



Helping hands

Part of the inspiration for JSC engineers working on robotic hands comes from Mother Nature. Story on Page 3.



Happy Halloween

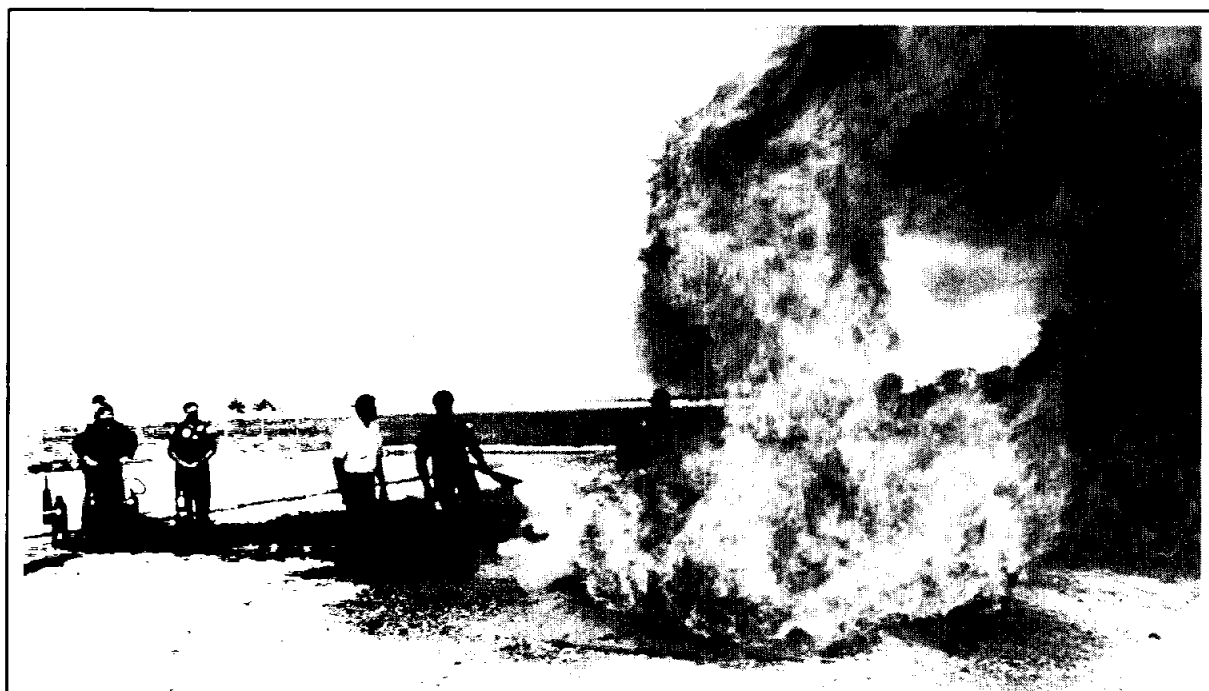
With a little trick (or treat) photography, a JSC shutterbug has "moved" a moonrise over the center for Halloween. Photo on Page 4.

# Space News Roundup

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No. 35



STS-27 Commander Hoot Gibson learns the proper technique for extinguishing flames during firefighting training. Fire Training Specialist Bob Fife gave instruction to Gibson and the rest of the crew, Guy Gardner, standing behind Bill Shepherd and beside Jerry Ross, and Mike Mullane, behind the flames.

## Roll out nears for Atlantis

Move to Pad 39B may begin as soon as Sunday

Atlantis has been connected to the fuel tank and boosters that will loft STS-27 into space, and the Shuttle is almost ready to head to the pad.

Roll out of the Shuttle to Launch Pad 39B at Kennedy Space Center is now scheduled for no earlier than 11:01 p.m. CST Sunday. Launch is scheduled for no earlier than Nov. 27.

The mission will be manned by Commander Robert L. "Hoot" Gibson, Pilot Guy S. Gardner, and Mission Specialists Richard M. "Mike" Mullane, Jerry L. Ross and William M. "Shep" Shepherd.

Atlantis was rolled over to the Vertical Assembly Building (VAB) late Saturday night to be mated with the already connected solid rocket boosters (SRBs) and external tank (ET).

On Sunday, Atlantis was hoisted skyward inside the VAB and maneuvered into position. By 6:15 p.m. Monday, the Orbiter had been completely hard-mated with the SRBs and ET.

After mating, engineers from Rocketdyne, contractor for the Space Shuttle main engines (SSMEs), began measuring an injector faceplate in Atlantis' Main Engine No. 3 to ensure that the plate had not warped.

The check was instigated following concerns about a popping noise heard during tests of other main engines, and an indication that the same type of noise was heard during an early test of Atlantis' No. 3 engine.

The popping noise heard during the engine tests had indicated a warped faceplate at the bottom of an oxidizer preburner in other engines.

Rocketdyne engineers have evaluated the data from the injector plate on main engine No. 3 and determined the measurements are within specifications and acceptable for flight. The plate was measured for flatness.

Atlantis was powered up about 4 a.m. Thursday morning in preparation for the Shuttle Interface Test (SIT), a comprehensive test of the critical connections between the vehicle elements and the launch platform. The test is scheduled to be complete on Sunday after which roll out preparations will begin.

The same modifications made to Discovery before its September launch have been completed on Atlantis, a veteran of Shuttle missions 51-J in October 1985 and 61-B in November 1985.



## Cohen foresees increasing need for high quality

A day-long seminar broadcast agencywide plus special posters and pins for each employee marked NASA's first observance of Quality Day, an event geared to help personnel share ideas promoting performance, pride and excellence.

"For the last 30 years, quality has been a matter of the highest priority within NASA," JSC Director Aaron Cohen said in an address during the Tuesday seminar. "It's appropriate, however, that we periodically set aside time to re-examine our commitment to quality."

Cohen said the Quality Day observance came at a particularly appropriate time, following the flight of Discovery and the feelings of a new beginning it created, both at NASA and for the American public in general.

"As we begin our next 30 years, I can see an ever-increasing requirement for higher quality," Cohen added. "We need to prepare ourselves now to meet these ever more stringent requirements."

The seminar featured officials from throughout the various NASA centers, discussing methods that have been used at their respective centers to ensure quality work, safety and efficiency.

"During the last few years, efforts have been initiated within NASA to make sure we have a strong and flexible organization, and that we resist and eliminate bureaucratic practices which may be on their way to acquiring a life of their own," Cohen said.

Others from JSC who spoke during the seminar included Deputy Director

Paul J. Weitz; Director of Safety, Reliability and Quality Assurance (SR&QA) Charles S. Harlan; Deputy Director of Administration Wayne Young; and Deputy Director of Space and Life Sciences Don Robbins.

Harlan outlined the ongoing work of ensuring quality in JSC's performance with a focus on improving SR&QA communications and information systems throughout the center. A Strategic Plan for improving those areas was completed in February, Harlan said. That plan is now being implemented.

Some of the accomplishments under that plan include establishing SR&QA work areas in 17 of JSC's on-site buildings; increasing work stations from 40 in May 1987 to 145 at present; developing about 50 new, custom-designed database applications since May 1987; and hiring a full-time user support person.

In little more than a year, the use of electronic mail to SR&QA has increased by 465 percent.

"Any individual can send me an electronic message even if he or she just came to work today," Harlan said. "And I've made my calendar available to the whole organization so they can attend any meeting I go to."

Better handling of information and better access to often obscure data can give workers the time necessary "to deal with the meaning of information rather than its mere existence," Harlan added.

Young gave an outline of JSC's Team Excellence Program, a pro-



## Hubble Space Telescope launch moves up to 1989

Launch of the Hubble Space Telescope has been moved up to December 1989 after a reassessment of payload requirements and Space Shuttle assignments, NASA announced Tuesday.

The crew of STS-31—Commander Loren Shriver, Pilot Charlie Bolden, and Mission Specialists Steve Hawley, Bruce McCandless and Kathy Sullivan—is now scheduled to deploy the telescope from Discovery in mid-December 1989. The crew had been scheduled to deploy the satellite from Atlantis, but that Orbiter will now be used to fly STS-36, a Department of Defense mission that will assume the February 1990 launch date.

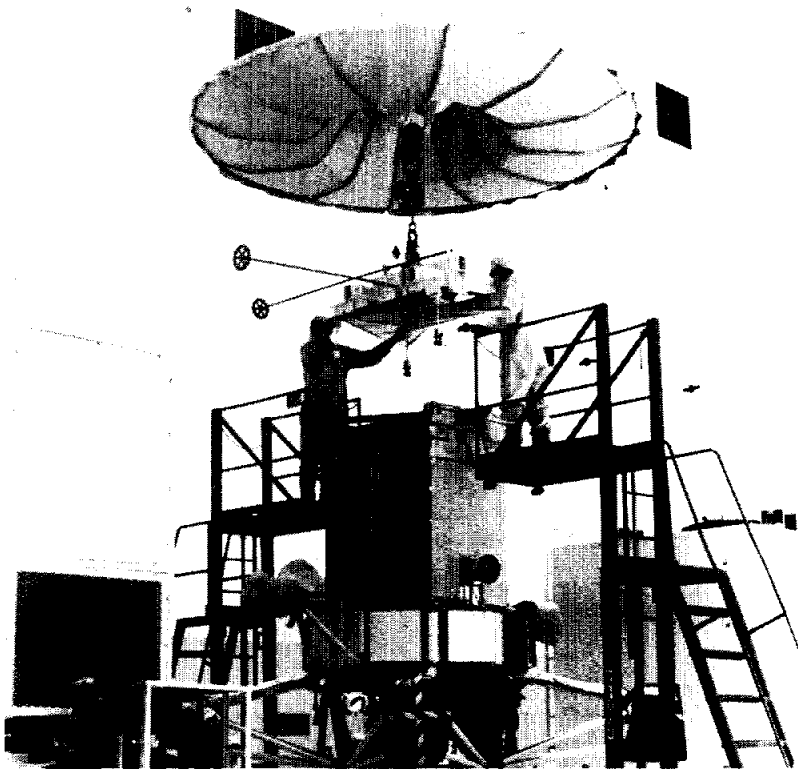
The telescope, which fills the Orbiter cargo bay, will be deployed with the aid of the remote manipulator system.

The Hubble telescope, a cooperative project with the European Space Agency, is the first spacecraft designed for routine on-orbit servicing by Space Shuttle crews. In the mid-1990s, a Shuttle crew is expected to revisit the telescope to

replace onboard scientific instruments with new instruments incorporating advanced technology now under development.

Astronomers hope that from its position 320 nautical miles above the Earth, the telescope will provide new visual clues about the origin of the universe. From high above the atmospheric distortion that plagues conventional telescopes, the reflecting Cassegrain telescope will use its 94.5-inch primary mirror to see objects 50 times dimmer than anything previously seen. It will make observations across a wide spectral range and beam the data back to Earth via the Tracking and Data Relay Satellite System (TDRSS).

The Astrophysics Division of the Office of Space Science and Applications at NASA Headquarters and Marshall Space Flight Center will establish a new shipping schedule for the Hubble spacecraft, presently at the Lockheed Missiles and Space Co. facility in Sunnyvale, Calif. The schedule for a final ground systems test involving the Hubble spacecraft also may be affected.



MOVING MAGELLAN—An overhead crane is attached to Magellan as technicians prepare to move the spacecraft from the transport trailer to the floor of the clean room in Kennedy Space Center's Spacecraft Assembly and Encapsulation Facility 2. Chet Vaughan, chief of JSC's Propulsion and Power Division, will serve on an investigative review board that will look into an Oct. 17 electrical fire that caused minor damage to the Venus radar mapper.

## Early contributions higher for Combined Federal Campaign

Officials have set a higher goal for Houston-area charitable contributions in this year's Combined Federal Campaign (CFC), and they are hoping JSC employees will surpass their \$237,301 in gifts from last year.

As of the JSC campaign's first progress report Tuesday, 532 employees had donated a total of \$55,090.40, an amount well above last year's report of about \$38,000 for the same period. This year's JSC goal is \$265,000. So far, the first reporting period's numbers indicate 16 percent of workers are participating, contributing 21 percent of the final goal.

"We're receiving excellent support so far, and I want to thank everyone who has contributed," said Teresa Sullivan, JSC's coordinator for the 1988 CFC. "I know the family of employees here at the center will work together to meet the challenge set by this year's goal, and I'd like to thank in advance those who'll make that happen. The kindness of our center's employees never shines brighter than it does during this drive."

The CFC kicked off at the center

# People

## Taqvi gets IEEE leadership award

Dr. Zafar Taqvi has been selected to receive the Regional Leadership Award of the United States Activities Board (USAB) of the Institute of Electrical and Electronics Engineers (IEEE). It is one of the highest honors that USAB can confer on an individual in the engineering profession. Dr. Taqvi was cited for his personal efforts in purchasing and installing a satellite receiving system for use as an educational medium on behalf of the Clear Lake Council of Technical Societies. Dr. Taqvi is an Advanced Engineering Specialist with Lockheed and has worked on Apollo, Skylab, Apollo-Soyuz, Shuttle and Space Station programs for the past 19 years.



Taqvi

Region IV deputy director for membership, has been a key individual in organizing the spring AIAA technical symposiums and the 1988 "Space-week" Banquet. She is communications manager for the Houston-Bendix company newsletter, and Bendix representative to the Clear Lake Chamber of Commerce. Lunsford will be coordinating the AIAA participation in NASA/JSC's Professional Women's week and the AIAA Regional Student Paper Competition in the spring of 1989.



Lunsford

## Lunsford receives AIAA recognition

Ava Lunsford has been named the October 1988 recipient of the American Institute of Aeronautics and Astronautics (AIAA), Houston Section's Professional Woman of the Month Award. Lunsford, an AIAA

## NCMA presents scholarships

The National Contract Management Association, Space City-Houston Chapter has selected scholarship recipients from a field of 16 applicants. The winners are: Susan Garman, a senior majoring in accounting, and a co-op student in the Shuttle Procurement Office. Reita May, a full-time law student and employee of the Shuttle Procurement Office. Thomas Swindell, a business administration student assigned as a co-op in the Data Systems and Aircraft Operations Procurement Branch.

# Dates & Data

### Today

**Combined Federal Campaign**—JSC Combined Federal Campaign will run through Nov. 18. This year's goal is \$265,000. Campaign representatives will be calling on JSC employees during the campaign. Anyone who does not know who their representative is may call Teresa Sullivan, JSC campaign coordinator, at x38970. Retirees may call Sullivan at 483-8970.

**EAA badges**—Dependents and spouses may apply for a photo I.D. badge from 6:30-10 p.m., Monday through Friday at the Rec Center.

**Aerobics and exercise**—Both classes are on-going. Sign up at the Rec Center. For more information, call x30303.

**Cafeteria menu**—Entrees: seafood gumbo, fried shrimp, baked fish, beef stroganoff, fried chicken (special). Vegetables: okra and tomatoes, buttered broccoli, peas and carrots, buttered squash.

**Monday**  
**COSMIC visit**—Two representatives from COSMIC, the official distribution center for computer software created under NASA funding, will visit JSC Oct. 31-Nov. 4. Pat Mortenson and Dan Jarrio will be available to discuss how to obtain free programs from other centers, how to submit software and distribute catalogs. To schedule appointments, contact the Technology Utilization Office at x33809.

**Cafeteria menu**—Entrees: Cream of potato soup; franks and sauerkraut, sweet and sour pork chop w/fried rice, potato baked chicken, meat sauce and spaghetti (special). Vegetables: French beans, buttered squash, lima beans.

**Tuesday**  
**Space conference and exposition**—The second annual Space Technology, Commerce and Communications Conference and Exposition will feature products of major international exhibitors as more than 100 speakers in specialized conference sessions, receptions and awards. The conference will be held Nov. 1-4 at the George R. Brown Convention Center. Free shuttle buses will be available to convey NASA personnel, contractors and Clear Lake business people. A bus will pick up passengers on Avenue D in front of the Visitor Center and deliver them directly to the convention center. Buses will depart from JSC at 9:15 a.m. and 1:30 p.m.,

arriving at 10 a.m. and 2:15 p.m. On the return leg, buses will leave the convention center at 12:30 and 4 p.m., arriving at JSC at 1:15 and 5 p.m. For more information call (617) 292-6480.

**Cafeteria menu**—Entrees: Navy bean soup, beef stew, liver and onions, shrimp creole, smothered steak w/ dressing (special). Vegetables: buttered corn, rice, cabbage, peas.

**Wednesday**  
**Introduction to Bridge**—A basic introduction to the game for those who have never played. Meets 5:15-7 p.m. every Wednesday at the Rec Center. Cost is \$10. For more information, call x30303.

**Cafeteria menu**—Seafood gumbo, roast beef, baked perch, chicken pan pie, salmon croquette (special). Vegetables: mustard greens, Italian green beans, sliced beets.

**Thursday**  
**Cafeteria menu**—Entrees: Beef and barley soup, beef tacos, ham and lima beans, stuffed cabbage (special). Vegetables: ranch beans, Brussels sprouts, cream style corn.

**Nov. 7**  
**Country and western dance**—Beginner classes will be available 7-8:30 p.m., and advanced classes 8:30-10 p.m. every Monday for six weeks at the Rec Center. Cost is \$20 per couple. For more information, call x30303.

**Nov. 10**  
**AIAA host lunch and learn**—The AIAA Houston Section Space Systems Technical Committee will host a lunch and learn session from 11:30 a.m. to 12:10 p.m. in the Bldg. 3 cafeteria. The speaker will be Andre Sylvester of NASA, and the topic will be "OMV Simulation in the System Engineering Simulator." Bring your lunch and enjoy the talk. For more information, call Michael Laible at 282-4573.

**Nov. 16**  
**Open season**—The Office of Personnel Management (OPM) has announced Open Season for the Federal Employees Health Benefits Program will be held Nov. 14 through Dec. 9. The Human Resources Office is sponsoring a one-day Health Fair from 9 a.m. to 9 p.m. Nov. 16 in the ballroom of the Gilruth Recreation Center. For more information call x32681.

# 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**  
 Sale: Inside lot at Rayburn Country, Jasper, TX., 80' x 200', bargain, 645-0008.  
 Sale/Rent: Pipers Meadow, 3-2-2, formal dn., fence, gas appl., corner lot, near pool, \$550/ mo. 280-9822.  
 Sale: Friendswood/Sun Meadow Estates, wooded lot in estab. neighborhood, cul-de-sac, bordered by stream & golf course on 2 sides, approx. 245' deep x 86' wide, approx 1/3 acre, util. on site, \$31,500. Doug, x32860 or 486-7412.  
 Sale: Middlebrook, 3-2-2, study, FPL, wetbar, covered patio, large lot, ex. cond., FHA assum. 10%. 480-9363.  
 Sale: University Green, Patio Home, 2-2-2D, Study, light and clean, low maint., \$98,700. 488-0397.  
 Sale: Heritage Park, 3-2-2 cust. home, tile entry, walls of windows in living and dining rooms, beautiful custom kitchen, new deck, fence, both baths redone, vanities custom, new paint inside and out, wallpaper, miniblinds, \$58,500. Tony or Lori, 482-5139.  
 Rent: NASA/Ellington, 2 BD apart., W/D, \$365/mo. Eric x38420 or 484-9179, Herb x38161 or 481-1253.  
 Sale: League City, 1980 mobile home, 14' x 56', 2-1, ex. cond., w/carpot, assum. loan, \$122/mo., plus low equity. Scott, 485-4364.  
 Rent: Galveston, beachfront condo on Seawall Blvd., amenities, sleeps 6, \$79/day or \$490/wk. 332-1614.  
 Sale/Lease: League City, 4-2-2, approx. 1900 sq. ft., large trees and large fenced back yard, \$550/mo. or \$65,000, both nego. Karl, x31236 or 554-6180.  
 Sale: 25 acres just off 517 between Alvin and Dickinson, \$5K/acre, owner finance with 25% down. 337-4051.  
 Rent: League City, Glen Cove, 4-2-2A tri-level, family room/FPL, fans, Jen Aire, fenced, sec. lights, CA/H, park, boat ramp, \$650/mo., \$600 dep., pets extra. 337-4051.  
 Sale/Lease: Kirkwood South, large custom 2-story, 4-2-2, formals, family room, FPL, study, intercom, cul-de-sac lot, near Dobie H.S., \$74,900 or \$650/mo. 488-5210.  
 Sale: 75' x 150', heavily wooded lot with view of Taylor Lake, all util. avail., \$19,500. 333-5821.

### Boats & Planes

Surf jet, powered surf board, fast, fun, runs like new, \$1,075. 354-7168.  
 '81 16' CAM II pleasure boat with 100hp outboard, like new, incl. trailer, bimini top, boat cover, skis, life jackets, stereo radio/tape, two fuel tanks, and more, \$3,800. 480-9363.  
 21' Santana, 6 sails incl. Spinnaker, well equipped to race or cruise, 4hp, 4 wheel trailer, \$3,000. John, 332-9976.  
 '84 Mistral Maui, complete with 6.2 sail, \$375; Mistral World Cup Camber 6.6 sail, \$135. Scott, x38093 or 333-1803.  
 '67 23' O'Day Tempest sailboat, 4' draft, fin keel, main, working jib, 150% Genoa, 6hp Johnson outboard, 8' cockpit, V-berth for 2. head, slip avail., \$3,000. 326-4481 or 485-1473.

### Audiovisual & Computers

Atari 800 computer, 2 Atari 1050 drives, 1 Atari 1025 printer, 1 Atari 1020 color-printer, 1 Atari 1030 Modem, 1 Atari 835 modem, 1 sharp B&W monitor/TV and all software, \$250, OBO. Damian, 280-9672.  
 Philco cathedral 3-band radio, Model 60 (1936) restored, \$125, OBO. 482-5274.  
 Macintosh software, Orbiter space shuttle simulation, \$30. Scott, x38093.  
 Stereo equip., 40 watt integrated amp., \$40; 100 watt integrated amp., \$190; tuner, \$60; three head cass. deck, \$195; turntable, \$25; subwoofer & satellites, \$190. 480-9363.  
 Trade: Epson widecarriage printer (MX-100) for smaller printer of equal value, or sell/buy for reasonable price. Amanda, 280-9956 or 480-1225.

### Household

Five Kirsch and Lovelord mini-blinds, sizes 5x5, 3x5, 5x3 in almond, terracotta, blue, and pink, \$60/ea.; four swivel kitchen chairs, \$50; misc. household items. Lynn Thebeau, 480-0287.  
 GE portable 5" color TV, with stereo AM/FM "removable" cass., like new - in box, \$169. C.W., 282-1871 or 280-8796.  
 Coldspot apartment size refrig., white, good cond., \$50. Tony, x35966.  
 Two LR chairs, \$45/ea.; two end tables, \$25/ea.; matching Bassett dresser, \$60 and nite stand, \$30; 90" sofa, \$70, all ex. cond. Ben, 482-8998.  
 Oak desk & chair, \$200; full upright piano, \$200; queen size sleeper sofa, \$200; 5 stack glass front bookcase, \$250; fish aquarium, and mahogany buffet, \$100. 474-7432.  
 Sears 17 cu. ft. upright freezer, white, ex. cond., \$150. 481-0608.  
 Complete white French provincial full-size canopy bed w/canopy cover, \$75; white French provincial dresser, \$35; sofa & loveseat, \$150. 487-3076.  
 Dark wood curtain rod, 96" w/matching wood brackets & rings, \$20; king size bedspread, dust ruffle, 2 pillow shams, burnt orange, \$25. 532-4766.  
 Antiques, oak rocking chair, \$150; oak jelly cupboard, \$175; grain bin, \$150; 3 shelf pine book case, \$75; quilts, green basket pattern, full size, \$175, peach diamond pattern, full size, \$175; pie safe, \$200. 532-4766.  
 Queen size sofa sleeper and matching love seat, \$400; glass top coffee table and end tables, \$300. Barbara, 282-4025 or 331-5346.  
 King size bed, headboard, solid maple, spindle type, ex. cond., \$125. John, x38178 or 482-5837.  
 Two twin mattress w/box springs, ex. cond., only a year old, \$150 for both sets, will sell separate. Tammy, 282-4455.  
 Solid oak dining room table and six matching chairs, new and in great cond., \$800. Clayton, x3501 or 532-1903.  
 Two matching loveseats, dark blue w/peach/cream print, good cond., \$250 for both. Valerie, 282-1812.  
 Mirrors, gold-veined, 45" x 91 1/2", two each, like new, \$200 for two or \$125 each, OBO. Doug, x32860 or 486-7412.

### Wanted

Hunters needed for goose lease, 300 acres, 1/2 rice, 1/2 plowed, near Eagle Lake, \$225/gun. Mark, 282-3428 or 481-4162.  
 19" color TV and/or metal detector (preferably submersible), good cond., and price. Amanda, 280-9956 or 480-1225.  
 Need roommate for 3-2-2 in Meadowbend, League City, great home, \$200/mo. plus util. John, x31929 or 332-0315.  
 Want '82-'86 basic Ford F-150 Chevy C-10, GMC pickup, auto., P/S, short bed, pref. "Fleet side". x31604 or 333-3103.  
 Want 1980-1984 Ford truck with bad engine or trans., prefer F-250 club-cab with 351 eng., will pay finders fee. Terry, x34473.

### Cycles

'80 Honda CB 750 F, silver, good Dunlops, S.S. super trapp, K&N air filter, ultra reliable, \$1,000. Bruce, x34925 or 923-4571.  
 '86 BMW K75C, 750 c.c., water-cooled, new tires, BMW hard bags, 8,300 mi., factory warranty, \$3,650. John, x36484 or 486-1186.  
 '76 Yamaha YZ125, needs some work or sell for parts, \$75, OBO. Margo, x35305.

### Pets & Livestock

Dickinson stalls and/or pasture for rent, 15

acres, \$30/mo. 534-2806.  
 Pearland-Friendswood, horse pasture and stall for rent, \$50/mo., partial board, \$150/mo., full board. Myron, x39419 or 482-8647.  
 Free puppy, 6 mo. terrier mix, black wire haired, very playful, house broken. Duane or Joann, 484-5927.  
 Beautiful, healthy Sheltie puppies, 4 males, ready to go, born Aug. 24, 1988. Frances, x33723 or Laurie Mount, 486-0584.  
 Free kittens, one black, one dark brown and black tiger, half grown, friendly with small children, litter box trained. Myron, x39419 or 482-8647.  
 Free kittens, 11 weeks old, very friendly, litter box trained, scratching post trained, first shots given. Beth, x33864 or 280-0861.  
 Looking for a good home for a great dog, seven yrs. old, beautiful black Labrador, male, AKC registered. Lili, x30962.  
 SKC Boston terriers, 1 male, 3 female, \$175. Jack, x32892.

### Musical Instruments

New Yamaha elec. guitar, metallic blue, w/stand and Peavey amp. was \$500, now \$400. Damian, 280-9672.  
 Upright studio piano, ex. cond., \$450. 331-0608.

### Lost & Found

Found stray friendly male cat, looking for a good home. Tomas, 282-4702 after 3 pm.

### Personal

Reunion: November 3, 1988, Gilruth Pavilion, Earth Resources Research Division personnel, NASA, contractor, USDA, NOAA, etc. Please contact B.A. Cox, x33151 or C. Wheelock, 282-1900

### Miscellaneous

Sliding glass door, complete with alum. frame, 6' or 9' wide, very good cond., \$95. John, x38178 or 482-5837.  
 '73 240Z Datsun hood, ex. cond., 5 wheels w/tires for 240Z, \$50 for all. 282-3564 or 488-4101.  
 Altec custom voice of the theater sound reinforcement speaker system, \$1,000. 480-9363.  
 4 BBS alloy rims, 4 bolt w/4.25 inch bolt circle, 2-6x13 w/20x6.0 Goodyear Racing Edge tires and 2-9x13 w/21.5x8.5 tires. Merrill, x34925.  
 Two camping/time sharing memberships at San Jo Cove Recreation Center, Lake Conroe. 550-4112.  
 Small drafting table, \$35; Rugcrafters Jungle Scene kit, was \$120, now \$5; large black & white rug chess set, was \$80, now \$35; Sears baby scale; 50' Rohm antenna tower, \$100, OBO. 482-5274.  
 Chapel-length wedding gown, candlelight color, with lace and beadwork on bodice and long sleeves, taffeta, size 6, \$500. Lynn Thebeau, 480-0287.  
 12 gauge 2 3/4 dove and quail load shotgun shells factory loads, Winchester and Remington brands avail., \$3.50/box, 25 boxes. Brian, 333-9408.  
 Helmet, bell mag 4, size 7 3/8, blue, ex. cond., \$40, OBO. Pat, x39375.  
 Sears garden tiller, 4hp, good cond., \$125, OBO. Pat, x39375.  
 3 formal dresses, black, tea length, sz. 3, \$50; blue, full length, sz. 5, \$150; pink, full length, sz. 6, \$50. Julie, x35774 or 332-3683.  
 Golf clubs, Tour Model System II irons, 1-9 PW, SW, new, peripheral weighted, ex. clubs, \$185, 554-5514 or 282-3827.  
 Below cost, a new and unused 1988 World Book set w/Imperial leather binding, \$625. Paula, 337-2703.  
 Pine logs, cut in 2' lengths, free. Jane, x37169 or 470-2744.  
 Florsheim black "Lightweights" man's dress shoes, 10-E, composition sole, soft inside, worn twice, \$20. x31604 or 333-3103.  
 Nagel's Patrick, commemorative prints, #7, #11, #12, #13, #14, #15, \$150 to \$500. Mike, x32439 or 326-3947.  
 Will pay cash for frequent flyer 1-pass miles, local. 480-5990.  
 2 openings on Grimes County deer lease near College Station; season opens Nov. 5, \$300 per gun plus \$12, util.; guys and/or gals welcome. Clark, x30514 or 643-7325.  
 Space Shuttle jackets; JSC-Space Shuttle team, STSOC, Space Station & STS 26. 480-1746 or 488-1454.  
 Exercise bike, Battle Creek trimcycle w/ motor, \$50; manual portable typewriter, Remington, \$15; Sony reel tape recorder stereo, \$30; Sony 19" color TV, ex. cond., \$150. 482-7643.  
 20" boy's bicycle, Mongoose, chromemoly, \$60. Tony, x35966.  
 Marlin Model 1894 .44 Magnum lever action rifle, ex. cond., \$195. 474-7433

# Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Gift Store from 10 a.m. to 2 p.m. weekdays:  
 General Cinema (valid for one year): \$3 each.  
 AMC Theater (valid until May 31): \$2.95 each.  
 Sea World—San Antonio (year):

children, \$13.56; adults, \$15.96.  
 Renaissance Festival (weekends in October through Nov. 15): children (5-12), \$4; adults, \$8.  
 Delta Downs bus trips, Nov. 19, \$18 (day trip includes transportation and admission) and \$50 (overnight trip includes transportation, admission, Beaumont Hilton accommodations, Sunday brunch).

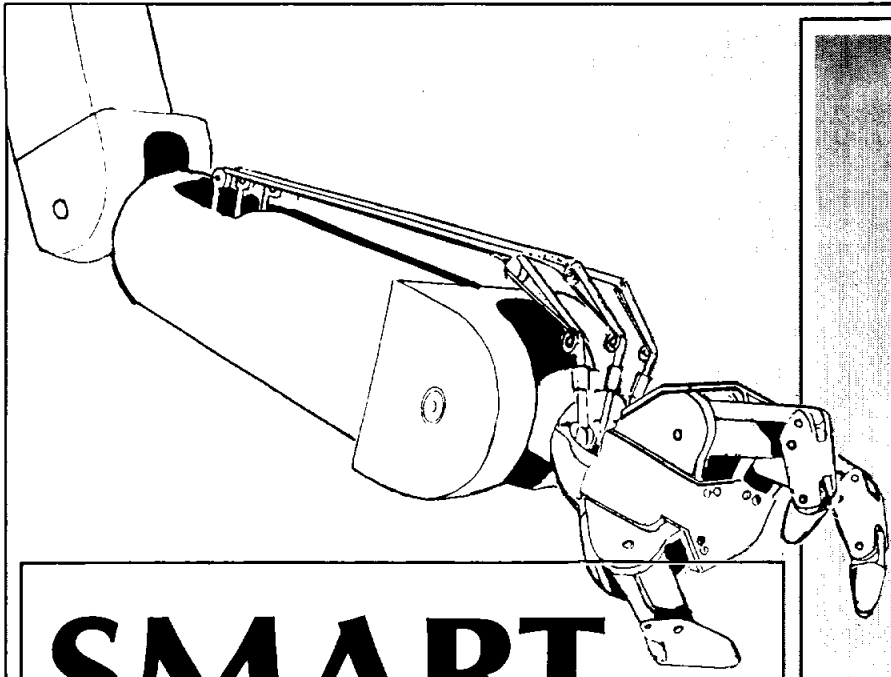
## U.S. SAVINGS BONDS

### You'll Never Forget

Elephants never forget and neither will you if you plan regular savings with U.S. Savings Bonds.

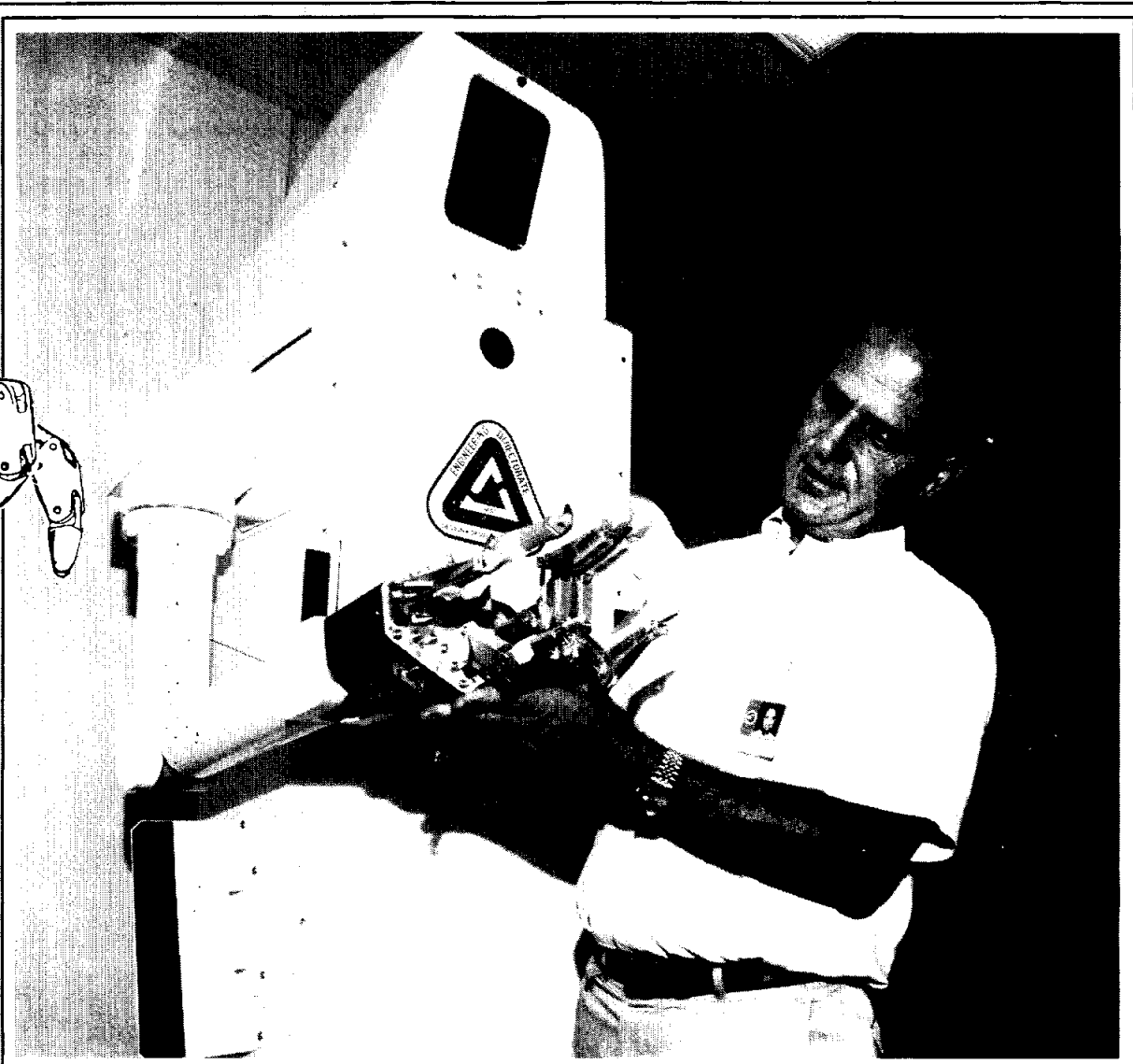
Sign up for the payroll savings plan where you work. Your Savings Bonds will accumulate automatically every payday every month, into a memorable fund for the future.





# SMART HANDS

## Flesh is inspiration for next generation of mechanical appendages



**By James Hartsfield**

When JSC's Larry Li works with his hands, he doesn't get his fingernails dirty. In fact, his hands don't even have fingernails.

Li is an electrical engineer working on developing "smart hands" for the Extravehicular Activity (EVA) Retriever, a robot designed to assist spacewalking astronauts by retrieving dropped items. A variety of robotic hands is being evaluated by Li and a team in the Special Projects Branch of the Crew and Thermal Systems Division (CTSD).

The hands now on EVA retriever are anything but human-like. The right one is basically a three-clawed gripper and the left only two-fingered tongs. But the appearance of many of the hands the team is evaluating makes it apparent the inspiration for them was found in flesh and blood.

"We're not saying a dexterous, human-type hand is the way to go," Li said. "But just looking at nature, it seems pretty obvious that Mother Nature seems to always have the best design."

In fact, debating the value of human-like, or anthropomorphic, versus a non-human-like, or non-anthropomorphic, design is a key ingredient of the team's current work, Li said.

"There are basically two approaches we could use. First, we could develop a specialized hand for specific tasks, such as is very effective in industry, but the drawback is that it would take a wide variety of them for the multitude of planned tasks," he explained. "And, second, we could develop a generic,

smart hand that can grip a variety of objects, with the software that allows the hand to judge for itself how it should grip an object."

Some of the hands being studied are not only like a human hand in appearance, but they can actually feel. Sensors on the fingers can gauge the pressure with which they grip, and another set can register a feather-light touch. And some sensors even surpass human senses—proximity sensors can register when the hand is close to an object without actually touching it.

Strolling through the EVA Robotics Lab in Bldg. 34, Li displayed a host of hands the team is working with, starting with strict mechanics and moving toward models that are an almost eerie imitation of flesh in steel.

One of the hands destined to be installed on EVA Retriever for the project's Phase 2 demonstration in January 1989 is a three-fingered design with one finger opposing the other two. The hand is similar to the right hand now on EVA Retriever and was designed by CTSD Engineer Tom Grubb.

The hand, designated CTSD-2, has three degrees of movement and basically differs from the current hand on EVA Retriever in the force and touch sensors it includes. Also, the hand is mounted to a wrist featuring gears that can provide simultaneous pitch and yaw movement, much like a human ball joint. The hand is powered by three separate electric motors.

The right hand to be installed on the Retriever for Phase 2 will be

a robotic derivation of a mechanical hand originally designed as a remote manipulator, an alternative to spacesuit gloves, by consultant Dr. John Jameson. The robotic Jameson Hand is now being fabricated by JSC's Technical Services Division. It will have two fingers and a thumb in a human-like configuration and will be powered by seven motors packaged in a forearm. The hand will have six degrees of freedom.

"We have to minimize the degrees of freedom we need but maximize the mobility," Li explained. "You have to strike a compromise, because the more degrees of freedom you have, the more hardware and software you'll need to control it."

The more a hand appears human, the more complicated it becomes. And the Salisbury Hand, so named for designer Dr. Ken Salisbury, attempts to improve upon Mother Nature.

The three fingers on the hand can overextend, basically, bend backward. The overextension could allow the hand to grasp some objects in ways humans can't, such as grabbing a ring by putting the hand through it and bending the fingers back. The Salisbury Hand features nine degrees of freedom and is driven by 12 separate motors.

The most complex in this spectrum of hands is the Utah-MIT hand, a mechanical appendage so adept that it can catch a ball. Developed by the University of Utah and the Massachusetts Institute of Technol-

ogy, the NASA team is using the hand as a test bed for research into the advantages and disadvantages of human-like designs. The way it's built, the Utah-MIT hand will never make it on to EVA Retriever.

The hand is run by pneumatic cylinders and tendons, an impractical method for space due to its bulk. It features 16 degrees of freedom, but it can be limited to fewer degrees of freedom if certain joints are locked, making it an excellent model for developing software, evaluating sensors and studying the advantages of anthropomorphic design, Li said.

What EVA Retriever's final hands will look like is uncertain, but it will probably end up a combination of the variety of possibilities under study. After the January 1989 demonstration is completed, a new set of hands will be installed on the robot for a Phase 3 January 1990 demonstration.

Creating a robot hand is a task filled with problems. "For a robot, gripping an object is a tough problem even on Earth," Li said. "But on Earth, you've always got that fallback, the ground—if an object's dropped, it will hit the ground. In space, though, it's unlimited."

And that lack of limits, coupled with lack of weight, means grabbing an object is a delicate chore. Motion must not be imparted to the target object before the robot hand is ready to grasp it. For that reason, a proximity sensor system being developed by Li and Cliff Hess may prove invaluable.

The sensors, placed on the hand, will be able to judge where an object is before it is touched by bouncing infrared light off of it. Such a perception could allow the hand to curl around an object before it closes, thus reducing the risk of accidentally knocking the object away during a grasping attempt. Li and Hess are in the process of patenting the sensor system.

Also in development is the software that will give EVA Retriever the artificial intelligence it will require to make judgments about where to grasp things and how it should maneuver in order to carry through with that decision. In the final product, EVA Retriever is planned to be highly autonomous so that all astronauts will have to do is give simple, verbal commands such as, "Retrieve."

Li has high hopes for EVA Retriever. "If it works out the way we want it to, it could serve as more than just a retriever. It could be an astronaut helper," he explained. "It could manipulate as well as grasp. It could maybe turn a knob, or hand a truss to an astronaut." He likened the possible robot-astronaut relationship to that of a 5-year-old child helping his father lay bricks.

For some, robots imitating humans is a bit frightening. But not to Li. "It's eerie for you, because you didn't program it. I programmed it; I know what it's supposed to do," he said. "I like to make things appear human, to give them a personality at demonstrations. It just amazes me how far robot technology has gone."



**Top: Tom Grubbs, Crew and Thermal Systems Division mechanical engineer, checks the redesigned robot hand destined for EVA Retriever's Phase 2 Demonstration in January 1989. Grubbs designed the hand now on the Retriever's right arm, and this update adds touch and pressure sensors. Left: Lockheed consultant Dr. John Jameson works with the remote manipulator hand he designed as an alternative to spacesuit gloves. A robotic derivation of the design, now being fabricated by JSC's Technical Services Division, will be placed on EVA Retriever's left arm for the January 1989 demonstration. Far left: Electrical engineers Larry Li, left, and Cliff Hess study a variety of the hands under development for EVA Retriever.**

# Ozone hole is weaker this year, scientists say

Scientists at Goddard Space Flight Center have noted the emergence of an unusually weak Antarctic ozone hole in 1988.

The scientists have been closely monitoring the total ozone levels over the Southern Hemisphere with the Total Ozone Mapping Spectrometer (TOMS), an instrument on board NASA's NIMBUS-7 satellite.

In 1987, the minimum value of ozone over Antarctica decreased by nearly 50 percent during September.

In contrast, the minimum value decreased only 15 percent during September 1988. If the current ozone amounts remain approximately constant throughout October, as has occurred in previous years, then the ozone hole in 1988 will be the smallest since 1982.

Goddard scientists, Drs. Arlin Krueger, Richard Stolarski and Mark Schoeberl, reported that the Southern Hemisphere winter began with record low ozone amounts at mid-

and sub-polar latitudes. In August, the polar vortex became highly distorted by large scale waves. Krueger, the TOMS principal investigator, said, "The ozone hole in September was considerably offset from the South Pole and was weak compared with the 1987 ozone hole."

These scientists also noted that the Southern Hemisphere stratosphere exhibited more north to south winds in 1988 compared to 1987, which probably dispersed the chemical

compounds trapped inside the polar vortex before significant chemical destruction of ozone could take place.

Current chemical theories of the ozone hole require that polar air remain contained within the band of strong stratospheric winds that surround the Antarctic continent throughout September.

According to Schoeberl and Stolarski, this has been a year of unusual dynamic activity in the Southern

Hemisphere. Not only has the dynamic activity had an effect on the development of the ozone hole, but it has slowed the long-term ozone decline in the rest of the Southern Hemisphere.

The reason for this year's extreme dynamic activity is not fully understood, according to Schoeberl and Stolarski. "But it seems to follow the 26-month cyclic change in stratospheric tropical winds," said Schoeberl.

## Center workers urged to give

(Continued from Page 1)

Oct. 18 and will continue through Nov. 18. The campaign is a once-a-year voluntary fund-raising effort authorized by presidential executive order that gives civil service workers and military personnel a chance to contribute to local, national and international health and welfare charities.

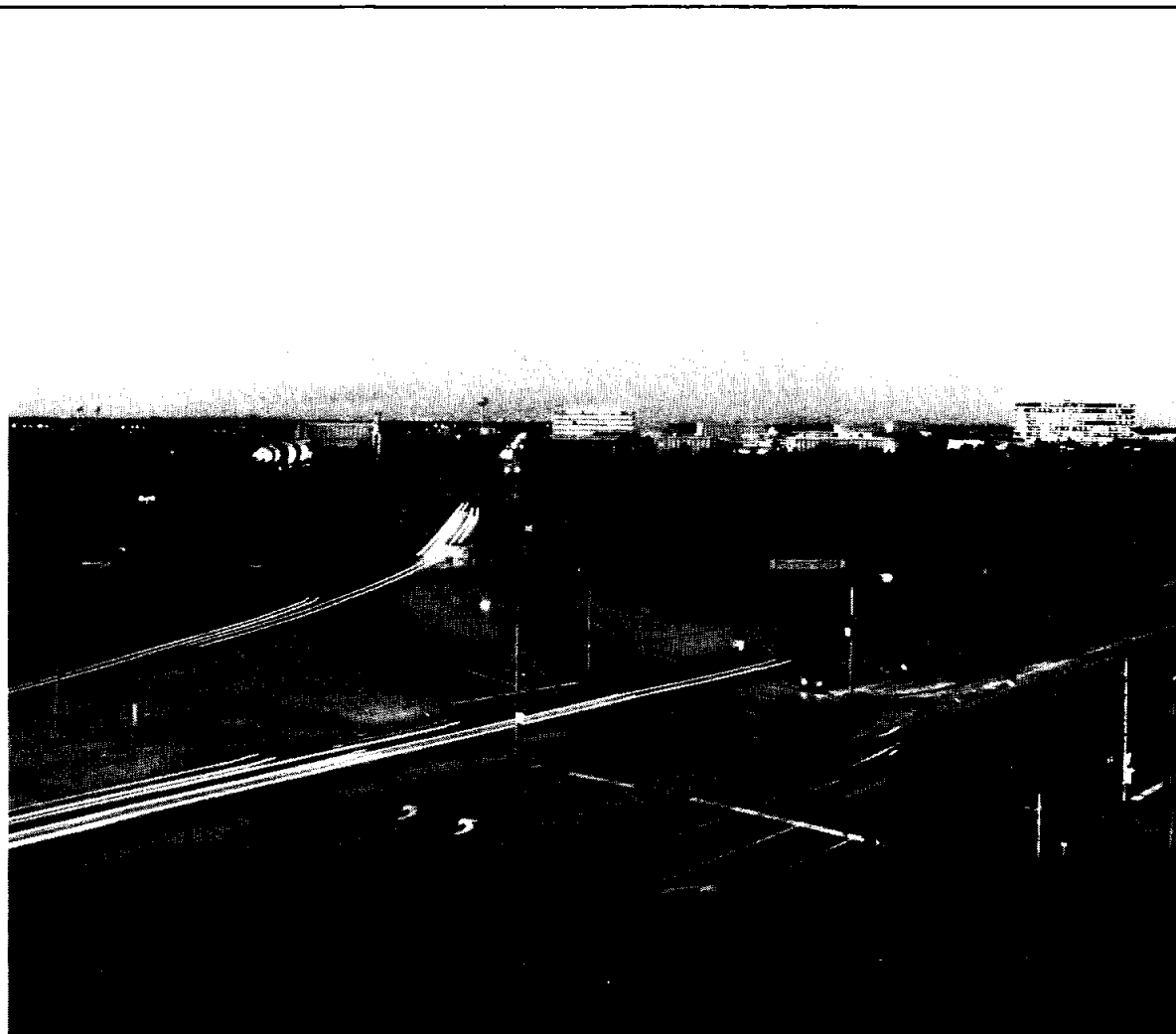
The total Houston goal in the United Way drive this year is \$50 million, and the CFC is hoping to raise \$2 million. Last year, the CFC raised about \$1.3 million, more than a fifth of which was given by JSC employees.

"I believe that JSC personnel care," JSC Director Aaron Cohen said. "I am confident JSC personnel will be generous with their gifts to this year's CFC."

To increase the total contribution by the \$700,000 needed, each federal employee is urged to increase individual contributions by about 50 cents a week. Such a boost would more than achieve the \$2 million total.

"In making this decision, it's good to remember that you will not only be helping your community to help itself, you will undoubtedly be helping a neighbor or loved one when they need it most," Cohen said.

The CFC supports a number of worthwhile causes, among them the NASA College Scholarship Fund, Inc., a fund that provides educational assistance to selected NASA dependents, and the Manned Space Flight Education Foundation, Inc., an organization chartered to design, build and operate a new visitors' center at JSC.



**TRICK (OR TREAT) PHOTOGRAPHY**—A harvest moon seems to rise from the north above JSC in this double exposure taken by Sheri Dunnette, a TGS Technology photographer. Dunnette took separate exposures of the moon and JSC on the same frame of film using two separate cameras and lenses. Both exposures were taken from atop the Nassau Bay Resort Motor Inn, but the moon was actually rising 60 degrees west of its apparent position in the photo.

JSC Photo by Sheri Dunnette

## Hinners appointed associate deputy

Dr. Noel W. Hinners became NASA associate deputy administrator Monday by appointment of NASA Administrator James C. Fletcher.

Hinners, previously associate deputy administrator for institution, succeeds Willis H. Shapley who is retiring but will continue to serve as a consultant to the administrator.

Hinners is now the third ranking official of NASA and the principal senior assistant to the administrator and Deputy Administrator Dale D. Myers. Hinners will continue as NASA chief scientist and supervisor of institutional management in NASA. The position of

associate deputy administrator for institution is being abolished.

Hinners is a career civil servant who first joined NASA in 1972 as deputy director of lunar programs, Office of Space Science. From 1974 to 1979, he was NASA associate administrator for space science. He was director of the Smithsonian Institution's National Air and Space Museum prior to being appointed director of Goddard Space Flight Center in 1982, a position he held until his current appointment.

Shapley, also a career civil servant, served in the Bureau of the Budget, the predecessor of the Office of

Management and Budget, from 1942 to 1965. He joined NASA in 1965 as associate deputy administrator and served in that position until his first retirement in 1975.

He rejoined NASA at the urging of Dr. Fletcher in 1987 to help NASA recover from the Challenger accident. He first served as associate deputy administrator for policy and later as associate deputy administrator where he was a principal advisor to the administrator on policy and related matters. His commitment to Dr. Fletcher was until the STS-26 flight was completed.

## Space News Roundup

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## Shuttle bus service to be discontinued to JSC as of Nov. 7 by Transit Authority

The Clear Lake Shuttle Service, which provides bus service to JSC, is scheduled to be discontinued Nov. 7 by Houston's Metropolitan Transit Authority.

"Metro carefully reviewed alternatives — many suggested by citizens such as yourselves. Unfortunately, none of the alternatives proved cost effective," said John Sweney, metropolitan transit authority spokesperson.

"Metro regrets its action," he added. "But we want you to know that it was a result of serious and sincere deliberation."



The newest in a series of Team Excellence posters by artist Al Chinchar focuses on the need for daring and innovation.

## Quality Day activities stress pride

(Continued from Page 1)

gram that received the President's Council on Management Improvement Award. Under the program at JSC, there are 19 active employee teams, including nine joint JSC-contractor teams, that help maintain a commitment to excellence, Young explained.

An example of those teams at work has been the streamlining of the small purchases process, a process that cuts through several areas by its very nature, often gathering unwanted moss in the form of red tape as it rolls toward the final product. A steering committee composed of managers from across the center, backed by a user team, a logistics team, a financial management team and a procurement team.

The teams' work has resulted in cutting the cycle of approvals for small purchases in half, reducing the time from receipt to delivery for certain purchases by 40 percent, documenting the entire process and reducing the number of change orders by half due to changes in policies and require-

ments. Altogether, the work in these areas and other continuing efforts have the team well on the way to reducing the processing time by as much as 35 percent, Young said.

Team programs also promote internal communication at the center and have gained a positive reaction from employees who usually are eager to participate in them, he added.

Weitz introduced a section of the seminar dealing with strategic planning for the future, and a centerwide effort at JSC that resulted in the publishing of the "JSC Strategic Game Plan" and the formation of the New Initiatives Office, among other outcomes.

"In many companies, strategic planning is done by a small group behind closed doors. That might be OK for them, but not for us," Weitz said. "Instead, Aaron Cohen decided that we could do a better job if we involved JSC employees."

Robbins detailed JSC's work on planning, efforts done via teams that,

at one point, involved as much as half of the work force here. Contractor teams also provided support, and the process is continuing.

"We felt that we were participating in shaping the future course of our center and, possibly, of the agency," Robbins said. "It was a fun thing we did."

The broad participation in JSC's planning also led to increased communications at the center and allowed many employees to see how their work fits into the larger perspective, he added.

JSC's presentations were only a portion of the programs featured during Quality Day, and representatives from virtually every NASA center were on hand to detail innovative efforts that have promoted the goals of the day. The sessions helped to highlight those efforts, share information within the agency and focus the importance quality work holds in the space program.

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