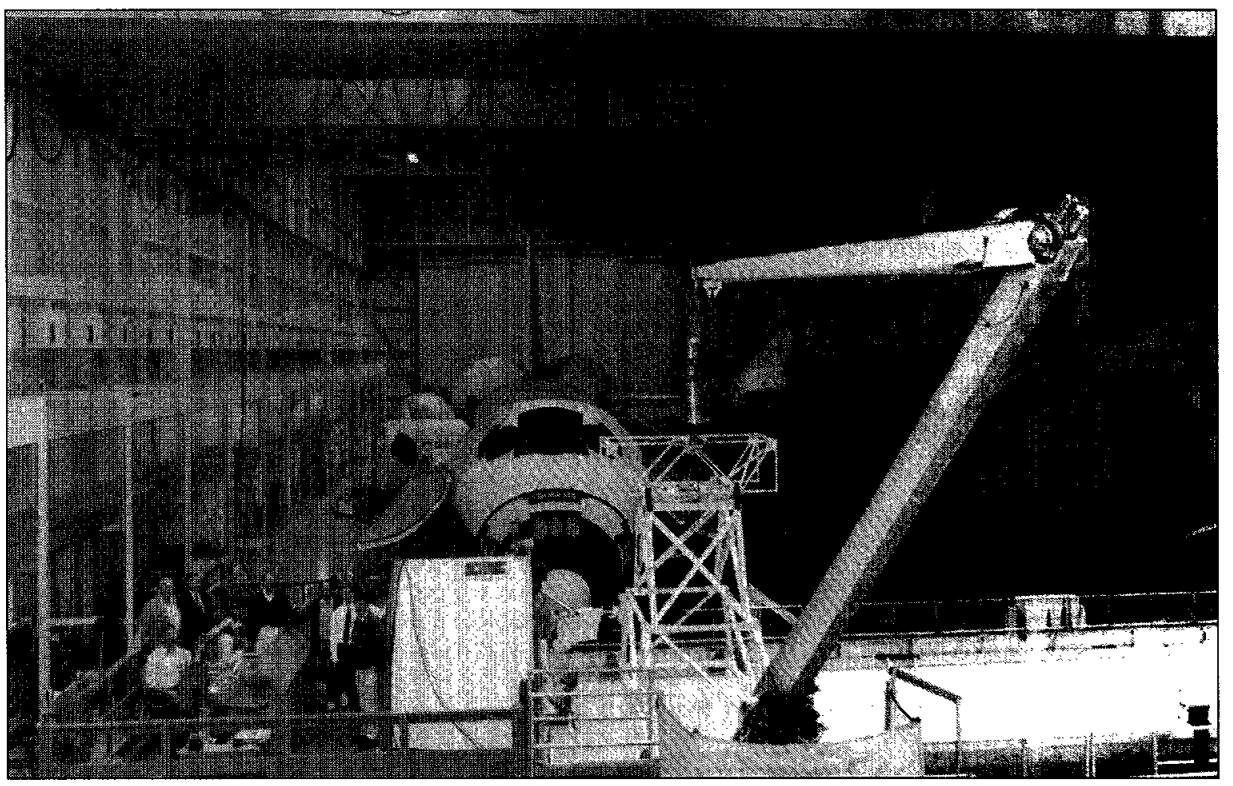
Jenny Lind baby crib, mattress, changing table, $150; Little Tykes turtle sandbox, $15; Cosco high-chair, $15. 486-8380.

English riding saddles, 15" and 17", good cond, best offers. 409-948-8844.

Sweetheart wedding gown, long sleeves, v-neck/backless, sz 6, $600. 337-4182.

Last Hurrah

Manipulator Development Facility ends 20-year career of helping train shuttle robot arm operators



By Kelly Humphries

Last month, the astronauts who run the shuttle's remote manipulator system lost their right arm—as far as training goes—but this week they have a new one.

The Manipulator Development Facility, which was used to train every astronaut who ever operated the shuttle's robot arm, made its last run on Dec. 21. The new MDF, which incorporates the lessons learned over two decades of development and use, became operational this week in Bldg. 9 North.

"It's interesting that the very last test on the MDF concerned the operations of the very first station flight," said Mike Veres, who designed the last test run with the veteran MDF. Veres is RMS mission designer for the first Space Station Freedom construction flight.

Astronaut Kathy Thornton piloted the MDF on its final run using the aft flight deck windows and television monitors to check the feasibility of mating the station's mobile transporter with the shuttle's unpressurized berthing adapter. The MDF's excellent visual cues helped point out a need to make some changes that will give the arm operator additional insight into how the operation is going, Veres said.

Lynn Harvey, who at one time or another has been MDF project engineer, facility manager and test director—or all three—said the MDF grew out of the initial work to develop a manipulator to handle shuttle payloads on orbit. It wasn't until after the concept of using the 50-foot arm on the shuttle was approved that folks decided to make the prototype a trainer.

Work on the MDF began about 1972 when JSC appointed a task group to monitor robotics and manipulator efforts going on at the NASA centers. In 1974, JSC appointed the mostly civil service team to develop an orbiter payload handling system, and that task group quickly became a working group to investigate the use of large manipulator arms aboard the orbiter.

The original working group was headed by Al Louviere and later Glen Miller, and Harvey became lead engineer after a succession of others who went on to different work.

That working group, which began with a commercially built manipulator and developed the 1-g arm in house, submitted its findings and recommendations in 1975, and its work was passed on to Rockwell International and the Canadian government as the basis of the "Canada arm's" design.

"We were basically working fast and dirty, just trying to test out concepts and get them working," Harvey said.

It was about that time 1975, that the decision was made to turn the MDF into a training facility with Northrop Services Inc. as the support contractor. Since then, it has performed 222 technical test for payloads and sophisticated control systems for the robot arm, participated in all flight contingency situations that called for RMS corrective actions—such as the Westar, Palapa, Solar Max, Syncom and Intelsat VI rescue missions—all without any serious injuries.

> *'The people that worked at this facility over a long period of time have developed a 'can-do' supportive philosophy of supporting the crews. Our main objective was to get the job done.'*
>
> — Lynn Harvey

"What happens at this facility and happens nowhere else is that when you begin to have collision problems you can identify them, you can learn how to correct for them, and you can learn how to keep them from occurring in the first place," Harvey said. "When we originally built this facility, the crews didn't express a great deal of interest because they thought the off-line complexes such as the SMS with its visual displays would be good enough. But after they began to use this facility they found out this is the only facility that's got a real arm out there, a real payload and a real payload bay."

Flight Crew Operations Deputy Director Steve Hawley, who trained extensively on the MDF for his job of deploying the Hubble Space Telescope with the shuttle's arm, said the MDF offers something that other simulators don't.

"It's the only place where you have a real arm, a real payload and a mock-up of the orbiter structure," Hawley said. "I always felt if you could do it in the MDF, you could do it for real."

The MDF also is a particularly valuable tool for beginners because it provides an easy way to correlate arm movements with the arm's sophisticated, but somewhat arcane coordinate system, Hawley said.

In addition to its important contributions to training and contingency planning for both astronauts and flight controllers, the MDF helped the arm's designers create sophisticated control modes that make the arm easier for astronauts to operate. The first of these control modes, for example, allowed an astronaut to fly the arm as if he or she were sitting on the end effector, which makes it much easier to reach and grapple payloads.

But those control modes wouldn't work right until Harvey and John Smith, who now is in charge of putting together the new MDF, tracked down the need for a shoulder joint motor that would deliver more torque. It took a year or two to figure out why the arm wasn't working like they thought it should. The new motor only cost about $500, but it made all the difference.

"John and I went out there and cranked up the system, and it was the first time we ever really saw true sophisticated control modes at work, and that was pretty exciting," Harvey said.

There were some humorous times at the MDF, as well. Harvey remembers the time he got a call saying that one of the astronauts had caught the arm on an I-beam in the ceiling.

"A certain astronaut—who will go unnamed—was monkeying around with the manipulator arm trying to find out how high it would reach," Harvey said. "The arm was basically straight up. When I went out there the astronaut was standing over there and Sally Ride was there and everyone was looking straight up in the air. I went to Sally and said 'Who did this?' and she said 'Don't look at me, I didn't do it.'"

Harvey rode a lift up to the ceiling and determined that a bolt head was caught on the I-beam. He got a rope, tied it onto the arm and with the help of five technicians pulled the end of the arm sideways a fourth of an inch until the bolt head could slip off the lip of the I-beam.

The MDF had some shortcomings, as well. During construction of the real arm, some minor changes were made in the lengths of the arm and forearm and those changes were never made to the training arm. In addition, when the arm is deployed on the shuttle, it swings out of the payload bay, so that it has a fuller range of motion than the MDF.

These changes were taken into consideration during the design of the new MDF so that astronauts will have an even more realistic training tool, Harvey said.

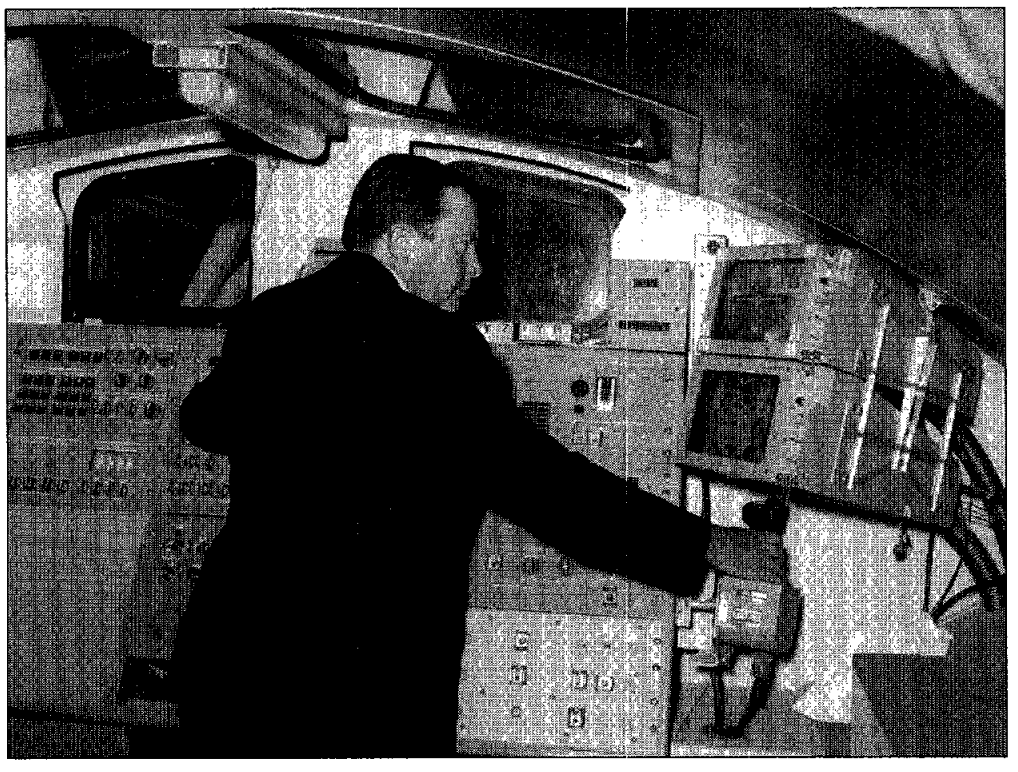
In addition, The MDF was fairly unreliable until the STSOC contract took over as support contractor in 1986 and began to use quality control guidelines to document and upgrade its systems and workings.

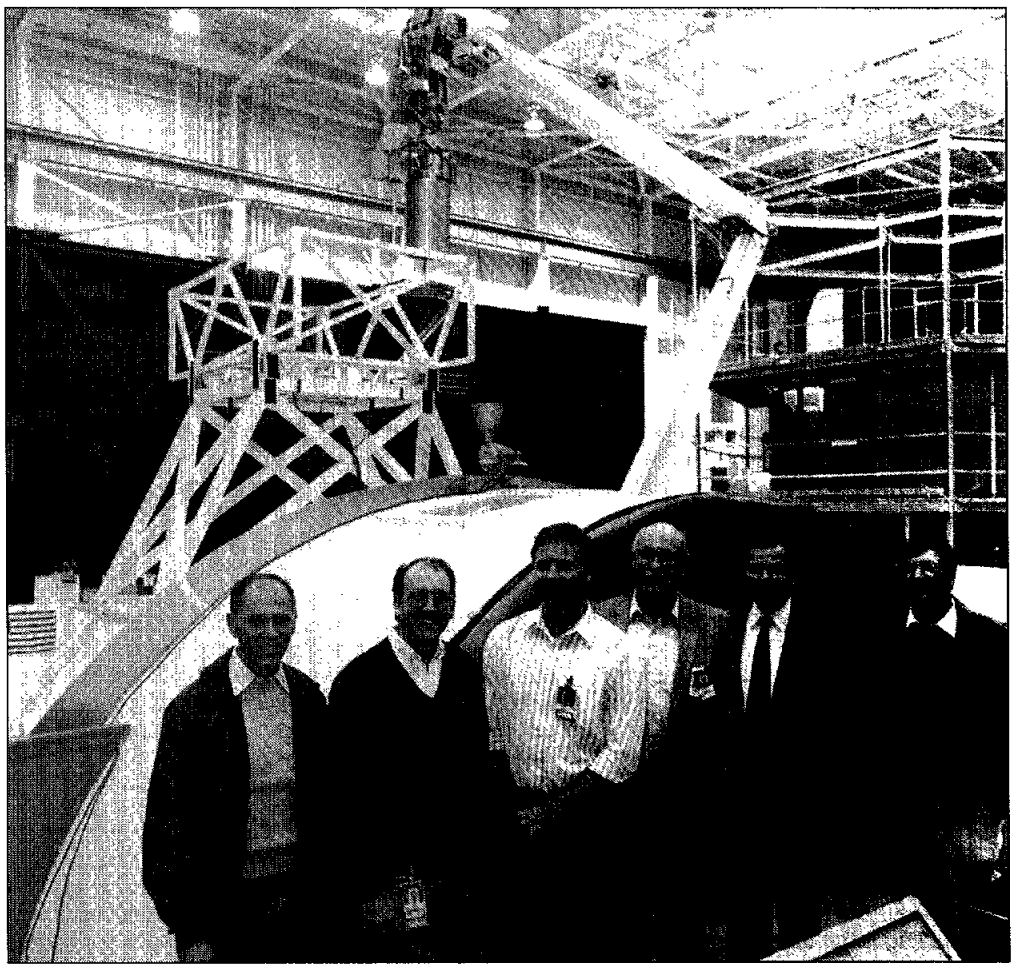
Over the years some 60 or 70 people worked to keep the MDF running, and it was through their efforts that its successes were made, Harvey said.

"The people that worked at this facility over a long period of time have developed a 'can-do' supportive philosophy of supporting the crews," he said. "Our main objective was to get the job done."

The new MDF is going into service just three weeks after the old MDF was shut down, a requirement specified by the astronauts who said they didn't want to do without one for six months. The new MDF utilizes several expensive systems from the old MDF, such as its closed-circuit television camera system, to save money.

Much of the old MDF's equipment will be used in other systems. For example, the crew station is scheduled to be moved to the Weightless Environment Training Facility as a control station for its underwater robot arm; other parts will be used in the construction of the Mobile Remote Manipulator Development Facility that will be used to train Space Station *Freedom* crews in the use of their manipulator. ❑





JSC Photos by Benny Benavides

Top: Workers prepare for the final test using JSC's veteran Manipulator Development Facility. The night test, which involved darkening all of the Bldg. 9 high-bay, tested the feasibility of mating the Space Station *Freedom*'s mobile transporter with the shuttle's unpressurized berthing adapter. Above: Lynn Harvey takes a final turn at the control panel he helped develop. Right: The team that worked on the final test included, from left, Lonnie Cundieff, crew interface; Jim Clark, MDF technician; Mark Webb, test director; Harvey; and Mike Veres, robot arm mission designer for the first Space Station *Freedom* construction flight.

Astronomers find huge concentration of 'dark matter'

Astronomers have discovered a huge concentration of mysterious "dark matter" using the international ROSAT X-ray observatory, some of the strongest evidence to date that the expansion of the universe, slowed by the pull of gravity, eventually may stop.

The discovery also appears to confirm previous suggestions of where most of the dark matter in the universe may be concentrated, namely in and around small groups of galaxies, according to astronomers.

"The new findings add much weight to the theory that most of the mass of the universe consists of dark matter, the precise nature of which remains unknown to scientists," said John S. Mulchaey of the Space Telescope Science Institute, Baltimore, Md., and the University of Maryland, College Park.

Dark matter is believed to exist although it has never been seen because it emits no radiation. Its existence has been inferred because fluctuations observed in the Big Bang—the explosion presumed to have created the universe—did not have sufficient gravitational pull to cause ordinary matter to coalesce immediately. It is presumed that dark matter, attracted to the weak gravity of the fluctuation, got the process started.

Dark matter may constitute up to 95 percent of the mass of the universe. Confirming its existence and volume would mean that there might be enough mass in space to "close the universe." This means that eventually the expansion of the universe, which is being slowed by the pull of gravity, would come to a halt or nearly so.

The discovery was made using x-ray pictures of three galaxies known as the "NGC 2300 group," about 150 million light-years from Earth in the direction of the northern constellation Cepheus. The images were taken from April 25-27, 1992, according to Dr. Richard F. Mushotzky of Goddard Space Flight Center. They show that the small group of galaxies is immersed in a huge cloud of hot gas, about 1.3 million light years in diameter.

"A cloud like this would have dissipated into space long ago, leaving nothing for us to detect, unless it was held together by the gravity of an immense mass," Mushotzky said. "The mass required to restrain the cloud is about 25 times greater than the mass of the three galaxies that are present."

This is the first time that a multimillion degree gas has been found to pervade a small group of galaxies, he explained, although such gas has been detected in larger clusters of galaxies and scientists suspected its presence in small clusters.

Results from the Hubble Space Telescope and other satellites already have shown that if the leading version of the Big Bang theory is correct, then 90 to 95 percent of the mass in the universe must be in the unknown "dark" form. This means that there must be 10 to 20 times as much dark matter by mass as ordinary matter.

"The universe is like the pre-industrial United States, in which the most conspicuous population concentrations were in a few big cities, but in which most people actually lived in small towns and rural America," he said.

If small groups of galaxies all have comparable ratios of dark to ordinary matter, Mulchaey explained, then the mystery of where most of the dark matter in the universe is located has been solved.

Although some scientists have suggested that the dark matter might be preferentially concentrated in small groups of galaxies, direct evidence was lacking until ROSAT observations were made. Further work is needed to confirm a discovery of this magnitude.

The discovery was announced at a meeting of the American Astronomical Society in Phoenix by Mulchaey; David S. Davis, Goddard Space Flight Center and the University of Maryland; Dr. Richard F. Mushotzky; and Dr. David Burstein, Arizona State University, Tempe.

ROSAT, an acronym for Roentgen Satellite, is a joint project of Germany, the United States and the United Kingdom.

Seminar eyes UHCL science

JSC will play host to a special seminar on "Programs in the School of Natural and Applied Sciences at the University of Houston-Clear Lake at 10:30 a.m. Wednesday at the Gilruth Center.

The free seminar is being presented jointly by the American Institute of Aeronautics and Astronautics Education and Professional Development Committee and the Institute of Electrical and Electronics Engineers Galveston Bay Section Education Committee.

The seminar will cover offerings in the areas of computer, software, robotics and control engineering. Reservations are required; call Frankie Hap at 333-6064.

STS-54 homecoming celebration planned

A homecoming celebration at Ellington Field is being planned to welcome the STS-54 crew about 10 hours after landing.

Based on a 7:31 a.m. Tuesday landing, the ceremony would begin outside Hangar 990 about 5:30 p.m. For the latest time, call the Employee Information Service at x36765.

Tax changes detailed

JSC's Black Employment Program Council will host a tax information and electronic filing seminar at 11:15 a.m. Thursday at the Gilruth Center.

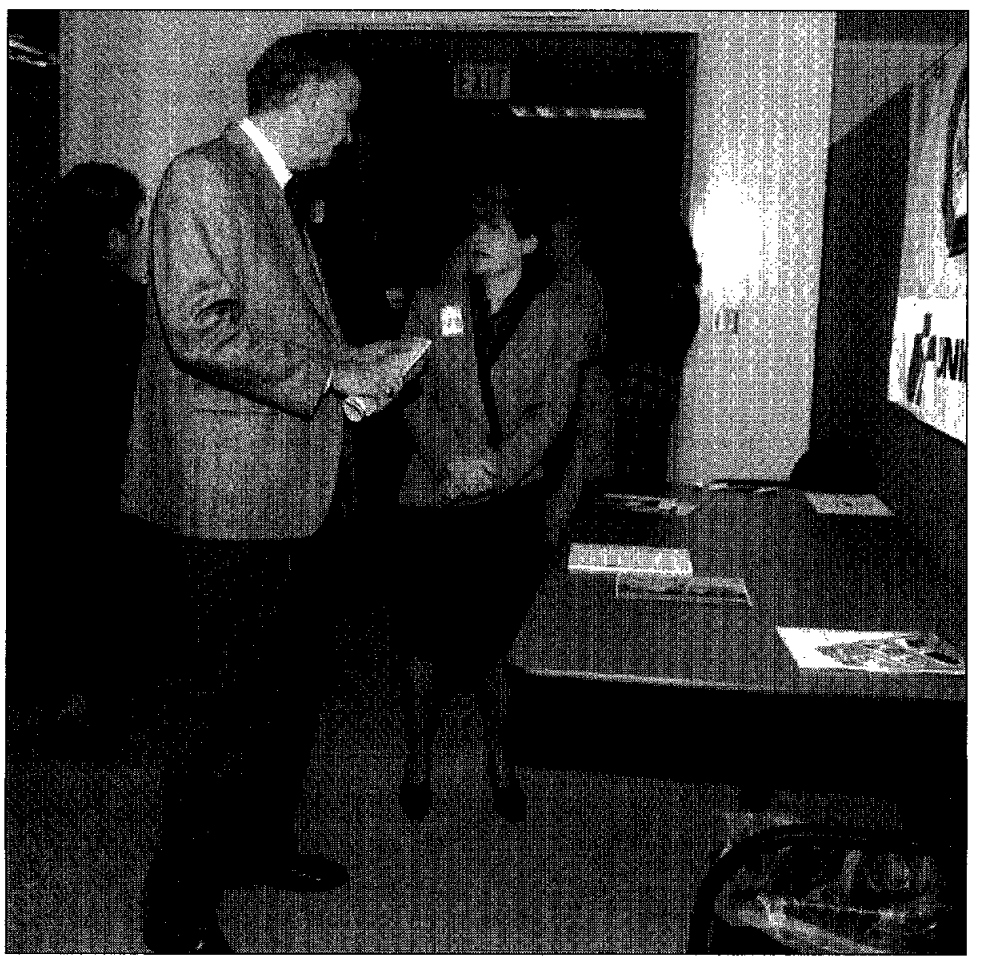
C.B. Collins, a taxpayer service specialist for the Internal Revenue Service's Taxpayer Service Division, will discuss recent changes to tax laws and regulations.

All JSC and contractor employees are invited to attend as their workloads permit. For more information, call Black Employment Manager Charles Hoskins at x30607.

Heartwalk is Saturday

JSC workers are invited to participate in the Al Jowid Memorial Heartwalk at 7:30 a.m. Saturday at the University of Houston-Clear Lake's Development Arts Bldg.

The 10-kilometer walk, which honors long-time NASA employee Al Jowid, is trying to raise $23,000 for the American Heart Association. For more information, call Christine Jowid at x30304.



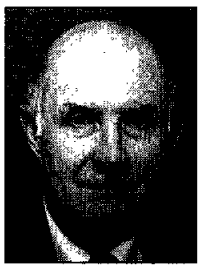
JSC Photo by Mark Sowa

OPEN HOUSE—JSC Center Operations Director Ken Gilbreath welcomes visitors to an open house in the new Bldg. 4 South last week. About 900 JSC workers stopped by the center's newest, most energy efficient building, which is attached to the old Bldg. 4, now Bldg. 4 North, by a glassed-in walkway.

Former astronaut Stafford to receive 1993 space trophy

Former astronaut Thomas P. Stafford will receive the 1993 National Space Trophy for his three decades of outstanding contributions to America's space program.

The Rotary National Award for Space Achievement Foundation will present the award at the annual awards banquet Feb. 18 at the Hyatt Regency-Downtown.



Stafford

Stafford is vice chairman of Stafford, Burke and Hecker of Alexandria, Va., chairman of the board of Omega Watch Co., and on the boards of Allied Signal Corp., Baroid Corp., Pacific Scientific Corp. and Wheelabrator Technology.

In 1990 and 1991, Stafford chaired the Synthesis Group, which charted national directions for the Space Exploration Initiative in an effort to identify technology development priorities for accomplishing those goals.

Stafford made his first space flight as pilot of the 1965 Gemini VI mission. In 1969, he became chief of the Astronaut Office, and in May of that year he commanded Apollo 10, the first manned lunar orbit mission that served as a dress rehearsal for the first humans to land on the moon two months later. In 1975, he commanded the Apollo-Soyuz Test Project, the first meeting of U.S. and Soviet astronauts in space.

Stafford was an Air Force fighter pilot from 1952-1958, and went to the U.S. Experimental Flight Test School in 1958. After leaving NASA, he commanded the Air Force Test Center and became Air Force deputy chief of staff for research, development and acquisition, retiring in 1979.

Study urges systematic technology transfer

(Continued from Page 1)

support to help researchers transfer technology;

- Technology can and should be transferred at every stage, instead of waiting until a project is completed.

The report's 10 recommendations include a category of implementation and measurement of performance of technology transfer and eight recommendations for changing NASA's culture to facilitate technology transfer.

The report finds that where technology transfer was the primary mission activity—such as aeronautics, the Small Business Innovative Research (SBIR) program and the Centers for Commercial Development of Space—NASA's overall efforts are relatively good.

For instance, a strong relationship exists between NASA and the aeronautics industry. Many vital technologies developed by NASA have been transferred to the aeronautics industry, including such items as supercritical wings, winglets, glass cockpits and many others. Still, a recent Gallup poll concluded that the aeronautics industry felt there was room for improvement.

In addition, researchers often viewed technology transfer as writing a report on the research results after it was completed. This is representative of a common view that technology transfer occurs at the end of the development process.

Researchers often encounter roadblocks when attempting to transfer technology, including the time-consuming processes of filing patents and software distribution through official channels.

Finally, no systematic measurements or statistics are kept on the activities or effectiveness of primary targeted technology transfer. The team identified six metrics that could be used to measure the effectiveness of the technology transfer process. These include the number of citations, acknowledged users and spin-off companies, the revenue from patent licenses, and the length of time from development to its transfer for use by a targeted customer.

The report found that the technology utilization offices are minimally staffed and cannot provide greater support for secondary and non-targeted technology transfer functions.

NASA's Office of Advanced Concepts and Technology was created in November to better meet the needs of industry, academia and NASA communities. One of the new office's major functions is to transfer technology into the commercial sector at a faster pace than in the past.

"We will seek the input of the technology user community to figure out the best mechanisms to transfer technology, whether it's technical papers, NASA-generated software, regional tech transfer centers, cooperative research agreements or working in our labs and other facilities," Goldin said.

STS-54 crew moves on to scientific tests

(Continued from Page 1)

Islands and successfully unfurled its antennas. It will be held on orbit in a "ready reserve" status, available to be placed into active service should one of the current satellites fail.

The deployment followed by about six hours *Endeavour*'s launch from Kennedy Space Center's Launch Pad 39B at 7:59 a.m. CST.

Wednesday afternoon, the crew and ground support teams turned their attention to a full complement of scientific and operational investigations that comprise the remainder of the six-day flight.

Payload controllers at Goddard Space Flight Center decided to temporarily stow the Diffuse X-ray Spectrometer instrument while experts investigated fluctuations in the readings of detectors mounted on both sides of the payload bay. Detectors on DXS—designed to study the interstellar medium, or the space between the stars—automatically shut down when the sensors began recording the fluctuations.

The crew—which also includes Pilot Don McMonagle and Mission Specialist Greg Harbaugh—worked with several other experiments including one that will collect information on various biomaterials that could provide information to better understand and treat disorders such as cancer, osteoporosis and AIDS.

On Friday, the crew was to participate in an interactive television demonstation of toys in space with elementary students at four schools.

On Sunday, Runco and Harbaugh were to perform the first in a series of test space walks designed to better refine training methods and the capabilities available for construction of Space Station *Freedom* in 1996.

Landing was scheduled for 7:31 a.m. Tuesday at Kennedy Space Center's Shuttle Landing Facility, but *Endeavour* was expected to have enough consumables to support an extended mission for additional science if necessary.

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 Friday by the Public Affairs Office for all space center employees.

Dates and Data submissions are due Wednesdays, eight working days before the desired date of publication.

Editor .....Kelly Humphries
Associate Editor .....Kari Fluegel

JSC to participate in senior exec search

(Continued from Page 1)

cess. Together, the candidates and mentors will develop individual development plans. Training will include developmental work assignments, interagency executive level training and seminars.

Certification of successful training program completion currently is good for three years, but the Office of Personnel Management is proposing rules that would make certification good indefinitely.

For more information, contact Collins at x33002. Application packages may be requested by phone or picked up in Bldg. 45, Rm. 110.