



Robotics work now under way at JSC may result in multi-armed Space Station robots that "see" and "feel." Story on Page 3.



Barbara Morgan, teacher-in-space designee, says she is looking forward to the upcoming return to flight. Story on Page 4.

Space News Roundup

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No. 19

Discovery ready for engine firing

Oxidizer leak not expected to cause major launch delay

Space Shuttle program officials and engineers are trying to decide what course to follow in dealing with a small oxidizer leak in *Discovery's* left Orbital Maneuvering System (OMS) pod.

Dick Kohrs, deputy director of the National Space Transportation System Program Office at JSC, said Thursday he is optimistic there will not be a major launch delay.

Program officials have decided to proceed with the Flight Readiness Firing (FRF) at 6:30 a.m. CDT next Friday, and are delaying a decision

on whether to roll the Orbiter off the pad until after the firing.

Three basic options are being discussed in relation to the STS-26 launch, now scheduled for early September. Working on one option, engineers are trying to come up with a way to stop the hard-to-reach leak at the pad. Under another option, *Discovery* would be rolled back to the Vehicle

Assembly Building (VAB), destacked, and rolled back to the Orbiter Processing Facility. Technicians would then remove the OMS pod and either stop the leak or replace the entire pod. Or, the mission might be flown without plugging the leak if it is safe to do so.

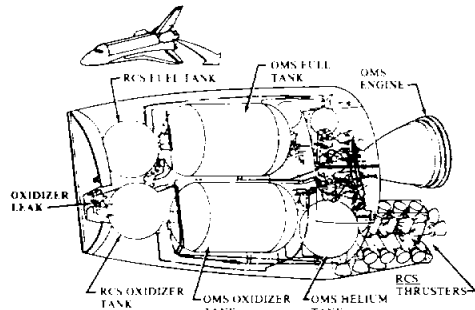
If roll back becomes necessary, officials are studying whether the

launch delay can be minimized by accelerating processing of a pod needed by the Shuttle *Atlantis* for STS-27.

"I personally feel we'll figure out a way to fix this on the pad or fly ason," Kohrs said. "If we get it fixed on the pad, depending on what method, if we're lucky it will be within our normal FRF-to-launch period of six weeks and we'll get it fixed in parallel."

The leak is in a half-inch diameter dynatube fitting for the Reaction Control System (RCS) oxidizer tank overflow vent. The vent, which is

Please see **OFFICIALS**, Page 4



Dynatube Fitting Oxidizer Leak



JSC Photo

SETTING SAIL — STS-26 Pilot Dick Covey sets sail in a one-man life raft that is part of the new Orbiter emergency escape system during the crew's bail-out training in the Weightless Environment Training Facility recently. The individual rafts are stored on the bottom of the parachute packs each crewmember will now wear during ascent and entry.

Freedom chosen as Space Station's name

President Ronald Reagan announced Monday that *Freedom* will be the name of the permanently manned Space Station being developed by the United States, Canada, Europe and Japan.

NASA Administrator James C. Fletcher recommended the name *Freedom* to the President following a review of more than 700 suggestions sent to NASA by employees, contractors, international partners and the general public.

"The yearning for freedom is a basic human emotion, and freedom of the individual is a value shared by all the nations that will work

together to build and use the Space Station," said Marlin Fitzwater, assistant to the President for press relations, who released the announcement. "In a literal sense, the Space Station will provide freedom from the confines of Earth's gravity, enabling scientific and technological research, new commercial uses of space, and opening the way for continued human exploration of space."

Fitzwater said the name *Freedom* is tied to the President's earliest statements on the program. When the President announced his decision to build a Space Station in his

January 1984 State of the Union address, he noted that he was inviting America's friends and allies to join us so "we can strengthen peace, build prosperity and expand freedom for all who share our goals."

Mark Hess, the NASA Headquarters public affairs specialist who coordinated the name search, said the Headquarters History Office first suggested the name *Freedom*. He said the next step is to put together style guidelines to ensure the new name is used consistently throughout the agency.

The list of more than 700 suggestions was first reviewed by a group

containing representatives from a cross section of NASA Headquarters organizations and each international partner. The review group significantly reduced the large list, giving special consideration to how each name would translate into the languages of each country involved in the project. Space Station managers at Headquarters then culled the list to seven possibilities. Fletcher cut the list to three and recommended *Freedom* to the President, who made the final selection.

JSC is managing Work Package 1 for Space Station *Freedom*. The work package includes the inte-

grated truss structure, mobile servicing system transporter, airlock outfitting, resource node outfitting, hardware and software for the data management system, communications and tracking system, the guidance, navigation and control system, extravehicular activity systems, propulsion system, thermal control system and external attachment systems.

The first Space Station test hardware — airlocks for use in the Weightless Environment Training Facility — is expected to be delivered to JSC next week.

Back to school

Employees receive fellowships

By Marie Simone
Special to the Roundup

Some will travel far and wide and some will drive around the corner, but each recipient of a 1988 JSC Fellowship will receive a graduate degree in higher education, with NASA paying the tab.

Over the next academic year, JSC will allocate more than \$25,000 to fund seven recently awarded fellowships.

JSC Fellowship applications are judged by the degree to which the desired education will benefit both NASA and the candidate, coupled with the candidate's need, Program Coordinator Glen Van Zandt said. Approved by JSC Director Aaron Cohen and a selection committee of five senior managers, the seven 1988 fellowship recipients combined make one of the largest such groups in

recent years, Van Zandt said.

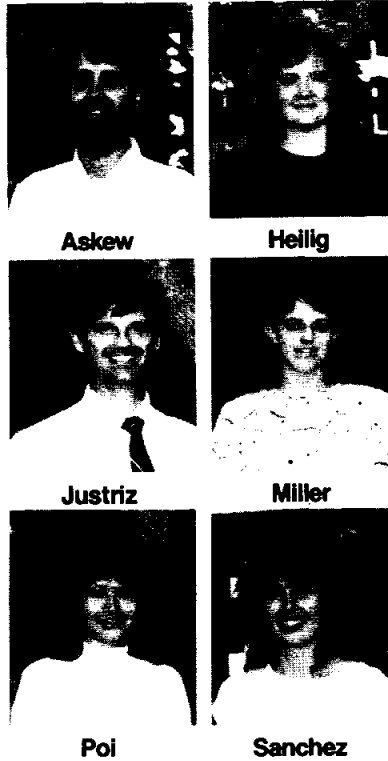
In 1987, four fellowships were granted, and the increase in number this year is an indication of senior management's growing support of the program, he added.

Fellowship recipients include Scott Askew, Leesa Heilig, Charles R. Justriz, Catherine C. Lin, Kathryn M. Miller, Sharon D. Poi and Merri J. Sanchez. They will begin their studies in August.

Askew, a mechanical design and analysis worker in the Engineering Directorate's Structures and Mechanics Division, will attend Virginia Technical University to study for a master's degree in electrical engineering. He has been with NASA since 1982.

Heilig, a worker in the Space Station

Please see **FELLOWSHIPS**, Page 4



New laser gun helps train security officers, police

By Kari Fluegel

You are a security officer called to check out a silent alarm at a federal credit union. The alarm has a history of accidentally setting itself off, and, as you approach the door, your partner says he will enter the building first. Shortly after he walks through the door, a shot rings out. You draw your .357-caliber Magnum when suddenly a man bursts out the door and abruptly turns toward you. Do you shoot or wait?

In this scenario, if you shot, you made a mistake. The man was an excited bystander rushing outside to warn you that your partner had been shot by a robber. A second man who runs out the door is the true gunman.

For security officers, decisions such as this must be made quickly and

correctly. The officer's life and the lives of bystanders must be protected, but the threat must be real.

JSC security officers recently tested their reaction and decision-making skills with the help of a new computer Firearms Training System (FATS) purchased about a year ago by NASA Headquarters.

Jim Lombard, assistant security chief for Mason & Hangar, said 115 security officers at JSC trained with FATS. About 85 percent of those also went back for a second training session.

In addition, JSC made the system available to about 35 local law enforcement units representing the Texas Department of Public Safety. Please see **SECURITY**, Page 4

JSC People

Onizuka honored by new memorial

Challenger Astronaut Ellison S. Onizuka was memorialized by friends and family recently at dedication ceremonies for a Hawaiian space center museum honoring the astronaut killed in the 1986 Challenger tragedy.

On what would have been Onizuka's 42nd birthday, his family was joined by local dignitaries and about 95 friends from Texas in dedicating the site and unveiling the plans for the museum to be built at Keahole Airport in Keahole, Hawaii.



Onizuka

"A lot of what he was and what he accomplished was because of you," Onizuka's widow, Lorna, said at the ceremony. "He's here today on the day of his birth ... watching down."

Owen Miyamoto, airport administrator, said the center will be the first permanent display at a Hawaii airport.

Schornick chairs community board

Dr. James L. Schornick, an aerospace engineer in the Safety, Reliability and Quality Assurance Directorate, recently was elected president of the Brook Forest Community Association board of directors.

Schornick, who has been employed by NASA for 13 months, will serve as president of the nine-member board for one year.

The board's duties include maintaining the association's property, upholding deed restrictions and supporting the volunteer fire department.

JSC

Dates & Data

Today

Circus—A limited number of tickets for a noon performance of the Ringling Bros. and Barnum & Bailey Circus on Aug. 13 are on sale today in the JSC Exchange store for \$6. Those purchasing tickets early are eligible to win a family backstage tour of the circus, but entry forms must be returned by Aug. 1.

Astros vs. Dodgers—Tickets for field level seats to see the Houston Astros play the Los Angeles Dodgers at 7:35 p.m. on Aug. 6 are now available for \$7 each at the Bldg. 11 Exchange Store.

Cafeteria menu—Entrees: tuna and noodle casserole (special), baked ham, fried shrimp, broiled codfish, seafood gumbo. Vegetables: corn, turnip greens, stewed tomatoes.

Saturday

Space environment—"Environmental Interpretation of Manned Flight and Space Photography" will be the topic of Astronaut Mary Cleave's Spaceweek discussion and slide presentation at 2 p.m. Saturday at the Armand Bayou Nature Center. Call Laura Lehtonen, 474-2551, for details.

Spaceweek observatory—A view of the moon and planets will be available at Challenger Memorial Park, 2301 W. NASA Boulevard, from dusk to 10:30 p.m. Saturday. Telescopes will be provided by local amateur astronomers. Movies also will be presented. All activities are free. For more information, call Bill Williams, x33848 or 339-1367.

Clown's play—The JSC-EAA will sponsor a special children's clown's play, a new version of Jack and the Beanstalk, at noon July 23 in the Satellite Theatre at UH-CL. Tickets, available at the Bldg. 11 Exchange Store, are \$2 for ages 18 and under; \$3 for adults. For more information, call Susan Starkweather, x36608.

Monday

Unisys NMA meets—The Unisys Houston Operations Chapter of the NMA will hold its monthly meeting with social hour from 5-6 p.m., dinner from 6-7 p.m. and a program from 7-8 p.m. at the Gilruth Recreation Center. Guest speaker Harold Stall, JSC director of public affairs, will discuss the new visitors center to be constructed by Walt Disney Enterprises. For ticket information, call Robert Kinsey, 282-3205, or Carolyn Hughes, 282-4721.

Cafeteria menu—Entrees: meatballs and spaghetti (special), weiners and beans, round steak with hash browns, chicken noodle soup. Vegetables: okra and tomatoes, carrots, whipped potatoes.

Tuesday

Lunch and learn—Stefan Roesler from the Department of Mechanical Engineering, University of Stuttgart, West Germany, will speak on "Aerospace Heat Pipe Development in Germany" in the Bldg. 3 cafeteria 11:30 a.m.-12:30 p.m. for a "Lunch and Learn" meeting sponsored by the American Institute of Aeronautics and Astronautics' Thermophysics Technical Committee. Anyone interested is welcome. For information, call Abdul Hye, 333-6515.

EAA Badges—Dependents and spouses may apply for a pictured ID badge from 6:30 to 8:30 p.m. in the Rec Center.

Oxychem 4x2 mile relay—Male, female and mixed teams will compete at the San Jacinto Monument at 7 p.m. July 26. Call Patrick Chimes, x32397, for information.

BAPCO meets—The Bay Area PC Organization (BAPCO) will meet at 7:30 p.m. in the League City Bank & Trust building. For more information, call Earl Rubenstein, x34807.

Cafeteria menu—Entrees: Fried chicken (special), beef stew, shrimp creole, sweet and sour pork chop

with fried rice, beef and barley soup. Vegetables: Stewed tomatoes, mixed vegetables and broccoli.

Wednesday

Cafeteria menu—Entrees: Swiss steak (special), fried perch, New England dinner, seafood gumbo. Vegetables: Italian green beans, cabbage, carrots.

Thursday

Cafeteria menu—Entrees: stuffed bell pepper (special), turkey and dressing, enchiladas with chili, weiners and baked beans, cream of chicken soup. Vegetables: zucchini, English peas, rice.

July 29

Cafeteria menu—Entrees: Salisbury steak (special), baked scrod, broiled chicken with peach half, seafood gumbo. Vegetables: cauliflower au gratin, mixed vegetables, buttered cabbage, whipped potatoes.

Aug. 3

Weight safety—A class in weight safety, a required course for employees who wish to use the Rec Center weight room, will be offered from 8-9:30 p.m. Cost is \$4. For more information, call x30304.

Aug. 4

Ballroom dancing class—Professional instruction in beginning, intermediate and advanced ballroom dancing begins and will continue each Thursday for eight weeks at the Rec Center. Advanced class meets 7-8:15 p.m. Beginning and intermediate class meets at 8:15 p.m. Cost is \$60 per couple. For more information, call x30304.

Aug. 6

Children's lunch—A luncheon theater for children, featuring the Texas Mime Theater, jugglers and a

clown, will be sponsored by the JSC-EAA at noon in the Rec Center. Tickets are \$2.50 for adults and children at the Bldg. 11 Exchange Store. For more information, call Susan Starkweather, x36608.

BAGSUG meeting—The Bay Area GS Users Group (BAGSUG) will meet at 2 p.m. at the Thomas Avenue Baptist Church. For more information, call Demetrius Roberts at 476-0069.

Aug. 20

Defensive Driving—A course in defensive driving will be offered from 8 a.m.-5 p.m. at the Rec Center. Cost is \$20. For more information, call x30304.

Aug. 26

SEDS conference—The Texas area chapters of the Students for the Exploration and Development of Space will sponsor an international conference at the Nassau Bay Hilton through Aug. 28. The conference will feature JSC tours, a space career exposition and several well known speakers from the space industry. For more information, call Peter Lange, x30850.

Sept. 9

AIAA China trip—A technical delegation from the Houston Section AIAA will depart for a trip to China to visit with the Chinese Society of Astronautics. Participants will meet with technical counterparts in Chinese space facilities at Beijing, Xian and Shanghai, home of Houston's sister section, the Shanghai Astronautical Society. Non-technical activities are planned for spouses. The delegation also will visit scenic and historic sites at Guilin and Hangzhou. For information on applications, call Jim McLane, 488-0312.

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. Send ads to Roundup Swap Shop, Code AP3, or deliver them to the deposit box outside Rm. 147 in Bldg. 2.

Property & Rentals

Rent: Lake Livingston waterfront, 3-2, fully furnished, covered decks, pier, fishing, swimming, skiing, new cond. 482-1582.
Sale: Friendswood/Sun Meadow Estates, wooded lot in established neighborhood, cul-de-sac, bordered by stream & golf course on 2 sides, approx. 245' deep & up to 86' wide, approx. 1/3 acre, gas/elect. on site, \$19,500. Doug, x32860 or 486-7412.

Sale/Lease: Fondren/SW traditional two-story, 4-2.5-2D, 2,400 sq. ft., formals, alarm, intercom, good schools, \$825/mo., or \$101,000 no-approval assum. 729-4447.

Rent: West Galveston beach house, 2-2, beach 100 yards, boat landing, marina w/pool, \$500/wk., weekend rates avail. Fendell, x31206 or 538-1147.

Rent: University Trace condo, 1-1.3, study, W/D, new carpet/paint, \$375/mo. Russ, x34742.
Sale: College Station, mobile home, 2 mi. south of A&M off Welborn Road, convenient, safe, private. Terry White, x35111 or 332-5177.

Rent: Galveston Victorian Gulf-front condo, sleeps 6, fully furnished, 2 swimming pools, 3 whirlpools, 2 tennis courts. 480-5270.

Sale: Piper's Meadow, 3-2-2A, ex. cond., many extras, playhouse in bk. yd., \$1,000 down, \$802/mo., 11.5% assum. 486-8998.

Sale: Galveston timeshare condo, Seawall Blvd., week 20 every year, RCI exchange membership, \$50. Jeff, 282-7744 or 996-1907.

Sale/Lease: CLC Baywind II condo, large 2-2-2, new carpet, mini blinds, paint, FPL, wet bar, W/D, tennis, pools, \$450/mo. C.W., 282-1871 or 280-8796.

Lease: Wharf townhouse, 2-2-1, beautiful waterfront view, decks, FPL, picture windows, W/D, refrig., dishwasher, boat slip avail., \$975/mo. x38492 or 554-2476.

Cars & Trucks

'76 VW camper, rebuilt engine, does not run, good cond. Gary, x38641.

'79 Cougar XR7, good cond., runs good, orig. owner, \$1,200. Long, 334-1107.

'79 Thunderbird, V8, auto., A/C, P/S, new eng., clean, no rust. Pete, x38572 or 946-6248.

'76 Buick Estate Wagon, 454 eng., needs body

work, \$200. 532-1175.

'69 Chevy Camaro conv., classic, 327 CU, A/C, P/S, P/B, 95% restored to orig. cond., \$7,395, OBO. 277-0929.

'85 '35' Mallard motor home, loaded, low mi., \$37,000, OBO. 337-4051.

'86 Dodge Lancer, turbo, will sell under book value. Bill, 388-2815.

'79 Triumph Spitfire, rebuilt eng., new int., tires, soft & hard tops, low mi., \$3,700 or trade for an equal value Jeep. Christy, x35046 or 669-8684.

'80 Honda CM400T, new tires, battery, crashbar, \$350, OBO. Scott, 474-9473.

'82 Dodge pickup w/camper top, 3 spd. w/overdrive, ex. cond. 486-9760.

'75 Ford Elite, ex. cond., \$800, OBO. 941-2495.

'79 VW Scirocco, standard, AM/FM cass, pioneer speakers, \$1,700, OBO. Rochelle, x34836 or 524-0705.

'87 Mustang, 3 spd., 289-V8, AM/FM stereo, good tires, airshocks, new paint, new exhaust headers, mags, A/C, runs good, \$2995. Mike, x38169 or 482-8496.

'83 F100 truck, 4 cyl., 4 spd., A/C, P/S, AM/FM, 70K mi., good cond., \$2,600, OBO. Johnny, x34189 or 486-7089.

'78 Pontiac Trans Am 400, auto, A/C, all power, cruise, 90K mi., \$2,500, OBO. 282-4481 or 996-8132.

'79 Buick Regal, 2 dr., V-6, A/C, AM/FM radio, new tires, new brakes, new cooling system, new paint, new alternator, 96K mi., ex. cond., \$1,800. 280-2110 or 488-3591.

'88 Chevrolet Beretta, new, 2 dr. coupe, A/C, auto., aux. lighting, AM/FM stereo, elec. RR wind defog, cruise, P/S, loaded. Debra, 931-1651.

'80 Toyota Supra, auto., A/C, sunroof, louvers, all pwr., 81K mi., ex. cond., \$3,400. 486-1865.

'77 Honda Civic, 3 dr., 111K mi., A/C, \$650, OBO. Mike, x38918 or 482-9447.

'88 assembled 1985 Porsche Speedster-C, replica, VW eng. and chassis, all new and/or rebuilt parts, black w/lan conv. top, \$13,000, OBO. Chuck, x32590 or 333-5829.

'80 Chevy Monte Carlo, \$1,600, OBO. Marcia, x38575.

'81 Delta 88, burgundy on burgundy, 2 dr., pwr. windows/doors, 2 new tires, 26K mi., \$1,800, OBO. Connie, 683-7954 or 541-4321.

Cycles

'82 Honda V-45 Sabre, customized sports tourer, bags, fairing, lowers, black w/met. grey & silver, \$1,400. Richard, 480-0880.

'82 Honda 110 3-wheeler, good cond., \$300, OBO. 482-1602.

Boats & Planes

15' Par-Kraft, center console, galv. trailer, 25hp

Evenrude, elec. start, troll motor, access., \$1,800. Don Thompson, x39475 or 941-1537.

Lease: Floating boat slip, Portofino Harbour, avail. now, up to 40', 5 min. from bay. Ritz, x38501 or 780-2391.

'78 17' Glastron bass boat, matching custom trailer, \$1,195. x38492 or 554-2476.

Chrysler 6hp outboard, long shaft, reconfig. to short, low hours, used only in fresh water, ex. cond., \$295. Musgrove, x38318 or 488-3966.

Household

La-Z-Boy rocker/recliner, large wingback style, ex. mech. cond.; dark brown Naugahyde cover in fair cond., \$120. Scott, x34437 or 334-2278.

9 drawer triple dresser w/matching mirror, dark wood, 1 yr. old, \$175, OBO. Jana, x31653 or 532-3008.

Baby crib w/water bed mattress, both in ex. cond., \$75. Alece, x32867 or 482-6556.

Antique, Victorian burled walnut bed; 6 ft. high headboard, Civil War period, ex. cond., \$500. 480-7838.

Solid oak bookcase/entertainment center, \$400; AM/FM stereo & turntable, 2 lrg. speakers, \$60. Pat, x39313 or 480-7406.

Modern Danish wooden living room set, couch and 2 arm chairs, rem. cotton covered cushions, ex. cond., all for \$125. 474-5721.

Love seat, earth tone fabric w/exposed wood trim, \$40. x30856 or 332-2671.

Wicker furniture, white, \$50; 2 metal chandeliers, \$50 and \$175; white/brown chests of drawers, \$30 and \$10; mini trampoline, \$15. 326-3370.

4 Pioneer HPM 100 speakers, \$100 each or 4 for \$350; double mattress/box spring/frame, \$75; 4 poster white bed, \$60. 326-3370.

Queensize waterbed in dark stained pine, reduced motion mattress w/heater, incl. mirrored headboard, rail pads and 12 drawers, \$400. 282-3972 or 488-0151.

Kingsize waterbed ensemble, solid oak, ex. qual., incl. mirrored headboard, matching high-boy chest and nightstand, six drawers under bed, all for \$900. 282-3972 or 488-0151.

Dining table, 6 chairs, 2 leaves, 5' china cabinet, all dark wood, good cond., \$600. 488-8379.

Pecan bedroom suite, full size headboard and frame, triple dresser, w/two mirrors and nightstand, \$400. 331-0133.

Litton microwave, full size, temp. probe, ex. cond., \$150. Glenda, x31764 or 482-2157.

Girl's Rainbow sherry drape, double bedspread & pillow shams, ex. cond., \$40. 331-6260.

Sofa and loveseat, dark multi colors, lots of pillows, ex. cond., \$300, OBO. Denise, 484-7247.

Range hood w/fan and light, almond, \$45. J. Kinsey, x32271 or 486-0421.

Audiovisual & Computers

Topline Kicker Super II, auto speaker system, ex. cond., was \$289, now \$175. x34333.

Utah 8" 2-way speakers, \$30 pair. 331-0133.

Radio Shack Realistic 7 band stereo equalizer for home systems, ex. cond., \$25. Musgrove, x38578 or 488-6266.

Commodore computer system w/CG4 computer, 31541 drives, 2 SFD-1001 (1 meg) drives, printer, interfaces, 1660 & 1670 modems, RGB monitor, computer desk w/hutch and over 2000 Commodore programs, \$1,500, OBO. Bill, x38213 or 470-2013.

Computers, XT and AT clones and access., service avail. Scott, 474-9473.

AT&T Monochrome screen, ex. cond., \$75. Bill, x38574 or 331-6260.

Epson HX20 laptop computer, extended mem., built-in printer, micro tape drive, battery charger, modem and cable, no documentation, \$150. Ted, x30621 or 474-2214.

Modem, Universal data system model 201C, 2400 Baud synchronous data, used with small IBM main frame, \$100. Ted, x30621 or 474-2214.

Wanted

Riders needed for carpool, Braeswood & So. Post Oak to NASA, 1988 Dodge van. Richard, x37557.

Want to trade \$10,000 electronic organ for land, car, truck, or boat of equal value, OBO. 337-4051.

Want to buy your house. Scott, 474-9473.

Want 289 Ford engine with C-4 auto. trans. in good running cond., at reasonable price. Paul, x37806 or 326-2311.

Quality child care in my home, Mon.-Thurs., ages up to 5, good ref., 5 min. from JSC. Patty, 480-6330.

Need partners for West Texas deer lease, 3,000 plus A., located on Pecos River in Crockett County, some mule deer, up to 5 guns at \$800 per gun. Graves, x39073 or 471-1930.

Would like to borrow or buy a used softball glove; also like to obtain a used tricycle for 2 1/2 yr. old. Phil, 282-3544 or 471-1471.

Want a pop up camper for a weekend. Phil, 282-3544 or 471-1471.

Musical Instruments

Bach Trigger trombone w/case, ex. cond., was \$900, now \$450, firm. Dave, x31146 or 996-0910.

Flute, closed hole, case, \$150; open hole flute, \$350, OBO. Marcia, x38575.

Yamaha classical guitar, 1 yr. old, was \$300, now \$200. Patti, 470-8522.

Photographic

Pentax 6x7 cm camera w/f 2.4-105mm lens, prism finder and hard case, SN 4010844, ex. cond., \$450. Chuck, x34241 or 487-2978.

Pets & Livestock

Free, small, black, young, male dog, very friendly. Gloria, 480-8357 or 486-0454.

Free kittens, 8 weeks old, litter trained. Bob, x32242 or 480-1735.

Free kittens, born 6-5-88. Mary Fae, x35143 or 482-9061.

Collie AKC puppies, born 5-27-88. 332-4734.

Lost & Found

Found small, black, young male dog, Clear Lake on Gemini. Gloria, 480-8357 or 486-0454.

Bicycle lost from Mission Control Center. 332-1473.

Personal

My membership in Great Expectations video dating service, transferrable if you decide to sell later or recover cost, price is 60% off current. Ben, 280-7334.

Miscellaneous

Vitamaster 250 motorized treadmill, new, was \$500, now \$350. Alene, x35435 or 488-0795.

Oxy-acetylene torch w/regulator and hoses, \$100. J. Kinsey, x32271 or 486-0421.

Bicycle rack, trunk mount, adjust., will hold 2 bicycles, used 3 times, \$30. Don Thompson, x39475 or 941-1537.

Healthkit oscilloscope, model 0-12, \$30. Samouca, x35053.

2 13" Bias Ply tires for small car, new, was \$85, now \$50. Bill, x38574 or 331-6260.

Gaffers & Sattler A/C compressor and condenser coils (outside unit), 3-ton, works fine, \$75. John McNeely, x38178 or 482-5837.

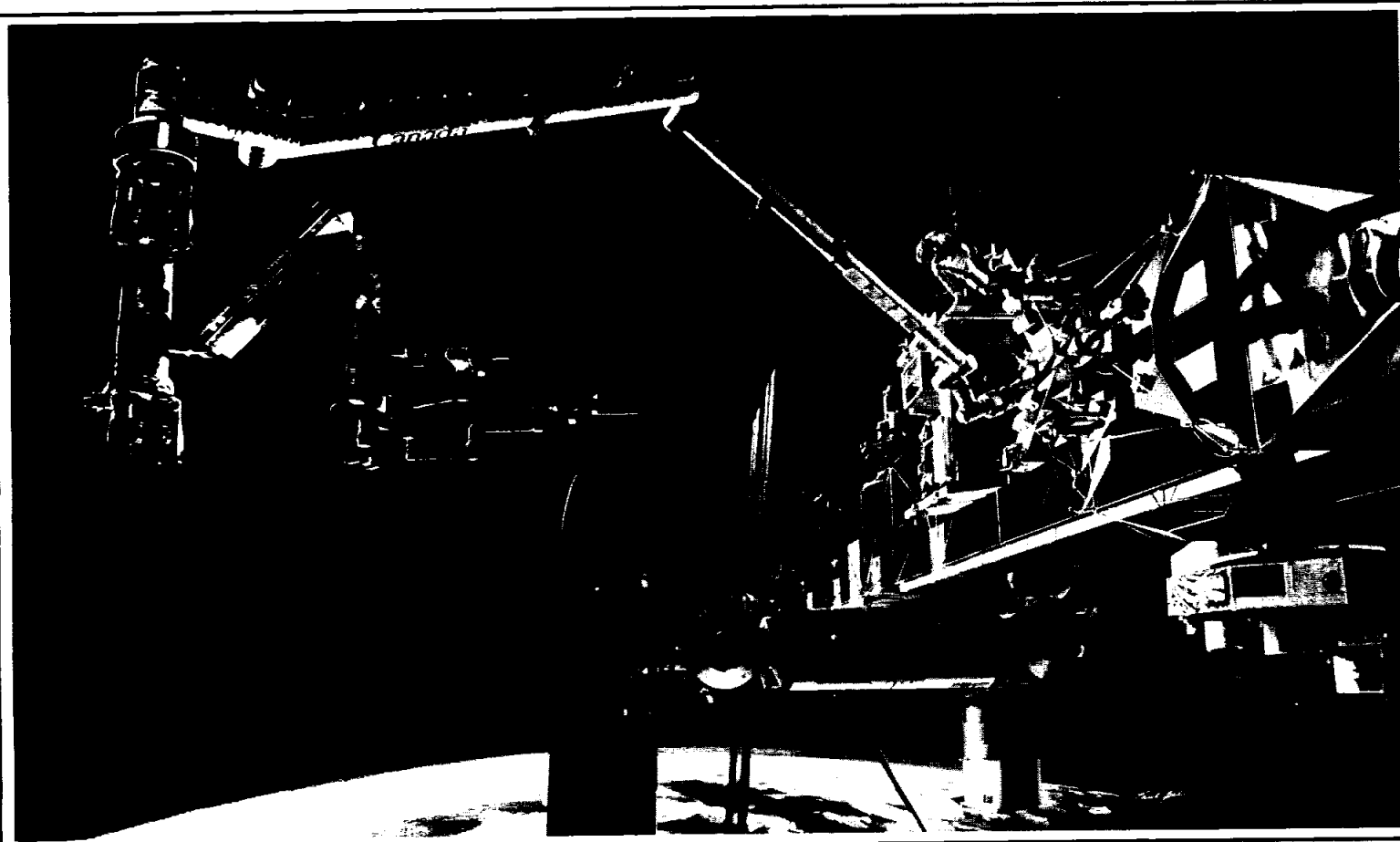
Baby car safety seat, circulation elec. heater, roof turbine, solid ox/propane welder, pressure sprayer and utility (5x) metal free-standing shelf. Bauch, 333-3382.

2 party dresses, black, sz. 7/8, 1-w/velvet bodice, taffeta skirt, spaghetti straps, 1-w/lace yoke, dropped waistline, pleated skirt, \$25/ea. Jana, x31653 or 532-3008.

4 Disneyworld/Epcot tickets, 2 adult, 2 children, no expiration date, orig. \$100, sell all for \$70. Bill, x38574 or 331-6260.

H-O scale train set, flex track, many scale buildings, all for \$50. Patti, 470-8522.

Finding out what robots can do



Left: An artist's concept of a Canadian-built special purpose manipulator arm at work on Space Station is the type of robotics work that may come from experiments now under way in the JSC Advanced Systems Development Laboratory. Below: Lab Manager Don Barron works with a compound robot, two small robot arms at the end of a larger arm, during a recent demonstration of the configuration. Bottom: One concept for the Space Station's Flight Telerobotic Servicer (FTS) is a multi-armed robot, shown working on the Station's truss structure. JSC is working with Goddard Space Center, the lead center for development of the FTS, on the displays and controls for FTS operation.

JSC Photo
NASA Illustrations

Arms that can 'see' and 'feel'

By James Hartsfield

Imagine ambidextrous robot arms that can "see" and "feel" and you have an idea of what may come from systems being studied in the JSC robotics laboratory.

The lab, the Advanced Systems Development Laboratory in Bldg. 16, recently completed a series of experiments and demonstrations with compound robot arms, a design that puts two small, independently operating robot arms at the end of a single large manipulator arm, Manager Don Barron said. The lab is now working with pressure sensors that can "feel" how tightly they grip an object. In the near future, another series of trials is planned with a type of computer graphics "vision" that will allow an arm to locate objects on its own.

"We're evaluating the different technologies and seeing how they work together," he said. The work is not so much the research and development of new technology, Barron explained, but rather research on the possible applications of already existing or emerging technology.

Robots will be an essential tool for the future of space exploration and are already an integral part of the design of Space Station. "You have to have robots to help you do all the work ... particularly around the Space Station," Barron said.

For compound robot experiments, the lab used three commercially available industrial robots. Although robot arms for use in space will be specially designed and built, industrial robots are useful for the lab's experiments. In the experiment, two small Microbot robot arms were placed on the end of a large Puma robot arm, and the compound robot could change batteries in a laboratory satellite mockup.

"We're the only ones that have tried anything with this compound configuration of arms," Barron said.

"We put arms on top of arms, and that's what was unique about it," Robotics Engineer Dorothy Schuster added. In the demonstration, given repeatedly for a host of observing groups including several from other NASA centers, the large, main robot arm moved the two small arms into position. Then one small arm pulled an old battery out of the satellite, and the other replaced it with a new one.

The apparatus was operated from a mockup of a Space Station cupola using an in-house developed, free-floating hand controller nicknamed a "space mouse," the only controller of its kind in the world, Barron said. "It's a six-degree of freedom hand controller that's not bolted down. When you move it one way, up, down, sideways or whatever, the robot mirrors that," he explained.

During the experiments, computer graphics were added that allowed the operator to view his work from almost any perspective. "Instead of looking out the window and seeing where it was going, you could see a picture on the screen of what it was doing," Barron said. "And you could zoom in for detail work, or move the picture around to look at it from different angles."

Experiments with the compound robot, work that involved Barron, Schuster, engineer Carl Adams and workers from Lockheed Corp., proved such a configuration may be feasible, Barron said. And it could have a lot of advantages.

"You can use the big arm to move into position and the small arms to do the work. The smaller arms are easier for detail work, and they can do more," he said.

But the robotics lab has moved on. Work is now concentrating on operating dual large arms simultaneously, and two more large industrial robots will be purchased for experiments. "We want to do a project where both arms have to cooperate together to do a task,"

Barron said.

Although dual and compound configurations can be a tremendous boost to the effectiveness of robot arms, other additions may make them even more sophisticated.

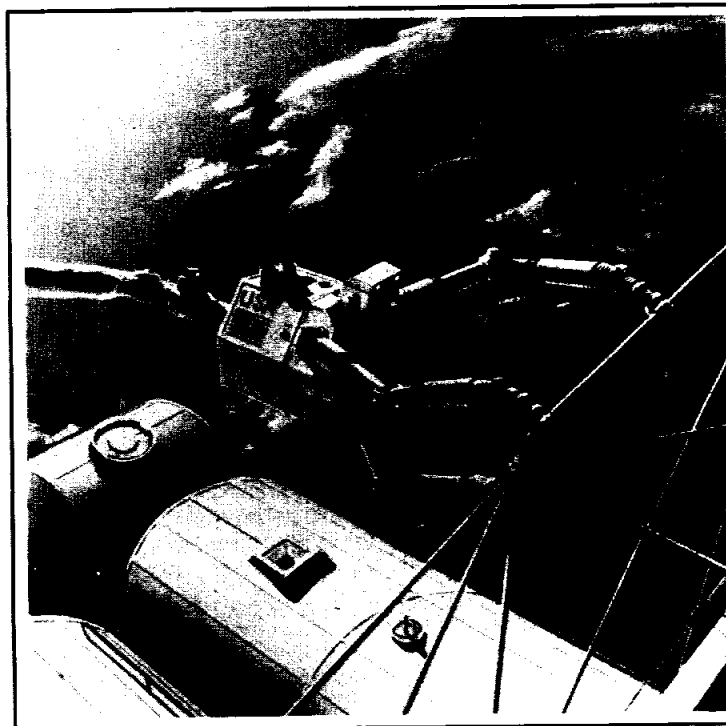
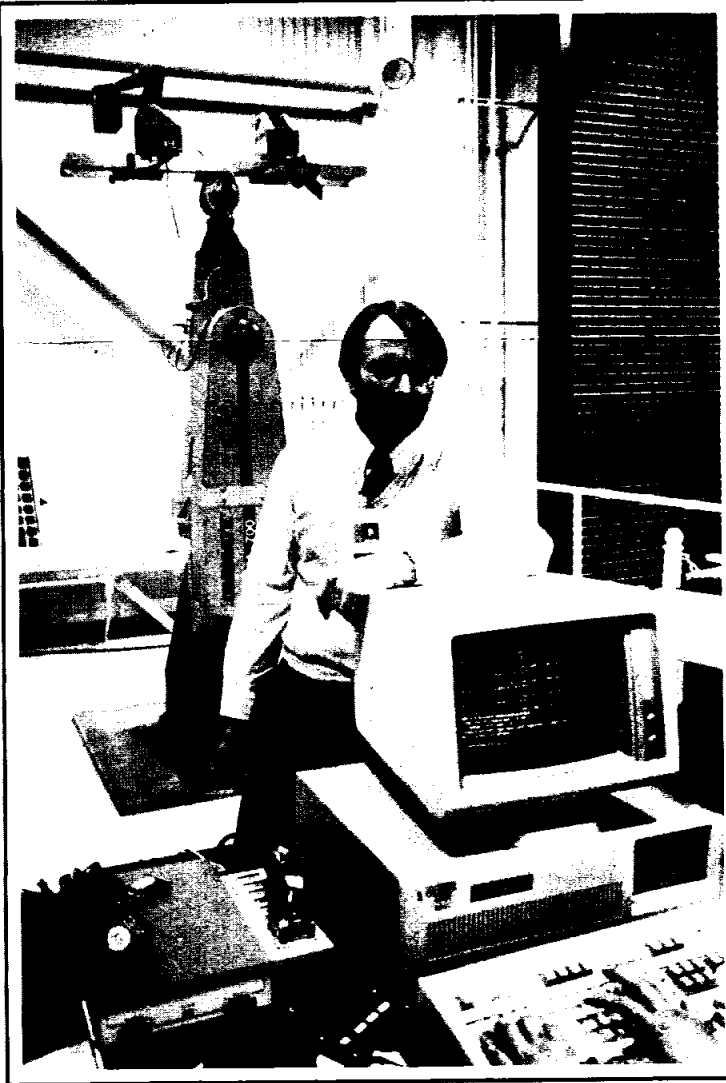
The lab has already tested several pressure sensors attached to grippers that can adjust the amount of force with which an object is held. "We used the sensors to pick up an egg without breaking it, and then to pick up a brick. It was a graphic demonstration; those were the two basic extremes we could think of," Schuster explained.

And plans are to experiment with an already developed type of "vision" for robots, a system that can allow the arms to locate objects. The possibilities are exciting, Schuster said, and with at least 17 various types of arms planned on Space Station, the work is indispensable.

"It's fun because you're always learning something. Robotics is a really interesting field to be working in right now," she said.

The Teleoperator Systems Branch, where Schuster and Barron are assigned, is only a little more than one year old. "The purpose of this branch is to be a focal point for all the robotics engineering going on at the center," Barron said. "Not that we would do all the work, but that we'd be aware of what's going on. We're not the only ones here working with robots. For instance, the crew systems people are looking at robots as an extension of the astronaut. They have a robot hand with fingers over there that can catch and throw a ball. It's impressive."

"We're looking at grippers and arms and software and what it takes to control all this stuff ... and what's the best system to put together for us—particularly upgrades to the Shuttle arm and for Space Station," he said. "We're learning about robots—what they can and can't do."





Morgan

Return to flight encourages back-up teacher

Barbara Morgan, teacher-in-space designee, is going to be watching the launch of *Discovery* on STS-26 with a lot of hope, excitement and memories, but no worries.

"I'm going to have good memories," she said last week, "good memories of what I learned from the crew of 51-L and a chance to see things continue on."

Morgan, who was Christa McAuliffe's alternate, was at JSC in connection with the first *Challenger* Center National Teacher Conference.

"I'm here to be a team member and part of the *Challenger* Center," Morgan said.

The *Challenger* Center is an

educational outreach effort started by the families of the seven astronauts killed in the 1986 *Challenger* explosion.

"Space is the thing that keeps children excited about learning," Morgan said. "It keeps them wanting to know what's going to happen next. It keeps them wanting to turn ahead in their books. That is the thing the *Challenger* Center and other groups across the country understand and are working on."

"I really feel that our future is in the stars," said Morgan, a third-grade teacher at McCall-Donnelly Elementary School in McCall, Idaho. "One of the things I think about as a

teacher is that we teach all subjects and one of the most important things we teach is how all those subjects relate to each other.

"Often, my students see the world as a closed environment. Sometimes they see themselves and their future as having to take care of a fish tank — an aquarium where you get in, close the lid and you can't get out. I think that when we look at space and our world opens up and enlarges, all of a sudden you open up all sorts of possibilities for our children's future.

"It gives them the thing that they love most like an opportunity to learn and a sense of adventure."

As a result of witnessing the disaster that befell the *Challenger*, some children may now be wary of space travel, but Morgan said, "Not everyone is going to be an astronaut.

"One thing we try to stress to our students is that the space program seems to focus on four, five or six people who are up in space doing some very important work. But when you look at the whole program you see that these are tremendous opportunities for a lot of people."

Morgan said she infuses the study of space throughout the curriculum used in her class. She said her students see teachers as a natural part of space.

Officials explore ways to fix leak

(Continued from Page 1)

used as a "fill and spill tube" during servicing on the pad, allows technicians to determine positively that the tank is full. The vent is closed during flight. The fitting that attaches the vent to the tank is wired down for safety, and engineers are certain it will not move in flight.

"The leak rate is small," said Chet Vaughan, chief of JSC's Propulsion and Power Division. "The concern that I have is whether or not it might grow. If the dynatube is properly torqued, I don't believe it will grow, which means the concern is much less."

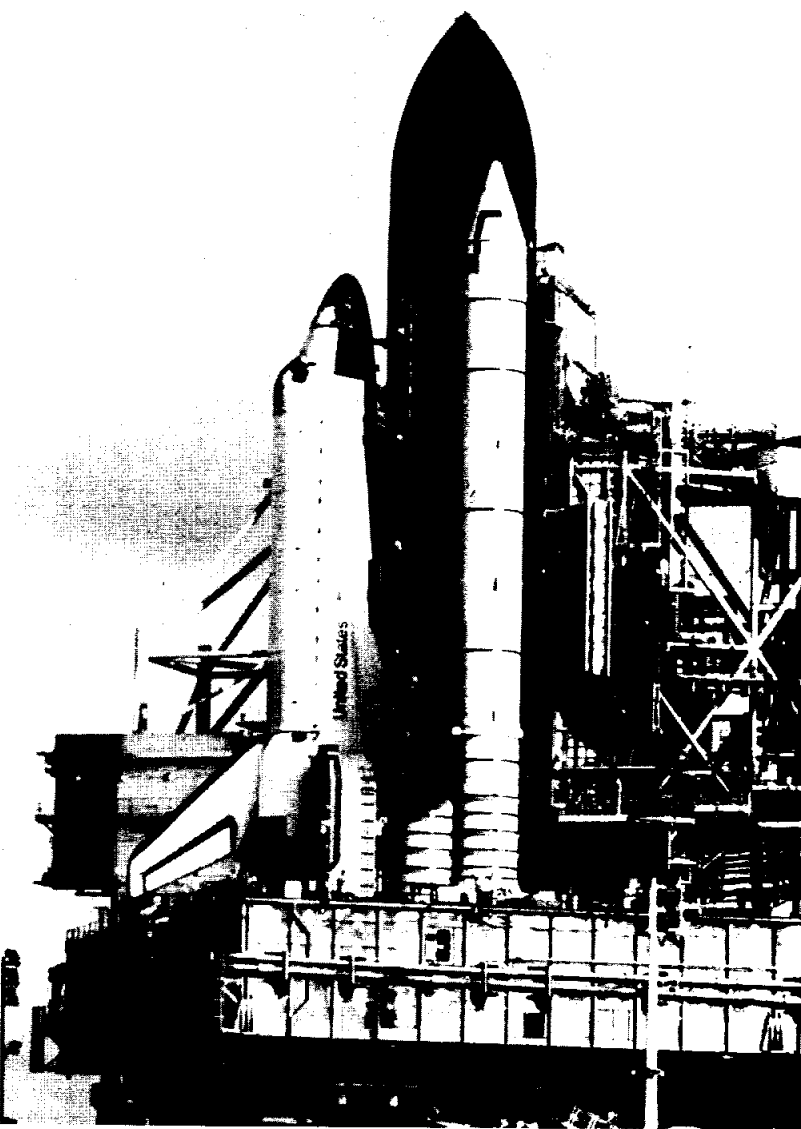
One of the main reasons a growing leak would be of concern is that nitrogen tetroxide is an acid and in sufficient quantity could chemically attack insulation, thermal blankets or nylon tie-downs for thermal blankets in that area. The odds of the oxidizer interacting with any of those materials and starting a fire are low, Vaughan said.

Vaughan said that in looking back over work records, officials believe the leak has been present since the dynatube fitting was disconnected and reconnected in October 1987. After the fitting was reconnected, it was retested and showed zero leakage. In December, however, the system was pressurized and technicians noticed a drop of 12 pounds per square inch (psi) in 16 days. Vaughan said the pressure drop was not pursued because it was so small, and could have been caused by factors other than a leak, such as temperature changes.

The left OMS pod contains one of three RCS modules used to control Shuttle attitude during orbit insertion, on-orbit and reentry of flight and to make velocity changes along the axis of the Orbiter. The left module contains 12 primary thrusters and two vernier thrusters. Nitrogen tetroxide and monomethyl hydrazine combine hypergolically to produce hot gases that expand and accelerate through nozzles to produce thrust and adjust the vehicle's course.

Pad technicians were preparing *Discovery* for next week's Wet Countdown Demonstration Test (WCDDT) and FRF when they noticed the smell of nitrogen tetroxide around the left OMS pod. Electronic sniffing devices narrowed the location of the leak to the area of the RCS oxidizer tank, and precisely located with a television camera and "sniffer" attached to a borer device called the "cobra."

Technicians closed out *Discovery*'s aft compartment and conducted a frequency response test of the main engines Wednesday. An FRF simulation is scheduled to be conducted from Firing Room 1 tomorrow to give the launch team practice and verify software. The "wet" tanking test is to begin with a call-to-stations at 10:30 p.m. CDT tonight and culminate at 6 a.m. Tuesday. A few hours after that, the countdown clock will be reset for the FRF, which is scheduled to culminate with a 20-second test firing of *Discovery*'s main engines at 6:30 a.m. Friday.



NASA Photo

Discovery flight readiness firing is scheduled for 6:30 a.m. Thursday, but a small nitrogen tetroxide leak in the reaction control system could require that the Shuttle be rolled back to the Vertical Assembly Building for repairs afterward.

New model may boost jet engine design

A new computational model developed at Ames Research Center achieves a major step toward accurately simulating the complex, fluctuating air flow within aircraft engine turbines and should lead to substantial advances in analysis and eventually to smaller, more efficient and longer-lived engines.

The new computational model, developed by Man Mohan Rai at Ames in Mountain View, Calif., should generate significant savings for the aircraft engine industry.

The NASA model allows analysis of rotor-stator air flows, which form the heart of most turbines and compressors within aircraft engines. The most accurate calculation to date of air flow within turbines, it provides precise analysis of interior changes in pressure, temperature and velocity. Flow is tracked in the three spatial dimensions over time.

The model performs one of the most complex computer simulations ever performed, involving more than 22 trillion computations. With some adaptation, it also may be used with other rotating machinery, such as prop fan engines and helicopter rotors.

Now valuable as an analytical tool, the model's computer run time must be reduced for it to be practical in the design process. The model now required 100 hours on an advanced supercomputer for a 3-dimensional single stage calculation.

But within a year researchers expect to reduce the run time to 20 hours, making the model useful in some design areas. The time may eventually be reduced to 1 to 10 hours within five years, depending on the speeds attained by supercomputers and further model development. The model then will have

broad applications for analysis of advanced designs.

"This work is significantly more complete than previous simulations," said Terry Holst, chief of the Ames Applied Computational Fluids Branch. "It's extremely difficult to do unsteady three-dimensional Navier-Stokes equations. To do this for complex geometries, as Rai has, is extraordinary. It's a tremendous achievement on the part of Man Rai."

Previous computer models calculating air flow involved major approximations. Some models do not include three-dimensionality or do not calculate unsteady air flow. Others use simplified geometries.

The NASA model's geometry is detailed enough to account for the narrow clearance between the tips of the rotors and the outer casing of the turbine. "We almost give you

reality. There's so much information, the problem is where to look," Rai said.

Calculating air flow within turbines and compressors is difficult because the flow continually fluctuates within these components due to the relative motion of some parts relative to other parts. Gusts of wind outside an aircraft or other changes in pressure of air entering the engine also can cause unsteady flow.

This unsteady flow creates fluctuating pressures on engine parts, resulting in thermal and mechanical fatigue that can drastically reduce the lifetime of parts. The NASA model can predict where these stresses will occur, so that engines can be designed to minimize flow-induced stresses or components under stress can be made stronger.

'88 fellowships expand at JSC

(Continued from Page 1)

Project Control Office, plans to attend Rice University and study for a master's in applied mathematics. She has been at JSC for three years.

Justriz, a senior aerospace engineer and project pilot on NASA/JSC research aircraft, will return to the University of Houston to study for a doctorate in aerospace engineering. He has been with NASA for eight years.

Lin, an electronics engineer working with Space Station development, plans to attend Rice University to study for a master's in electrical engineering with a minor in computer engineering. She has worked at JSC since 1987.

Miller, a test manager in the Thermochemical Test Branch, plans to attend Texas A&M University to study for a master's degree in nuclear engineering. She has been with NASA since 1987.

Poi, a data systems engineer working in mission support, will attend Rice University to study for a master's in computer science. She has been with NASA since 1984.

Sanchez, a Vehicle Integration Test Office worker in flight crew operations, plans to attend the University of Houston to study for a master's in aerospace engineering. She has been with NASA for six years.

Security officers have simulation

(Continued from Page 1)

League City Police Department, Clear Lake Shores Police Department, Deer Park Police Department and the Harris County Constable's Office.

Security officers at JSC have rarely been required to draw their guns, said Everett Schafer, chief of security, but if the need ever does arise, they must be prepared.

"It helps develop that thought process," Lombard explained.

The scenarios include stories in which felons drop their guns, attempt to run or shoot back. The FATS system also introduces factors which can draw an officer's attention away from the real threat.

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Emergency mission control center moves to White Sands

The Space Shuttle Emergency Mission Control Center (EMCC), formerly located at the Goddard Space Flight Center, Greenbelt, Md., has been moved to the Tracking and Data Relay Satellite Ground Terminal in White Sands, N.M.

In the past, an emergency evacuation of the Mission Control Center (MCC) at JSC would have sent a 14-member flight control team to Goddard's Greenbelt facility. There

they would have maintained communications with the Shuttle, calculated data necessary for immediate return of the crew and relayed that data to the Shuttle commander. Now, the MCC flight control team will fly to White Sands and conduct the same operations from that site.

Goddard Network Director Gary Morse will communicate with the Shuttle commander through Goddard's ground network or the Track-

ing and Data Relay Satellite System (TDRSS) while the MCC team flies to New Mexico. "GSFC, in concert with the Shuttle commander, assumes mission control during the flight control team's transition from JSC to White Sands," said Morse.

From White Sands, the MCC team has communications with the Shuttle crew through Goddard's ground network or the TDRSS.

In addition to the improved voice

and data capability provided by the ground and satellite links at White Sands, the new site is physically closer to JSC. Time required to transfer mission control is shorter, according to Morse.

"The weather also is better at White Sands," he said. "If a hurricane hits JSC and everyone flies to Goddard, the storm is just as likely to sweep east and hit Goddard. But hurricanes tend not to hit the Southwest."