



Big on small

JSC will join the rest of the nation in observing Small Business Week beginning May 10. Story on Page 4.



Showing off

JSC's co-op students will show what they've been doing and learning at the Spring Co-Op Job Fair. Story on Page 4.

Space News Roundup

Vol. 31

April 24, 1992

No. 17

STS-49 on deck for EVA triple play

[Editor's note: This is the first of two articles examining the complex task of performing three space walks on the same shuttle mission. Part 1 looks at the Intelsat capture and reboost. Next week, Part 2 will detail plans for the two Assembly of Station by EVA Methods space walks.]

By Kyle Herring and Kelly Humphries

When a baseball team makes three outs in one play, they call it a "triple play." When a hockey player scores three goals in one game, they call it a "hat trick." When NASA plans three space walks in the same

flight, they call it a "real challenge." STS-49 has been heralded as the first flight of the new Space Shuttle *Endeavour*, but orbiters have made maiden voyages before. Some other big firsts for the May mission will be a part of that Buck Rogers game called extravehicular activity, or space walking.

This will be the first shuttle flight in which three space walks have been attempted one right after the other. It will be the first time four different astronauts have stepped outside the airlock on the same mission. It will be the first time four space suits have been carried on a shuttle. It will be the first on-orbit use of the Intelsat retrieval's lynch-

pin, a "capture bar" designed and built at JSC. And it will be the first time for astronauts to work over the nose of the shuttle, where they will work during Space Station *Freedom* assembly.

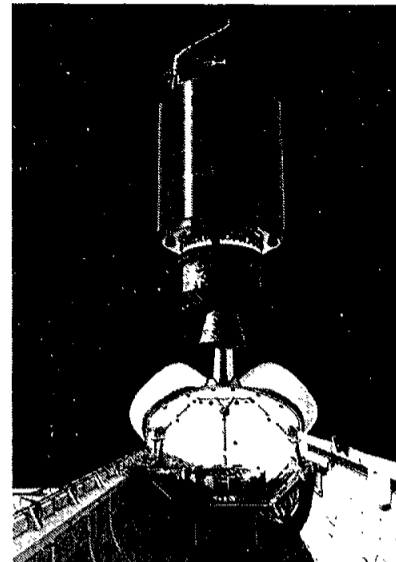
The flight controllers who will support the STS-49 space walks are treating the flight almost like two different missions — the first to retrieve the stranded Intelsat VI satellite and attach a new booster and the second to test Assembly of Space Station by EVA Methods.

Work on the first part of the mission began just two years ago when the Titan rocket carrying the International Telecommunications Satellite Organization's payload

malfunctioned and stranded Intelsat in a useless orbit.

One month later, a "tiger team" gathered at JSC for a two-day brainstorming session to discuss the feasibility of using the shuttle to rescue the satellite, repair it and send it on its way to geosynchronous orbit 22,000 miles above the Atlantic Ocean. Top JSC payload engineers, Mission Operations representatives and executives from Intelsat and Hughes Aircraft, builder of the satellite, hammered out a basic plan. An agreement to attempt the rescue was signed in June 1990, less than three months after Intelsat was stranded.

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Hughes Aircraft Illustration
Intelsat rises out of the payload bay following a successful EVA.

New badges make informal visits easier

JSC employees who want to let friends and relatives have a look at where they work should have an easier time of it when a new badge and policy go into effect next month.

Employees will be able to obtain the new Escort Required Visitor Badges through their own directorate or division offices thanks to a Total Quality Management streamlining effort sponsored by the Center Operations Directorate's Security Division.

Any badged employee who wishes to escort personal visitors into non-public buildings or areas of JSC will be required to check out one of the new badges effective May 15.

"We've had some requests that have come out of TQM that said, 'Why don't we let the divisions badge their own personal visitors?'" said Security Specialist Debra Griffin. "This way, division people can control who comes into their area and, hopefully, make it easier on their employees."

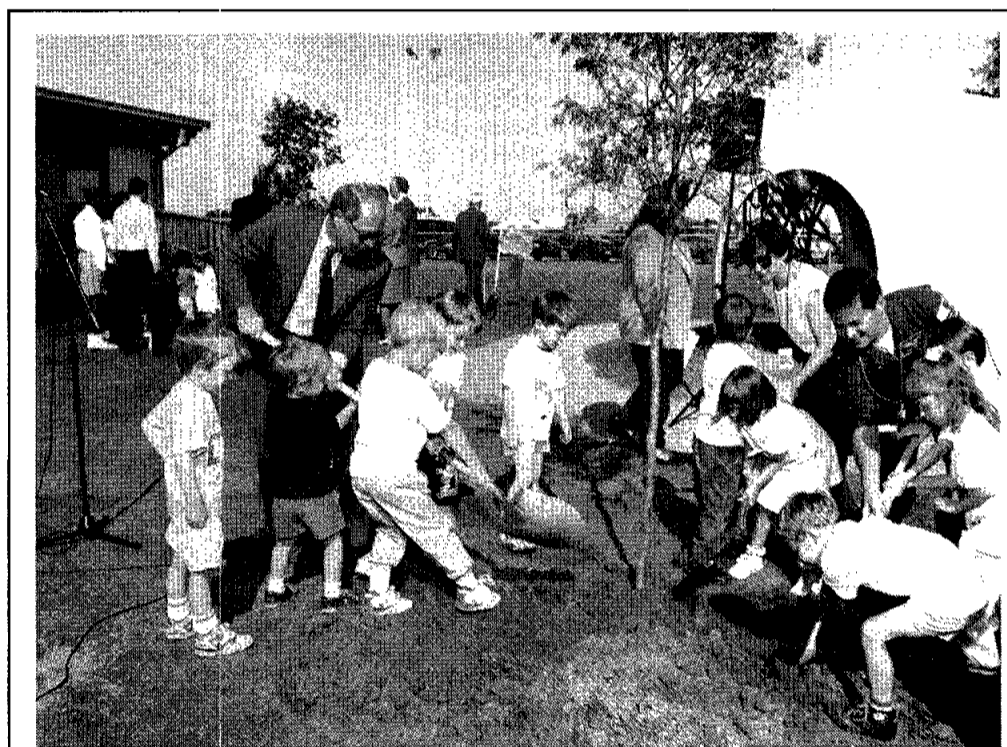
The badges will allow employees to escort their visitors into any JSC building, but employees still will need to get prior approval to visit any areas outside their normal work area.

Employees should remember that only United States citizens or resident alien card holders are allowed in non-public buildings and that unofficial visitors won't be allowed in the Mission Control Center during missions.

The policy change means that the badging offices in Bldgs. 100, 1 and 30 will no longer issue badges for unofficial visitors after May 15.

The JSC Security Office will provide the ERVBs to each directorate.

Please see **BADGES**, Page 4



JSC Photo by Jack Jacob

EARTH DAY — JSC Associate Director Dan Nebrig, Astronaut Dan Bursch and Space Family Education Inc. President Ann Bufkin help students from the JSC Child Care Center plant a Drake elm tree on Wednesday. Two trees, the elm and a burr oak, were planted at the Child Care Center in an effort to raise the JSC consciousness on environmental issues. Since recycling began at JSC in 1989, the center has saved an estimated 29,889 trees.

Endeavour gets 'go' for May 4 liftoff

By James Hartsfield

With three main engines replaced and checked out, shuttle managers Thursday set a 7:34 p.m. CDT May 4 launch for the maiden space flight of *Endeavour* on STS-49.

The May 4 launch window will extend 53 minutes as *Endeavour* takes aim at the stranded Intelsat-VI communications satellite. Installation of the three main engines was completed at Launch Pad 39B late last week. The three engines used in *Endeavour's* flight readiness firing had been removed due to irregularities seen in the operations of two of those engines during the firing test.

Also last week, the STS-49 crew — Commander Dan Brandenstein, Pilot Kevin Chilton and Mission Specialists Pierre Thuot, Bruce Melnick, Rick Hieb, Kathy Thornton and Tom Akers — and launch controllers completed a countdown dress rehearsal at the pad. Later this week, technicians will check the auxiliary

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Dunbar earns National Engineering Award

Astronaut Bonnie Dunbar has earned the 1992 National Engineering Award presented by the American Association of Engineering Societies.

The annual award is presented on behalf of the engineering community to recognize an engineer whose career and accomplishments have particularly benefited humanity. The AAES represents the mainstream of U.S. engineering — more than half a million engineers in industry, government and education.

Dunbar received the award for

her contributions to ceramic engineering, bioengineering and engineering education. She was nominated by Dr. David Clark, president of the National Institute of Ceramic Engineers.

"When I received the award, I accepted it on behalf of all NASA engineers," Dunbar said. "The dedicated, talented and hard-working engineers of our agency deserve the recognition for their creation of what is truly a national resource."

The award, presented April 2 at a ceremony in Washington, D.C., carried with it an honorarium of \$5,000

to be used in furthering engineering education. Dunbar said she plans to donate the money to the engineering schools at her alma maters, the University of Houston and the University of Washington, Seattle, and to start an engineering scholarship fund at Sunnyside High School, Sunnyside, Wash.

Dunbar said the bequest is her way of thanking the teachers and managers who have provided opportunities throughout her career and continue to do so for the many talented up-and-coming engineers of the future.



Bonnie Dunbar

Astronomers find long-sought variations in glow from Big Bang

Scientists using NASA's Cosmic Background Explorer announced Thursday at the American Physical Society's meeting that they have detected the long-sought variations within the glow from the Big Bang — the primeval explosion that began the universe 15 billion years ago.

The detection is a major milestone in a 25-year search and supports theories explaining how the initial expansion happened.

Earlier in the week, Hubble Space Telescope scientists celebrated the orbiting observatory's second anniversary by showing images of the hottest star ever recorded and detailing discoveries that may change widely held beliefs about how galaxies are formed.

NASA Astrophysicist Sally Heap reported

that the white star in a nebula of the Great Magellanic Cloud galaxy is 33 times hotter than the Sun. Heap said the star's life appears to be ending in a "blaze of glory," as it burns itself out at 360,000 degrees Fahrenheit.

"As far as I know, this is the hottest star on record," she said.

The variations detected by COBE show up as temperature fluctuations in the sky, revealed by statistical analysis of maps made by the Differential Microwave Radiometers on the satellite. They are extremely faint, only about thirty millionths of a degree warmer or cooler than the rest of the sky, which is itself very cold — only 2.73 degrees above absolute

zero. The DMR is still gathering data and the measurements are expected to become even more precise.

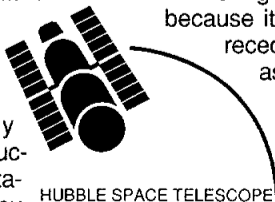
The Big Bang theory was initially suggested because it explains why distant galaxies are receding from us at enormous speeds, as though all galaxies started moving away from the same location a long time ago. The theory also predicts the existence of cosmic background radiation — the glow left over from the explosion itself.

The Big Bang theory received its strongest confirmation when this radiation was discovered in 1964 by Arno Penzias and Robert Wilson, who later won the Nobel Prize for this discovery.

Although the Big Bang theory is widely accepted, there have been several unresolved mysteries. How could all of the matter and energy in the universe become so evenly mixed in the instant following the Big Bang? How could this evenly distributed matter then break up spontaneously into objects of all sizes, such as galaxies and clusters of galaxies? The temperature variations seen by COBE help to resolve these mysteries.

"The COBE receivers mapped the sky as it would appear if our eyes could see microwaves at the wavelengths 3.3, 5.7 and 9.6 mm, which is about 10,000 times longer than the wavelength of ordinary light," explained Dr. George Smoot, University of

Please see **HUBBLE**, Page 4



HUBBLE SPACE TELESCOPE

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 NASA Picnic (May 2, Gilruth): adult, \$5; child, \$3; prices go up \$1 April 27.

EAA NASA Night at Astroworld (6 p.m.-midnight, April 24): \$10.50.

EAA Galveston Historical Home Tour (May 2, 3, 9, 10): \$11.

Sea World, \$18.90; Astroworld, \$16.95; Waterworld, \$9.50; and Six Flags, \$14.95. Movie discounts: General Cinema, \$4; AMC Theater, \$3.75; Loews Theater, \$4.

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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.

Weight Safety — Required course for employees wishing to use the Gilruth weight room is offered from 8-9:30 p.m. April 29. Cost is \$5.

Defensive driving — Course is offered from 8 a.m.-5 p.m. May 9 and June 6. Cost is \$19.

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 classes meet from 5:15-6:15 p.m. Mondays and Wednesdays. Cost is \$24.

Aikido — Martial arts class meets Tuesdays and Fridays. Cost is \$35 per month.

Intercenter Run — Runners in the 10-kilometer or 2-mile races may turn in their times for the annual Intercenter Run at the Rec Center throughout April. Fall Intercenter Run T-shirts can be picked up in Rm. 146.

Country and western dance — Six-week class will meet Fridays beginning April 17, or Mondays beginning April 27. Beginner classes meet from 7-8:30 p.m.; intermediate from 8:30-10 p.m. Cost is \$20 per couple.

Almost Anything Goes — Six co-ed teams needed for JSC Picnic May 2. Teams consist of three men and three women. Entry fee is \$10; deadline is April 24. Each participant receives a T-shirt.

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

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Dates & Data

Today

IEEE video conference — The Institute of Electrical and Electronics Engineers will present a video conference on "Workstations of the Future" at 10:30 a.m. April 30 in the Gilruth Center. Deadline for registration is April 24; for details, call Andy Lindberg at x31474.

Cafeteria menu — Special: meat sauce and spaghetti. Entrees: baked scrod, liver and onions, fried shrimp. Soup: seafood gumbo. Vegetables: green beans, buttered broccoli, whipped potatoes.

Monday

Cafeteria menu — Special: wieners with baked beans. Entrees: beef chop suey, breaded outlet with cream gravy, grilled ham steak. Soup: beef and barley. Vegetables: buttered rice, Brussels sprouts, whipped potatoes.

Tuesday

Cafeteria menu — Special: pepper steak. Entrees: fried shrimp, pork chop with applesauce, turkey a la king. Soup: celery. Vegetables: au gratin potatoes, breaded squash, buttered spinach.

Wednesday

STI conference — JSC will host the 1992 NASA Scientific and Technical Information Conference April 29-May 1 at the Nassau Bay Hilton. The agencywide conference will focus on issues relating to the production, dissemination and retention of NASA scientific and technical information. For more information, call Patti Kanz, x31197.

Lunch and learn — The American Institute of Aeronautics and Astronautics' Materials, Structures and Dynamics Committee will present a program on "Hypervelocity Impact Analysis of Space Station Freedom and Other Spacecraft" at 11:30 a.m. April 29 in Lockheed Plaza 1 Rm. 12C.

Cafeteria menu — Special: Mexican dinner. Entrees: fried catfish with hush puppies, braised beef ribs. Soup: seafood gumbo. Vegetables: Spanish rice, ranch beans, buttered peas.

Thursday

IEEE videoconference — The Institute of Electrical and Electronics Engineers will present a videoconference on "Workstations of the Future" from 11 a.m.-2 p.m. April 30, 1992, at the Gilruth Center. Topics will include multimedia computing, adapting technology, and engineering and business applications. Cost is \$50 for members, \$15 for students; registration deadline is April 24. For more information, call Andy Lindberg, x31474.

Cafeteria menu — Special: hamburger steak with onion gravy. Entrees: corned beef with cabbage and new potatoes, chicken and dumplings, tamales with chili. Soup: split pea. Vegetables: navy beans, buttered cabbage, green beans.

May 1

Technology 2002 — Abstracts for Technology 2002, the third national technology transfer conference and exposition, are due May 1. Abstracts

should be sent to Leonard Ault, program Chairman, Code CU, NASA Headquarters. For more information, call Ault at 703-557-5598, or Joseph Pramberger at 212-490-3999.

AIAA China trip — The Houston Section of the American Institute of Aeronautics and Astronautics and the Chinese Society of Astronautics are jointly sponsoring an International Space Year Commemorative Tour of Chinese Space Facilities from May 1-15. All AIAA members, applicants and their spouses are eligible. Cost is \$3,085 double occupancy. For more information, call Jim McLane, 488-0312.

Cafeteria menu — Special: barbecue link. Entrees: deviled crabs, broiled codfish, liver and onions. Soup: seafood gumbo. Vegetables: buttered corn, green beans, new potatoes.

May 5

Cinco de Mayo — The JSC Hispanic Advisory Committee will sponsor a Cinco de Mayo program and luncheon at noon May 5 at the Gilruth Center. Dr. Albert Baez, well known educator, physicist and holography pioneer, will speak about his Vivamo Mejor projects involving edible oyster mushrooms grown from coffee bean waste pulp, child development and Mexican women weavers who are learning to manage their own work. Luncheon tickets are \$8 and may be obtained in the Equal Opportunity Programs office, x30604, or from committee members. For more information, call Michael Ruiz, x38169.

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

Rent: Barringer Way, 2-1, W/D conn, pool, stor area, no pets, ex cond, \$425/mo. 486-2048.

Sale/Lease: CL TH, 3-2.5-2CP, patio, FPL, fan, new A/C, remodeled, conv to NASA, \$63.9K or \$800/mo. Ed, x36969 or 332-0442.

Rent: New Orleans condo in French Quarter, Jazz Festival wk Apr 24th-May 1st, priv rooftop deck, great skyline view, furn, TV, \$500. 282-6422 or 280-8927.

Rent: Arkansas Lake cabin, furn w/ antiques, screen porch, accom 8, \$250/wk or \$50/dly. x33005 or 338-2517.

Rent: Lake Livingston, Cape Royal, Harbour Villa TH, near marina, fishing, golf, tennis, sleeps 6. 334-5818.

Sale: Omega Bay waterfront lot, city util, 25 min fr NASA. (409) 935-9250.

Lease: Webster/Ellington condo, 2 BR, W/D conn, carpet in good cond, \$450/mo. Dave, x38156 or Eric, x38420.

Sale: '87 Oakridge 16' x 80' MH, 3-2, skirted, fenced, lg cov deck, \$25K. Greg, x31580 or 997-2250.

Sale: Friendswood residential lot, 70' x 185', CCISD, \$16K owner finance w/10% down. 482-5226.

Sale: Lake Travis lot, Point Venture Dev, all util, golf course, tennis, pool, marina, \$13.9K. Nasser, x33685 or 334-1032.

Sale/Lease: South Houston, 2-1-2, C/AH, stove, refrig, close to school, avail mid June, \$550/mo. 486-8653.

Lease: El Lago, 3-2.5-2D, RV and boat pad, crnr lot near water, \$1K/mo. x38068 or 532-1949.

Rent: Santa Fe, 12' x 50' furn MH on 1 acre, 1 detached rm, \$325/mo. Larry x30428 or 326-1159.

Lease: Shoreacres, 4-2-2, 1800 sq ft, no pets, avail May 1st, \$650/mo plus dep. Sally, x37485 or 488-5501.

Sale/Lease: Baybrook condo, upstairs w/balcony, 1 BR, 1CP, appl, W/D, 15 min from NASA, avail May 1st, \$26K or \$325/mo. Richard, x31488 or 286-6915.

'81 Melody MH in park, 2-1, C/AH, cov prkg, stor unit, pool, playground, recreation, laundry facilities, was \$6K, now \$3.8K. Donna, 280-2541.

Rent: Baywind II, 1 BR, upstairs by pool, W/D, \$400/mo. 282-2638 or 480-1905.

Lease: University Green, new Brighton

TH, 2-story, 2100 sq ft, new W/D, refrig, walk to pool/tennis, avail May 5th, \$1.2K/mo. x34181 or 286-6254.

Sale: Friendswood, Wedgewood Village, 70' x 185' residential lot, CCISD, owner finance w/10% down. 482-5226.

Sale: Lake Livingston, Southwood Shores, 14' x 55' Titan MH on lot, 2-1, furn, \$32.5; Lake Livingston, Southwood Shores, lg crnr lot, lakeview, near boat ramp and fishing pier, \$17.5K. Gary, x32494 or 554-2023.

Sale: El Jardine, 2-story bay house, 3-2.5-2.5, 2400 sq ft, 15 min fr NASA, \$169K. 474-7029.

Sale: Pearland, Dixie Hollow lot, all util, concrete street. x39530 or 482-5003.

Sale: Orlando time-share at Vistana Resort, entrance to Disney World, 2 BR, sleeps 8, 1300 sq ft, 2nd floor, screen porch. \$9.9K. Phil, 283-5648.

Sale: Bacliff, 14' x 66' MH, 3-1, 8' ceilings, new carpet, paint, A/C, heat, \$5K; 100' x 125' wooded lot w/20' x 30' warehouse in back, partially wood fenced, \$17.5K or finance all for \$20K w/\$5K down, \$300/mo at 10%; Lake Livingston/Holiday Shores property, near water, util avail, national forest on 2 sides, creek on third, quiet, cul-de-sac, approx 1/3 acre, \$2.5K. 339-1337.

Cars & Trucks

'68 Mustang, rebuilt in-line V-6 eng, red, orig int, hubcaps, good cond, \$4.2K. 339-1337.

'85 Toyota MR2, 5-spd, sun roof, 81K mi, \$3.7K. J. Craig, 283-5311 or 420-2936.

'59 Chevy PU for restoration or parts. 334-2335.

'91 Honda Civic DX, 5-spd, AM/FM/cass, A/C, 16 val eng, tint windows, 7.5K mi, \$9.7K. 333-7867 or 534-3437.

'91 Chevy GEO Storm wagon, AM/FM/cass, A/C, low mi, \$8K. 286-1754.

'87 Camry LE, loaded, ext warr, 50K mi, ex cond, \$7.2K. x36149.

'89 Chevy Cavalier, 2-dr, auto, A/C, AM/FM, 24K mi, ex cond, \$4650. 488-8493.

'90 Dodge Dakota convert PU, P/L, P/W, P/S, A/C, alarm, serv contr, 13K mi, ex cond, \$12.9K OBO. x49744 or 333-9742.

'77 Toyota Celica, 5-spd, good mech cond, \$950 OBO. Marianna, 532-3342.

'79 Honda Accord LX, new tires, good A/C, \$300 OBO. x32678 or 334-2271.

'79 Datsun 280ZX, new paint, 92K mi, \$2.2K. x37892 or 333-9518.

'89 Toyota Corolla SR5, looks like GTS, loaded, ex cond, 55K mi, \$7K OBO. Joel, 992-4259.

'85 300ZX, 2+2, silver, T-top, auto, low mi, \$6.5K. 332-7373.

'81 SWB Chevy PU, new paint, rebuilt 350, AM/FM/cass, ex cond. Lisa, 333-6795.

'89 Chevy Camaro Convert, wht w/bk top, auto, tinted windows, AM/FM/cass, new tires, loaded, 48K mi, ex cond,

\$11,595. Cathy, x30961 or 334-5550.

'85 Chevy Cavalier, 4-dr, 4 cyl/2.0L, auto, new tires, brakes, 75K mi, ex cond, \$2.4K. 488-5522.

'68 Classic Dodge Dart, good eng, little rust, slant 6, 225 w/Holley carb, 90K mi, \$800. x36391 or 326-2395.

Boats & Planes

'83 Renken 18 sailboat, roller furling jib, 4hp aux, galv trlr, sleeps 4, good cond, \$3.4K. 339-3476.

'79 Cape Dory, 30', 5hp Volvo, 5 sails, marine A/C, heat, Bimini, wheel head, galley, shower, instr, \$35.5K. 474-5414.

'73 Blue Water, 24' Twin Bilge Keel Hurley, water tight, \$4K. Kathy, 334-2208.

22' Aurora sailboat w/ixed keel, 3hp long shaft O/B, \$1.5K. Cindy, 527-8699.

'85 Invader ski boat, 18' I/O, 205hp Merc, DF, AM/FM/cass, ski gear, Shorelander trlr, \$6250. John, 488-2756.

Hobie 16, multi-color sails, blk anodized alum frame, dbl trapeze, righting sys, trapeze harnesses, galv trlr, custom cat box, \$1.2K. Carla, x32959 or 992-4137.

16' Cobia, tri-hull, no motor, Power Winch, galv trlr, boat cover, \$850. (409) 935-9250.

'76 Catalina 27' sailboat, 3 sails, I/B diesel, Bimini, wheel, updated int, 2 batt, depth, knot meter, \$12.3K OBO. Ken, x30921, or 554-6504.

Hobie 16 w/trlr, new blk mesh trampoline, color sails, ex cond, \$1.3K. John, 244-5491 or 280-9478.

'28 Beneteau Evasion pilot house sloop, '80 Volvo diesel, DF, VHF, Loran, Bimini/Gallows, good cond, \$28K OBO. Barbara, x36802 or (409) 935-1650.

Cycles

'73 Honda CB500 4, header, new batt, red, helmet, 12K orig mi., \$400 OBO. x34754 or 554-7116.

'90 Yamaha 100 RT, less than 50 hrs, red/blk, ex cond, \$800. x35961 or 532-2050.

Audiovisual & Computers

Commodore 128, 1581 and 1571 FD, Star 1000 & 1526 prtr, mouse, modem, 50 disks, 1K programs, \$450/all or part; 5.25" 50 disk mailers, \$20/ea or \$10/all. Rick, x33856 or 488-3527.

Apple IIc, 12' moni, ex dr, 300-1200 modem, mouse w/pad, SW, desk, \$325. 538-1479.

Photographic

Complete blk and wht darkroom setup, Omega B66XL enlarger, trays, bottles, tongs, \$400. Betty, 331-0985.

Pets/Livestock

AKC Lab pups, born 3-13-92, blk & yellow, sire & dam hunters, FTC bloodline, \$200. 244-9682.

Baby cockatiels, hand-fed. Linda, 484-7834.

AKC Basset Hound pups, tricolor, \$250/ea. Bettie, x37554 or 944-1838.

Musical Instruments

Orig Fender jazz bass, ex cond, \$350; Collector's Mossman acoustic guitar, Dreadnought sz w/Herringbone Inlay, ex cond, \$750. Mark Irving, x37353 or 286-3515.

Household

Sealy twin bed matt/box springs, good cond, \$50. 332-9105.

Refrigerator, ex cond, \$250; desk, \$50. Frank x37714 or 286-3513.

Three 3-draw press wood dressers, blk w/gold trim, ex cond, \$15/ea or \$40/all. 486-8485.

Early Amer qn sz sleeper sofa in fall colors, ex cond, \$150; 2 rust colored swivel rockers, good cond, \$30/ea or \$50/both. 992-3876.

Faberware indoor rotisserie broiler, 1650 watts, 10" x 15" stainless steel broiling surface, ex cond, \$30. Betty, x30280 or 480-3424.

Oak pedestal claw foot DR 54" table, 6 chairs, \$500. Betty, 331-0985.

Swivel recliner, good cond, was \$250, now \$40. 331-0164.

Sofa/love seat, blue-It brwn-off wht, good cond, \$175; Judy Rankin, ladies full set of golf clubs, bag, balls, tees, sz 8 shoes, \$250. 532-2158.

Refrigerator, \$200; W/D, \$125; lawnmower, \$50; gas weedeater, \$50; elec weedeater, \$10; microwave, \$25; hobby horse, \$15; boy's bicycle, \$20; tricycle, \$5. x34776 or 482-7874.

Rattan LR furn, couch, love seat, coffee/ end table, ex cond, \$375. Allan, 472-7526.

Two couch set, one 7', one 5', ex cond, \$200/both; sm bar refrig, \$40; Righteous Brothers greatest hits CD, \$10. x36391 or 326-2395.

Wanted

Want nonsmoking roommate to share 2-2 house near water, near South Shore, \$275/mo plus 1/2 util. John, 538-3320.

Want nonsmoking female roommate to share home in LC. BR furn or unfurn. 332-8743.

Want '80 or newer car, prefer 4-dr, Amer car must have less than 80K orig mi, foreign car w/less than 125K mi, no body work, mech work ok, up to \$1K. 339-1337.

Want Nordic Track ski machine; floor tile tools and/or how to video. 334-2335.

Want cheap work car, minor repairs ok. Phil, 280-2239 or 333-1017.

Want entertainment ctr, 2 bay. Fred, 944-0493.

Want non-smoking female roommate to share 3-BR house in CL, furn, \$250/mo plus 1/2 util. Diana, x31512 or 286-9822.

Want children's outdoor play equipment, plastic slid, trampoline. Terry, 280-8608.

Want lg sz female clothing, good cond, styling unimportant, fair price. S. Hulka, x56725.

Miscellaneous

Two round-trip tickets from Houston to London, England, aboard British Airways, was \$1.7K, now \$550/ea. x35376 or 943-3842.

Motorcycle helmet, x-lg, HJC w/neck cover, carrying case, blk, perfect shape, \$80; motorcycle trunk, fiberglass, wht, lg, no key, \$25. 339-1337.

Four Rockwell plates, women series, collector item, \$45/ea or \$140/set. 474-5414.

Remington model 7400, 30.06 autoloader rifle w/3 x 12 raised Tasco Scope, case, sling, ex cond, \$425. Tim, x39289 or 487-3216.

Derringer, 32 caliber, 2-shot, very sm, new, \$63. John, x36965 or 332-6926.

Traditional wht wedding dress w/train and veil, \$150; Whirlpool hot tub spa, \$25; suede jacket, \$150; typewriter, ex cond, \$100. Mary Lou, 996-9534.

Brom dresses, lt blue/wht lace, Southern bell type, wht lace gloves, and full petticoat, sz 10-12, \$100; apricot/metallic color, full length/strapless, sz 7-9, \$75. 283-8213 or 286-5244.

Dacor scuba regulator, 960XLB first/ second stage w/960XLE octopus, all brass/ chrome, 3 yrs old, serviced, XLB second stage has external air demand control, \$250. Sy, x30504 or 776-9754.

Prom dress, sz 3/5, Dusty Rose tea length, reasonable. Soo, 480-5027.

Craftsman wood lathe w/copy crafter and 12 piece wood carving tools, was \$600, now \$300. 283-1834 or 332-4807.

Timeshare condo for rent, \$600/wk, anywhere in the world. 286-8417.

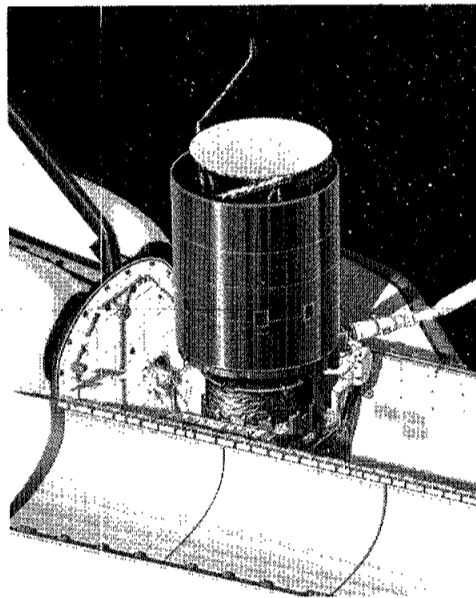
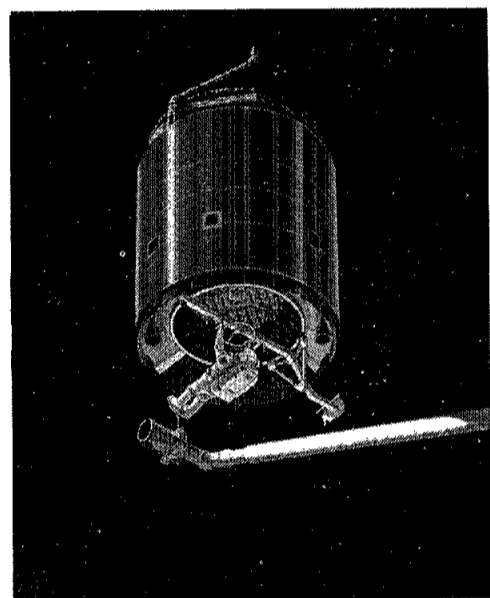
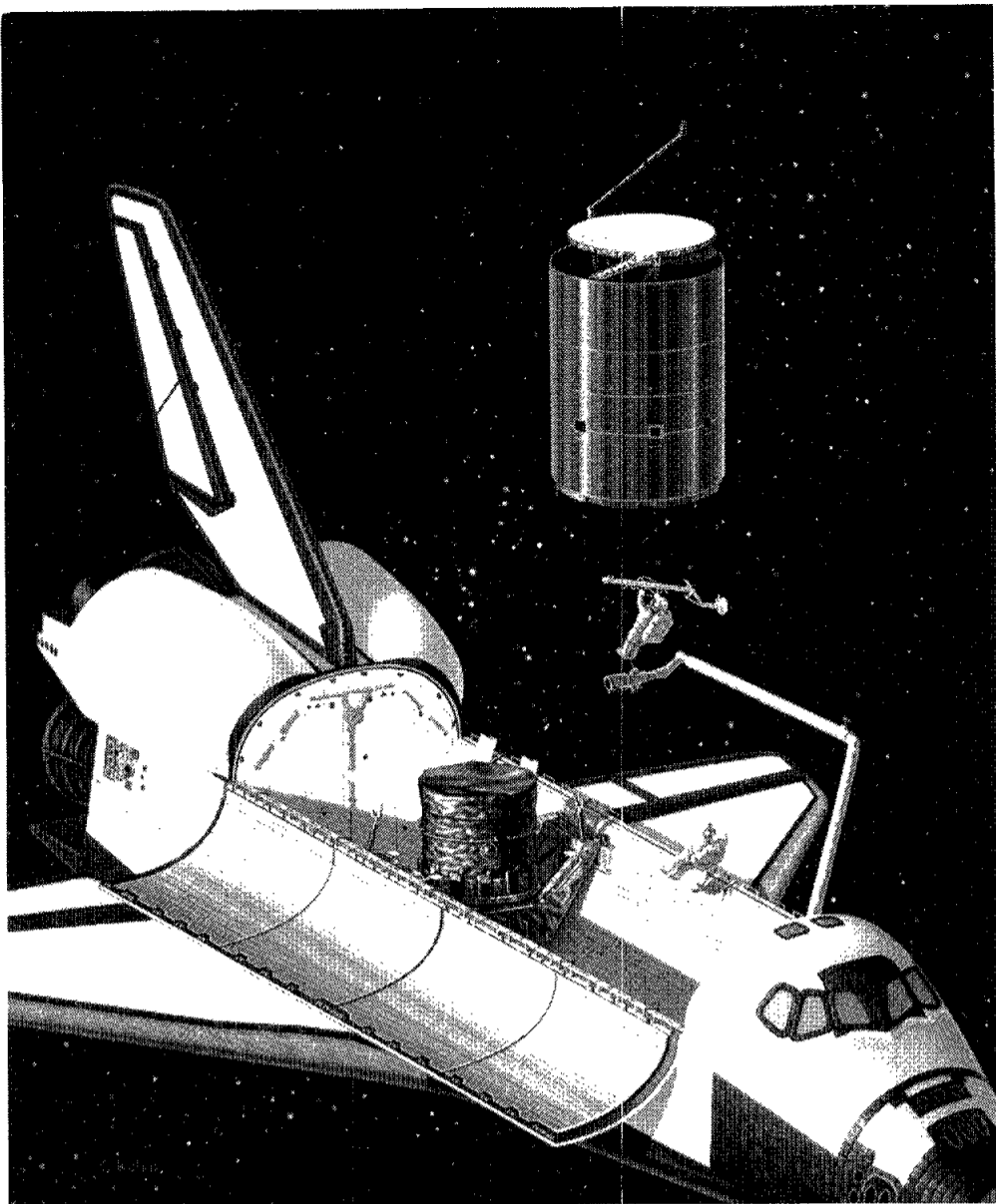
Stun guns, 75K-150K volts, \$35-\$55. 332-6779.

Toro lawnmowers, 21" self-propelled, 1 Grassmaster 5hp bagger, 1 Guardian 4hp, both running, but worn out, \$20/ea. Clarence, x38820 or 554-2911.

Full set of golf clubs w/bag, \$75; 2 brwn vinyl couches, 5' long, \$50/ea OBO. 339-3476.

Aquarium set, Oceanic 26-gal, 36"L x 17"H x 13" W, w/beveled front corners, mirrored back, matching stand w/stor cabinet, Aerator setup, foundation and tubing, gravel, blue, wht, thermostatic water heater, activated charcoal aquaclear, 610 filtration sys, artificial plants, rocks, fish breeding and aquarium cleaning access, chemicals, food, \$300 OBO. Cathy, 280-0754.

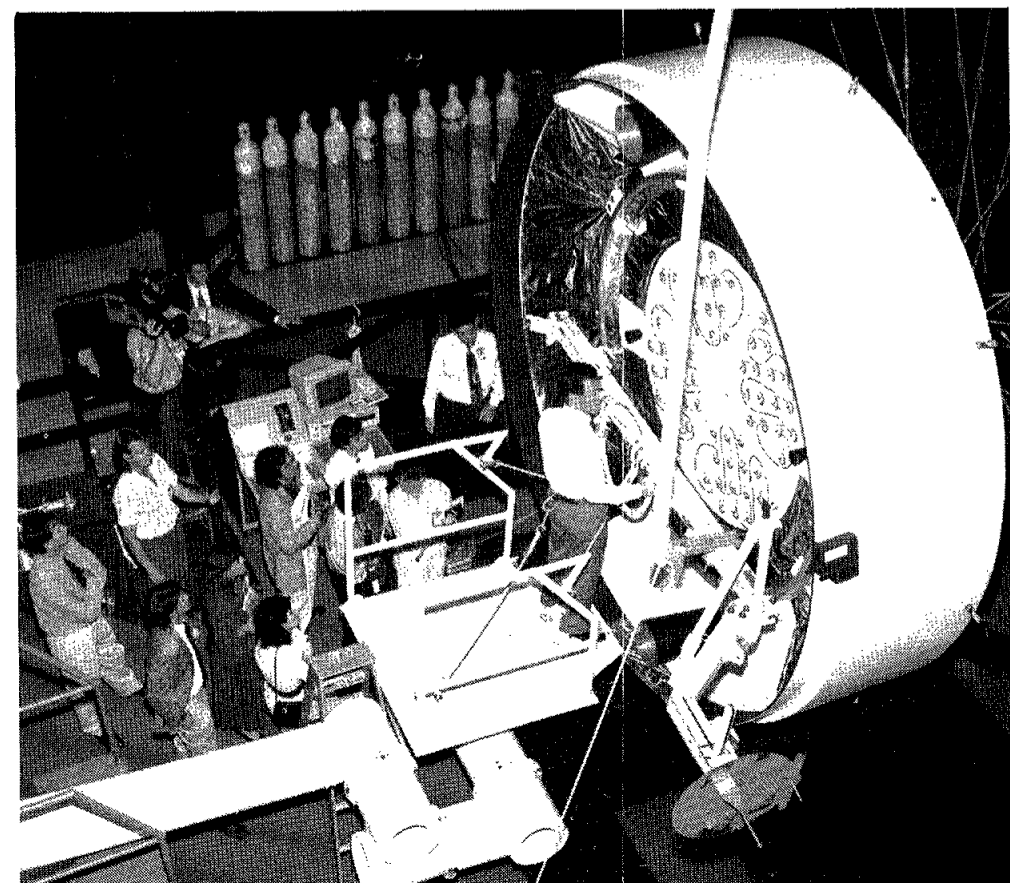
Brother EP-20 elec typewriter, Personal Electronic Printer, w/AC-DC pwr supply and cass ribbon cartr, 12 ea, \$90 OBO. Mike, 335-8547 or 280-7544.



Illustrations from Hughes Aircraft

Top: The Intelsat retrieval space walk will start with Pierre Thuot riding *Endeavour's* robot arm into position beneath the satellite. **Above left:** Thuot will latch onto Intelsat using a special "capture bar" designed, built and tested at JSC. The capture bar has both automatic and manual latching mechanisms that can be reset if early grapple retrieval attempts fail. **Above right:** Robot arm operator Bruce Melnick will grapple the attached capture bar and pull Intelsat down into *Endeavour's* payload bay, where Thuot and Rick Hieb will attach it to a new booster and prepare it for deployment. **Below:** Capture bar Project Engineer Calvin Seaman demonstrates the use of the capture bar on an air-bearing floor simulator in Bldg. 9.

JSC Photo by Bob Walick



Triple Play

Three consecutive space walks to build experience for space program's future

Continued from Page 1

This is not the first satellite rendezvous, retrieval and repair mission, but the Intelsat rendezvous and repair will be different. The rendezvous, called a "dual active vehicle" rendezvous, requires maneuvering both the shuttle and the satellite because Intelsat's parking orbit is higher than the shuttle can reach with the 23,000 pound boost motor tucked in the payload bay.

At Intelsat headquarters in Washington, D.C., controllers must wait until *Endeavour* is safely in orbit before commanding the satellite to lower itself. As *Endeavour's* Commander Dan Brandenstein and Pilot Kevin Chilton maneuver the spaceship toward the satellite from below and behind, Intelsat engineers will begin lowering the satellite from above and in front of the orbiter into an imaginary "control box" about nine miles high and six miles wide.

The satellite must be in the control box within 46 hours after launch to allow enough time to slow its rotation from five to less than one revolution per minute and to send safing commands that will prevent inadvertent thruster firings as the astronauts prepare for the capture and repair.

With Kathy Thornton and Tom Akers calling range distance between the two spacecraft with the assistance of a laser range rate device, Brandenstein and Chilton — "Chili" to those who know him — will close in on the Intelsat.

Once the orbiter has been maneuvered close enough to the satellite, space walking astronauts Pierre Thuot and Rick Hieb will go outside to begin the six hour process of grabbing the satellite with a special "capture bar" designed to attach to the bottom of the satellite and allow the shuttle's robot arm to grapple the spacecraft.

A new feature called the portable foot restraint attachment device will allow Thuot to "ride" on the arm while Bruce Melnick captures the satellite and lowers it into the waiting arms of Hieb in the payload bay.

Once there, the two space walkers will attach the satellite to its new boost motor and make the necessary electrical connections for Intelsat ground control to fire the motor at the desired time sending the satellite on to its originally planned home over the Atlantic.

"The capture bar is the critical link," said Calvin Seaman, project engineer for Engineering's Crew and Thermal Systems Special Projects Branch. "It's either going to work or it's not. If it doesn't work, we have no way of catching the satellite and bringing it down into the bay."

The capture bar was designed, built and tested at JSC, and the work started immediately after that brain-storming session.

"They gave me a whopping \$2,000 to go off and build a mockup of the satellite out of foam core and cardboard and some plywood," remembered Seaman. "Then we built a capture bar out of Styrofoam and balsa wood. We rigged it up with forklifts, a ladder and a bunch of tape. It was a real shoe-string operation over in the model shop."

JSC's Charles Alton was the lead designer for the capture bar, and Keith Day and Larry Zielke of JSC's Technical Services Division built the flight hardware, which has gone through testing that included vibration to eight Gs and a fit check on a sister satellite at the European Space Agency's launch site at Kourou, French Guyana.

They also built simulators in the Weightless Environment Training Facility and on an air-bearing floor in Bldg. 9 that were used to train Thuot and Hieb to use the capture bar and then maneuver and stabilize the vehicle in preparation for grapple by the shuttle's robot arm.

Throughout that training, the sister capture bars were subjected to rough treatment.

"With the thermal and vibration testing, the Kourou fit check, the WETF training and the air-bearing floor training, I have a high degree of confidence that we're going to have a successful mission," Seaman said.

The one thing that worries Seaman is the condition of the satellite when the astronauts arrive.

"If we get up there and something isn't built per print or maybe something's damaged that we don't know about, that's the only thing that can bite us," he said. "We've tried to design this to incorporate the lessons we've learned from past missions. We wanted it to be as forgiving and as tolerant as possible."

After the repair and deploy, *Endeavour* will maneuver away from the satellite and be more than 300 miles away when the new boost motor fires.

The Intelsat space walk will be just the first of three in a row, a feat that has been accomplished on the lunar surface but never in zero-gravity. The space walks by four of the crew members will occur consecutively on the fourth, fifth and sixth days of the mission.

"Getting Intelsat accomplished and then the other two EVAs is really a primary objective of the whole ASEM," said Jerry Miller, who will be the execute phase EVA flight controller for the Intelsat retrieval. "The whole point is to look at how the shuttle will support station assembly requiring three consecutive complex EVAs all on the same mission."

The triple play also will be much needed experience for the Hubble Space Telescope repair mission, which also will require three space walks.

The task of preparing for STS-49 has been demanding for the Mission Operations Directorate's EVA Section, which had to help train twice as many crew members as usual, develop three times as many procedures as usual and compile three times as much Flight Data File documentation.

"Everything that EVA-MOD does for a mission was essentially doubled, if not tripled, in some instances," Miller said. "Our checklist for this mission looks like a phone book."

MOD's Intelsat EVA team consisted of Miller, Wayne Wedlake, Scott Bleisath, Cynthia Lowery and Kieth Johnson. Bleisath and Johnson, the space suit experts, also will serve on the ASEM team.

Among the challenges the team faced were cramming four EVA suits into a cabin that normally holds only two and planning for contingencies that might keep one or more space walkers from doing their jobs.

"If anything were to happen and Rick couldn't go, then Pierre would perform his normal tasks and Tom would perform Rick's. If something were to happen and Pierre couldn't go, Rick has also been cross-trained to perform Pierre's tasks and Tom would go and perform Rick's," Miller said. "Kathy Thornton also has trained on performing Rick's tasks."

Fitting the four extravehicular mobility units inside the crew cabin "was a Houdini act to figure out how you get an elephant into a shoe box and still make the procedures flow logically."

Both Miller and Seaman said they relish the STS-49 challenge and believe it is good for NASA.

"It's EVA experience that we're going to get for space station," Seaman said. "This is an opportunity to go help someone out, go pull somebody's bacon out of the fire and save the day."

"We have invested so much time and effort and taxpayers' money into developing these capabilities," Miller said. "I would regret not exercising the abilities we have garnered when we have an opportunity like this. We learn so much in the process when we are presented with this kind of challenge." □

JSC contractor earns small business award

One of JSC's prime contractors, Hernandez Engineering Inc., will receive the Small Business Administration's Award of Excellence during this year's national Small Business Week, which begins May 10.

Hernandez provides graphics, technical publication and tour guide services for JSC organizations through the Center Operations Directorate's Management Services Division. This work includes production support for Space News Roundup.

JSC also will honor its two "Small Business Buyers of the Year" for their work in fiscal 1991, a year in which JSC awarded more than \$123 million in contracts to small businesses.

Betty Burg's efforts resulted in the largest number of new awards to small businesses by a single buyer, and Ginger Darnell coordinated the largest dollar volume of new awards to small businesses during fiscal 1991, said Bob Dupstadt of JSC's Small and Disadvantaged Business Office.

In March, NASA announced the selection of more than 50 research proposals for immediate negotiation of Phase II contracts in NASA's Small Business Innovation Research Program.

Selections were chosen competitively from 258 proposals submitted to continue Phase I projects begun in 1990. The total number of Phase II proposals, including those

announced earlier, is 137. Total funding for all of the projects will be about \$68.5 million.

Eleven of the projects selected are managed by JSC:

Quick Look Modal Testing Of Flexible Structures, Garman Systems, Inc., Getzville, N.Y.

Surface-Discharge Ac Plasma Color Flat Panel Display For Space Station Applications, Photonics Imaging Northwood, Ohio.

An Ultrasensitive Laser Microprobe for Detector of Surface Contamination, Potomac Photonics Inc. Lanham, Md.

Robot Fault-Tolerant Feedback System, Robotics Research Corp., Amelia, Ohio.

High-Temperature-Waste-Heat-

Driven Cooling Using Complex Compound, Rocky Research, Boulder City, Nev.

Language Engineering In Speech Recognition, Sorption Media Speech Systems Inc., Tarzana, Calif.

Log-Polar Binocular Vision System, Transitions Research Corp., Danbury, Conn.

Portable Dark Focus Instrument, Essex Corp., Orlando, Fla.

Nontoxic, Heat-Transport Fluids for Habitat Two-Phase, Thermal-Control Systems, Mainstream Engineering Corp., Rockledge, Fla.

Extended Tactile Sensing for Dexterous Robotic Hands, Sarcos Research Corp., Salt Lake City.

Fuzzy Cognitive Maps for Mis-



Burg

Darnell

sion Planning and Flight Control, Tacan Corp. Carlsbad, Calif.

SBIR objectives are to stimulate technological innovation in the United States by using small business, including minority and disadvantaged firms, to help meet federal research and development needs and to encourage commercial applications.

Board OKs promotions

JSC's Senior Promotion Board has approved 23 promotions based on expanding job responsibilities and scientific and engineering impact.

The dual career ladder promotions to the GS- and GM-14 and 15 levels were made separate from those selected through the Competitive Placement Plan.

Those receiving promotions, which became effective April 19, are:

Flight Crew Operations: Kathleen M. Abbotteen.

Mission Operations: Bryan P. Austin, Susan H. Graham and James B. McDede.

Engineering: Stephen M. Derry, Alan H. Feiveson, Thomas D. Jeffcoat, Glenn C. Lutz, John D. Miller, Kornel Nagy, Ned J. Robinson III and Robert A. Vogt.

Space Shuttle Program Office: Emmett Shepard.

New Initiatives Office: Sonbol F. Sepahban.

Office of the Comptroller, John H. Chisler.

Safety, Reliability and Quality Assurance: Larry C. Shaw.

White Sands Test Facility: Harry T. Johnson.

Space and Life Sciences: John B. Charles, Alva C. Hardy, Lakshmi Putcha and Peggy A. Whitson.

Orbiter and GFE Projects Office: C. Ragan Edmiston.

Exploration Programs Office: B. Kent Joosten.



JSC Photo by Mark Sowa

CONGRESSIONAL VISIT — U.S. Rep. Tom DeLay, R-Texas, is briefed on the extravehicular mobility unit used by shuttle astronauts for space walks by Steve Anderson of ILC Space Systems and Wade Frost of Hamilton Standard Management Services. DeLay visited Bldg. 9 Tuesday during a tour and briefings that covered what JSC workers are doing in the area of mission simulation, the bioreactor and Space Station Freedom.

Hubble discoveries relate to 'dark matter'

(Continued from Page 1)

California, Berkeley, the leader of the team that made this discovery. "Most of the energy received from the sky at these wavelengths is from the cosmic background radiation of the Big Bang, but it is extremely faint by human standards.

Another COBE scientist, Dr. Charles Bennett of Goddard Space Flight Center, said a major challenge for the team was to distinguish the Big Bang signals from those coming from our own Milky Way Galaxy.

The temperatures and sizes of the fluctuations in the background radiation COBE detected agree with the predictions of "inflationary cosmology," a theory that says the structure and behavior of the universe were determined by minute fluctuations when the universe was younger than one-trillionth of a second.

The amount of gravity provided by these visible fluctuations was inadequate to draw together the galaxies

and clusters of galaxies. Instead, astronomers conclude that the galaxies formed only because most of the material in the universe is invisible and unlike ordinary matter.

This "dark matter" provides the necessary gravitational attraction for forming galaxies. The fluctuations seen by COBE are too small to explain how the visible matter in the young universe could condense into the galaxies that now exist. According to COBE scientist Dr. Edward Wright from the University of California, Los Angeles, the COBE measurements support theories postulating large amounts of dark matter.

"These theories say that most of the matter in the universe is invisible to us and must be a new kind of matter, not yet detected in our laboratories," Wright explained. "Ordinary matter would be attracted into regions of concentrated dark matter, and the universe as we know it today could develop, eventually

leading to the formation of galaxies, stars and planets."

The HST scientists presented findings that suggest the "dark matter" theorized by Albert Einstein is not compressed in the cores of galaxies.

Astronomer John Bachall reported that after 350 observations, his team has found only one instance in which the light on its way to Earth from distant quasars was bent by the gravity of galaxies or other celestial objects.

Overall, the HST scientists said they are pleased with the telescope's performance despite a spherical aberration in its primary mirror. Shuttle astronauts are scheduled to repair HST in late 1993.

"Those days of blue gloom have turned into some weeks and months and now two years of what I might call true grit," said Steve Maran of Goddard Space Flight Center. "As a result, we have had a lot of terrific findings."

Gaseous oxygen leak won't take long

(Continued from Page 1)

power units, three generators that supply power to the spacecraft's hydraulics, for leaks and install ordnance on the vehicle in preparation for launch. The flight readiness test of the main engines — a check of the electrical systems in the engines and a leak check of the plumbing — were completed. A small leak was detected in the engine's gaseous oxygen plumbing, however its repair is not expected to affect the launch date.

Elsewhere at KSC, preparations of *Columbia* are continuing for a 13-day space flight set to launch in June. In the No. 3 processing facility, workers this week installed liners in *Columbia*'s payload bay, filled the hydraulic system and closed out the mid-fuselage. The tunnel adapter for *Columbia*'s airlock hatch also was to be installed.

Atlantis, in Bay 1 of the processing hangar, is being readied for a July flight on STS-46, carrying the Tethered Satellite System and the

European Retrieval Carrier. This week, technicians began arranging the aft flight deck and middeck for the cargoes, leak checking the forward steering thruster system and performing a functional test of the auxiliary power units.

In Bay 2 of the processing hangar, *Discovery* is receiving a host of upgrades as part of a down period that includes a thorough structural inspection. The inspections and modifications will continue through early next fall.

Cinco de Mayo tickets on sale until Wednesday

JSC will not be excluded from the celebration of Mexico's independence from France on May 5 as the center's Hispanic Advisory Committee hosts this year's "Cinco de Mayo" observance.

"Cinco de Mayo" commemorates General Ignacio Zaragoza's defeat of 6,000 French troops in 1862 at the Battle of Puebla. About 2,000 Mexican soldiers defended to forts of Guadalupe and Loreto during the battle.

To observe the date, the advisory committee will sponsor a special luncheon at the Gilruth Center. Dr. Albert Baez, an educator, physicist and pioneer in the field of holography, will be the keynote speaker.

Baez is president of the humanitarian foundation Vivamos Mejor/USA and chairman emeritus of the Commission of Education for the

International Union for Conservation of Nature and Natural Resources. Prior to the luncheon, he will discuss several Vivamos Mejor projects including a project that uses the waste pulp of coffee beans to grown oyster mushrooms, saving the toxic pulp from being dumped into the rivers; a child care and development center that provides food, medical care and science and art activities; and a program that helps female Mexican weavers manage a cooperative resulting in financial self-sufficiency.

Tickets for the noon luncheon are \$8 and may be purchased from the Equal Opportunity Programs Office or from members of the Hispanic Advisory Committee. The last day to buy tickets is Wednesday. For more information, call x30604 or x38169.

Spring Co-op Job Fair achievement showcase

JSC's co-op workers will be showing off their talents at the annual Spring Co-op Job Fair at the Gilruth Center Thursday from 10 a.m. to 4 p.m.

The theme for this year's event is "Recognizing 30 Years of Young Professionalism," commemorating the contributions to JSC by the hundreds of co-op students since the program's inception in 1961.

The primary purpose of the co-op program is to supply a feeder program for full-time positions. The

current program, which includes 212 individuals in 1992, provides about 80 man years of support each year and accounts for 30 percent of the new college hiring for the past 15 years.

About 10 divisions throughout the center will participate in this year's job fair, representing the Engineering, Mission Operations, Administration, Space and Life Sciences and Center Operations directorates.

The job fair is open to all interested individuals.

Safety Learning Center offers May courses

JSC's Test Operations and Institutional Safety Branch is offering another set of safety classes in May for civil servants and contractors.

Instructors will teach the classes in the JSC Safety Learning Center, Bldg. 226N, unless otherwise specified. Civil service tuition is pay for by the Human Resources Office. To register, fill out a registration form available by calling the learning center at x36369.

May's classes include:
Radiation Safety Instrumentation

and Compliance, 8 a.m.-4 p.m. May 4-8, tuition required.

Explosive Handler's Course, 8 a.m.-4 p.m. May 13, no tuition.

The SLC offers Community CPR, Standard First Aid, Protect Your Back and Hazard Communication classes monthly. Anyone interested in a CPR refresher class for those who hold a current Red Cross Community CPR card that will expire in June or July should call the SLC; a class will be set up if there is enough interest.

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.

Editor Kelly Humphries
Associate Editor Kari Fluegel

Badges change for friends, family

(Continued from Page 1)

which may request badges for each of their divisions. Each office will be responsible for the badges they are issued, and one person will be detailed to maintain a log and keep the badges.

If security officers see unofficial visitors without an escort, the badges will be confiscated and the visitors escorted from the building.

Anyone with questions about the new policy should call the Security Division at x34441.