



### Catching up

JSC will be working up to the last minute on the STS-32 rendezvous with the Long Duration Exposure Facility. Story on Page 3.



### Heel kickin'

The Flight Crew Operations Directorate kicks up its heels at its annual Fajita Fiesta. Story on Page 4.

# Space News Roundup

Vol. 28

November 17, 1989

No. 46

## Christmas mission crew ready for flight

By Linda Copley

Dan Brandenstein, commander of the STS-32 flight, and his crew said Tuesday they are looking forward to their 10-day December mission and are excited about being part of "an extremely interesting flight."

The mission, scheduled for a Dec. 18 night launch, will be only the second 10-day shuttle mission (the first was STS-9 in 1983) and will involve a complicated rendezvous maneuver that is to be flown by Brandenstein.

Brandenstein outlined a plan that includes

deploying a Syncom IV-05 satellite, the retrieval of the 11-ton Long Duration Exposure Facility (LDEF) and tests designed to provide information on the effects of long duration space flight on the shuttle crew.

The commander, who has logged a total of 315 hours in space aboard STS-8 in 1983 and STS-51G in 1985, is currently chief of the Astronaut Office. He characterized his crew

as "ready" for their flight aboard Columbia, and introduced them by nickname.

"WXB" (Wexbee), pilot Jim Wetherbee, formerly an F-18 Navy test pilot with an aerospace engineering degree from Notre Dame, will be making his first shuttle flight.

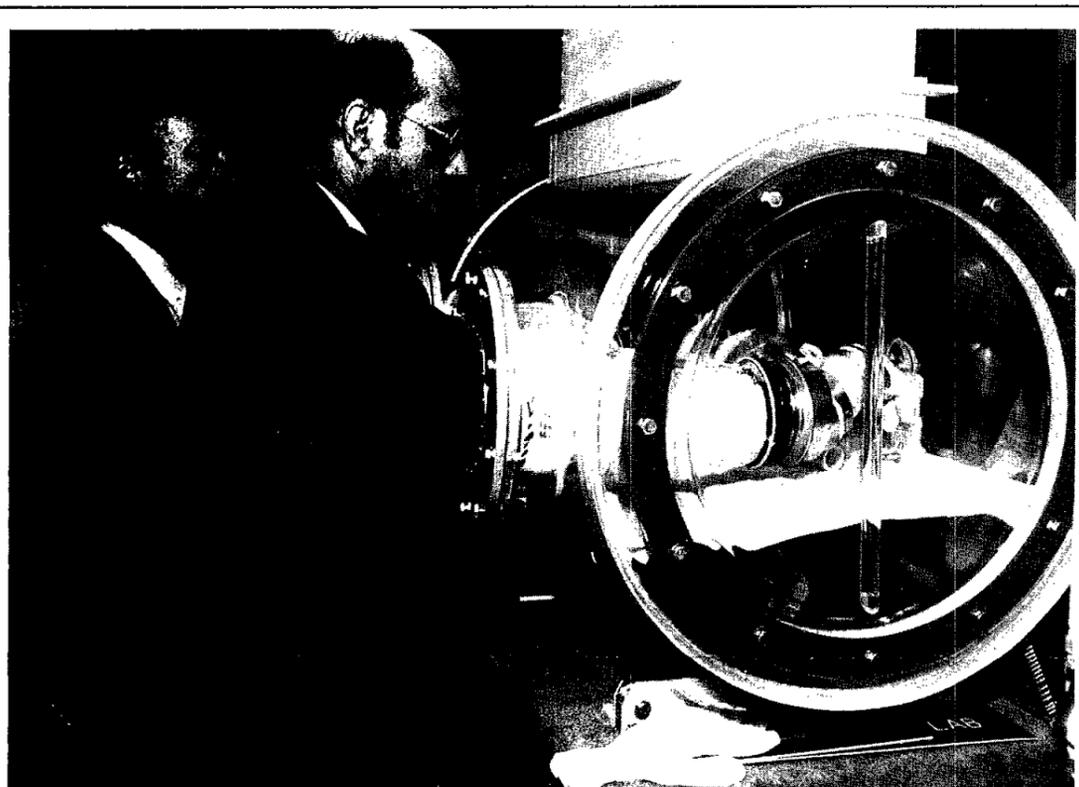
"You can imagine how hard he's been to live with, with Notre Dame's current standing in the (football) polls," Brandenstein said.

Wetherbee's prime function, according to Brandenstein, will be shuttle responsibilities and assisting with the planned experiments.

Asked about his feelings about flying during the holidays, Wetherbee noted that "although we'll be gone from our loved ones and families, we need to remember that servicemen and women and others serving our country are also often unable to get home for Christmas."

"BJ," Mission Specialist-1 Bonnie Dunbar, is a veteran of the STS-61A, the seven-day

Please see **MISSION**, Page 4



JSC Photo by Jack Jacob

NASA Deputy Administrator J.R. Thompson tries his hands at operating space suit gloves in a box that simulates pressurized operations. The Crew Systems Branch briefed Thompson and JSC Acting Director P.J. Weitz, who toured JSC facilities and spoke with employees Tuesday, on new technology that is providing better glove mobility.

## Thompson sees many challenges

Deputy administrator tours JSC, speaks to employees

By Linda Copley

"The challenges and opportunities for (NASA's) success, as well as for failures, are as evident today as any time that I can remember," NASA Deputy Director J.R. Thompson told an audience of almost 500 JSC employees in Teague auditorium Tuesday afternoon. "We've got an awful lot going on," he said.

The former director of Marshall Space Flight Center, named agency deputy director in July, addressed center employees as part of a Houston visit that also included

making the opening keynote address to the third annual Space: Technology, Commerce and Communications Conference that morning.

Introduced by JSC Acting Director P.J. Weitz, Thompson told employees it was a "joy to be back" at JSC, and reminisced about visits harking all the way back to the Apollo program, "with their good, hard-nosed interchange of technical ideas."

Although pleased to see "that there is a real effort across the agency to see that the centers are working well with each other," Thompson also

noted the value of natural tensions when dealing with ideas. He said the checks and balances found in the discussion of ideas among people with different viewpoints are an important part of the decision-making process.

Citing the numerous projects on the agency's agenda in the near future, Thompson said. "You might say NASA is on a roll. But there are potholes along the road," he warned. "We at NASA have a big appetite—but we need to get our budgets in

Please see **J.R.**, Page 4

## Discovery's launch awaits solid rocket wiring inspections

By Kyle Herring

Launch of *Discovery* on its ninth space shuttle flight will occur no earlier than Wednesday to give workers at Kennedy Space Center time to remove and inspect the integrated electronics assemblies (IEA) on each solid rocket booster for possible wiring damage.

The launch had been planned for Monday, but a problem with two of the IEAs at the vendor prompted shuttle managers to call for the inspection of *Discovery's* booster rocket IEAs. The inspection was to be completed by Thursday. Any problem found would require a change out of the IEA with one from the boosters being readied for *Columbia's* next flight in a month.

The IEAs act as the brain for the booster by routing power, commands and data between the orbiter and boosters. It was discovered by the vendor that wiring in these two aft units could potentially have been routed such that some wires could rub against a metal edge creating the possibility of a short.

Once removed, these units were transferred to the United States Boosters Inc. (USBI) facility where inspectors from Bendix will verify the wiring.

Wednesday, workers removed close-out material, or foam, from the IEAs to gain access to these units in the vicinity of the external tank attach ring.

Later, explosive devices on the vehicle were disconnected and the IEAs removed. Close outs of the aft compartment are under way.

Purges of the power reactant storage and distribution system tanks have been completed.

Prelaunch activities completed last weekend included a hot fire of the solid rocket booster hydraulic power units, final ordnance operations, pressurizing the orbital maneuvering system and reaction control system tanks for flight and loading storage tanks on the launch tower with liquid oxygen and liquid hydrogen propellants.

Last Friday, checks of the regulators for the reaction control system were completed and the extravehicular mobility units, or spacesuits, were installed.

On Sunday, the launch countdown is scheduled to begin at 3 p.m. CST and the STS-33 flight crew will be arriving. STS-33 launch is scheduled for Wednesday during a four-hour launch period beginning at 5:30 p.m. CST.

The STS-33 crew will travel to the launch site aboard T-38 training jets from Ellington Field and proceed with final preparations for the launch.

Commander of the mission is Fred Gregory. Pilot is John Blaha who joined the crew in June after the death of David Griggs in a private plane crash in Arkansas. A single star on the STS-33 crew patch design is in memory of Griggs. Gregory and Blaha have each flown once before.

Mission specialists for the flight are Sonny Carter, Kathy Thornton, and Story Musgrave. Carter and Thornton are making their first shuttle flights. Musgrave is making his third flight.



## JSC rockets above goal in Combined Federal Campaign

JSC employees donated a whopping \$308,574 to this year's Combined Federal Campaign (CFC), boosting the grand total to 112 percent of the goal.

Teresa Sullivan, campaign coordinator, noted that all but five JSC organizations gave more than 100 percent of their goals. Employees contributed \$47,000 more than they had in 1988, but the percentage of people who gave dropped to 78 percent from last year's 88 percent.

"It's still coming in and we're still going to accept, but we're way over the top," Sullivan said.

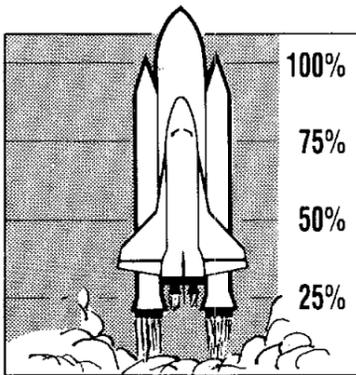
Those who topped their goals by the most were the Human Resources Directorate, with \$7,202 or 182 percent of its goal; the Office of the Director, with \$2,962 or 180 percent of its goal;

the Equal Opportunity Programs Office, with \$784 or 166.8 percent of its goal; and the National Space Transportation System Program Office, with \$2,704, or 160 percent of its goal.

The Engineering Directorate contributed the largest dollar chunk, with \$63,930 or 115 percent of its goal. The Mission Operations Directorate gave \$47,911, or 121.4 percent of its goal.

A total of 2,720 out of 3,490 civil service employees participated. The New Initiatives Office, Space Station Projects Office, NSTS Operations Office, the Office of the Director and the Equal Opportunity Programs Office all reported 100-percent participation.

Anyone who still wishes to donate should contact the JSC Exchange Operations Office at x39168.



**GRAND TOTAL: \$308,574**



## Bush signs budget bill; anti-deficit cuts loom

By Kelly Humphries

President George Bush has signed the bill that contains \$12.4 billion for NASA in fiscal year 1990, but the agency still faces a possible deficit-reduction cut of \$589 million.

Bush signed the HUD and independent agencies budget bill on Nov. 9. That bill contains \$12.4 billion for NASA, an 11.9 percent increase over last year's budget.

But on Oct. 16, automatic cuts took effect for most government agencies under the sequestration guidelines of the Balanced Budget and Emergency Deficit Control Reaffirmation Act of 1987 (Gramm-Rudman).

According to JSC Comptroller Wayne Draper, the automatic cuts

took effect because Congress was not able to pass a 1990 budget bill by Oct. 15 that met the deficit reduction target of \$100 billion.

Gramm-Rudman guidelines specified automatic cuts of \$16.1 billion across the government; some programs such as Social Security, Medicare and veterans pensions are exempt.

Congressional leaders have said they expect to meet the 1990 target once the final reconciliation bill is passed. Draper pointed out that although Congress can attempt to rescind the automatic cuts, Bush has indicated he would like to see some additional progress made in reducing

Please see **BUDGET**, Page 4

JSC

# 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): \$3.50 each.

AMC Theater (valid until May 1990): \$3 each.

Sea World (San Antonio, year long): adults, \$17.25; children \$14.75.

Delta Downs Bus Trip (Nov. 19, includes transportation, continental breakfast and drinks, and clubhouse admission): \$29 per person.

Powderhorn Colorado Ski Trip (Jan. 23-27, includes chartered air fare from Hobby to Grand Junction, air transfer, lodging for 3 days, 4 nights): Trip package must be purchased by Nov. 24, \$385 per person, double occupancy.

Dickens on the Strand (Dec. 2-3): adults, \$3; ages 6-12 and 65 and older \$2.

Christmas tree sale: (Dec. 2-3, Gilruth Recreation Center).

JSC/EAA Christmas Dance (Dec. 8, includes roast beef dinner, \$15; Dec. 9, includes prime rib dinner, \$20.) Tickets go on sale Nov. 21.

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# Gilruth Center News

**Sign up policy**—All classes and athletic activities are first come, first served. To enroll, you must sign up in person at the Gilruth Recreation Center. Everyone will be required to show a badge or EAA membership card. Payment must be made in full at the time of registration. Classes tend to fill up four weeks in advance. For more information, call x35789 or x30304.

**EAA badges**—Dependents and spouses may apply for a photo I.D. 6:30-9:30 p.m. Monday-Friday.

**Defensive driving**—Course is offered from 8 a.m.-5 p.m., Nov. 18 and Dec. 16; cost is \$15.

**Weight safety**—Required for use of the Rec Center weight room. Classes will be 8-9:30 p.m. Nov. 29; cost is \$4.

**Low-impact aerobics and exercise**—Each eight-week session runs twice a week from 5:15-6:15 p.m. Cost is \$24.

**Blood drive**—The last blood drive for 1989 will be held in the gym on Nov. 21 from 8 a.m. to 4:30 p.m.

JSC

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

Lake Travis cabin, priv. boat dock, A/CH, fully equipped, accom. 8, wkly./daily rental, \$325/\$75. 326-5652.

Sale: Wedgewood Village, Friendswood, two residential lots, ea. approx. 70' x 185', owner fin. w/10% down. 482-5226.

Sale: Seabrook, 3-2-2, 1,800 sq. ft., brick, never flooded, formals, lg. den w/FPL, remodel, w/new A/CH, roof, int., deck w/spa, \$0 down, \$69,900. Richard, x30271 or 474-9334.

Trade: Custom canyon view 4-3 off 360 West of Austin, prefer 5 yr. old, open plan w/in 20 min. of JSC. 471-8795 or 333-6083.

Rent: 3-2-5 townhouse, 2 min. from JSC, carpet, avail. 12/1, \$550/mo., sec. dep. 488-8563.

Lease: Piper's Meadow, 3-2-2, very clean, new paint, extras, 1st mo. dep., no pets, \$675/mo. Ron, 486-8803.

Lease/Sale: Newport, League City, 3-2-2, FPL, built-ins, ceiling fans, covered patio, fenced, new roof, new A/C, near Clear Creek schools, NASA, \$625/mo. 488-6306.

Texas A&M townhome, lg. 2/1, walk to campus, \$38,000, lease, purchase, BO. (713) 333-4182.

Sale: 3-2-2 brick, one owner, never flooded, formals, dbl. insulation, storm windows, 5 ceiling fans, C/AH, 12' x 26' screened patio, fenced yard, fruit trees, \$59,500. 991-1121 or 282-4085.

Lease: 1-1, FPL, W/D, upstairs, new carpet, pool, tennis courts, near NASA, \$325/mo. 681-4732.

Sale: heritage park, 3-2-2, qual. bond buyer pays \$500 move in, we pay closing costs, landscaped, decking, sec. sys. Linda, 282-5241 or 996-1990.

Rent: Lake Livingston, waterfront, 3-2, C/AH, FPL, covered deck, pier, new cond., fully furn., wknd. or wk. 482-1582.

Rent: Buena Vista, 1 mi. from Disneyworld, 2 BR w/loft, sleeps 8, tennis, hot tubs, deli, on site, 12/16-12/23, \$425. x33434 or 333-5266.

Rent: Kauai's North Shore, 1 wk. condo, sleeps 6, avail. now thru 12/31/89, \$395, OBO. 283-5332 or 991-7439.

Sale: Country Restaurant, well estab., and 3 BR home on 3 acres, pecan trees, 1 1/4 hr. West of Houston, \$175,000. Gene, x33016 or (409) 732-6321.

One wk. Timeshare to exchange before Feb. '90, 2-2 condo anywhere in the country, need flexible schedule, \$500. Tim, 996-9191.

Sale: Kemah lot for home building, 111' x 180', some trees, \$7,200. 334-1883.

Sale: Kemah country home, Clear Creek school dist., 1.33 acres, 3-2, huge gar., carport comb., deep well, \$85,000. 334-1883.

Sale: Crystal Beach cabin, 2-1, A/C, close to beach, \$32,000. Dorothy, (409) 832-2582 or (409) 755-1638.

JSC

# Dates & Data

## Today

**Voyager: The Grand Tour Comes to a Close**—This "wrap-up" presentation of the grand tour of Voyager and Pioneer spacecraft of the outer planets of the solar system will be at 7:30 p.m. Nov. 17 in the World Affairs Lounge, University Center Underground, University of Houston. Call 639-4221 for additional information.

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

## Nov. 18

**Charity garage sale**—JSC Child Care Center volunteers will conduct a garage sale from 9 a.m.-4 p.m. Nov. 18 at the Gilruth Recreation Center's new pavilion area. For more information call Estella Gillette, x33077; Mike Evans, x37667; Jessie Gilmore, x32739; Mary Allen, x33087; or Mary Lee Meider, x39862.

## Monday

**ACM dinner meeting**—The Clear Lake Chapter of the Association for Computing Machinery will hold a dinner meeting on Mon., Nov. 20, beginning at 5:30 p.m. in the Forest Room of the University of Houston-Clear Lake. The featured speaker is Robert Hennen, Computer Systems Department Manager, Barrios Technology, Inc. For information or reservations, contact Susan Porter at 480-4101 or Gary Young 480-1994.

**Cafeteria menu**—Special: chili and macaroni. Entrees: barbecue sliced beef, parmesan steak, spare rib with kraut. Soup: French onion. Vegetables:

ranch beans, English peas, mustard greens.

## Tuesday

**Blood drive**—The last blood drive of the year will be held Tues., Nov. 21, from 8 a.m.—noon and from 1—3:30 p.m. at the Gilruth Rec Center. Contact Helon Crawford, x34159, for information.

**Cafeteria menu**—Special: corned beef hash. Entrees: meatballs and spaghetti, liver and onions, baked ham with sauce. Soup: split pea. Vegetables: buttered cabbage, cream style corn, whipped potatoes.

## Wednesday

**Cafeteria menu**—Special: turkey and dressing with trimmings. Entrees: cheese enchiladas, roast pork and dressing. Soup: seafood gumbo. Vegetables: pinto beans, Spanish rice, turnip greens.

## Thursday

**Thanksgiving Day**—Most JSC offices will be closed in observance of the Thanksgiving Day holiday.

## Nov. 24

**Cafeteria menu**—Special: fried chicken. Entrees: fried shrimp, baked fish, beef stroganoff. Soup: seafood gumbo. Vegetables: okra and tomatoes, buttered broccoli, carrots in cream sauce.

## Nov. 26

**The Clydesdales are coming**—The Anheuser-Busch Clydesdale horses and coach will be on exhibit at JSC at Rocket Park on Nov. 26. Employees and visitors are invited to

view them from 11:30 a.m.—3 p.m.

## Nov. 27

**Cafeteria menu**—Special: meat sauce and spaghetti. Entrees: franks and sauerkraut, sweet and sour pork chop with fried rice, potato baked chicken. Soup: cream of potato. Vegetables: French beans, buttered squash, lima beans.

## Nov. 28

**BAPCO meeting**—The Bay Area PC Organization (BAPCO) will meet at 7:30 p.m. Nov. 28 at the League City Bank and Trust. For more information, contact Earl Rubenstein, x34807 or 326-2354; or Ron Waldbillig, 337-5074.

**Cafeteria menu**—Special: smothered steak with dressing. Entrees: beef stew, liver and onions, shrimp Creole. Soup: navy bean soup. Vegetables: buttered corn, rice, cabbage, peas.

## Nov. 29

**Cafeteria menu**—Special: salmon croquette. Entrees: roast beef, baked perch, chicken pan pie. Soup: seafood gumbo. Vegetables: mustard greens, Italian green beans, sliced beets.

## Nov. 30

**Cafeteria menu**—Special: stuffed cabbage. Entrees: beef tacos, ham and lima beans. Soup: beef and barley. Vegetables: ranch beans, Brussels sprouts, cream style corn.

## Dec. 1

**Cafeteria menu**—Special: Salisbury steak. Entrees: fried shrimp, deviled crabs, ham steak. Soup: seafood gumbo. Vegetables: buttered carrots, green beans, June peas.

# Swap Shop

\$25. Pete, 334-2963.

'84 Honda V-65 Magna, black, new batt., new rear tire, \$1,800. Paul, 282-4098 or 554-6366.

24" boys 10-spd. bike, red Open Road 3000XT, \$65. x37325 or 332-8188.

## Boats & Planes

14' Glassmagik skiboat, 80hp Merc., galv. trlr., skis, fresh water use, ex. cond., 38mph, \$1,595. x35180 or 326-3706.

16' Hobie Cat w/Dilly trlr., dbl. trap, extras, \$1,000. Brian, 282-2784 or 280-8500.

15' bass boat, fully equipped, \$1,200. Phil, 488-4453.

'87 18' Celebrity Bowrider, 183VBR, 165hp I/O, SS prop, full leak swim platform, tilt/trim, cover, bimini, Sportsman trlr., mint cond. 333-1640.

Tri-Q exper. aircraft, 2-place, 140mph, 75hp, 300hr T, based at Houston Gulf Airport, cost 20K plus, will take \$12,500 or trade for fishing boat, motorhome, car, etc. Wood, x37007.

15' boat w/40hp motor, new seats, canopy and extras, \$550, OBO; 14' boat w/33hr, many access., trlr., \$650, OBO. 474-5558.

## Photographic

Canon AE-1 camera w/Canon 50mm f1.8 FD lens, 35mm f2.8 lens, 135mm f2.8 lens (both auto aperture), Vivitar 3500 flash, \$250. Chris, 333-6866 or 532-1198.

## Pets & Livestock

Male standard poodle, 2.5 yrs. old, blk., 53 lbs., all shots, neut., \$150. Tom, x32344 or 486-1152.

Cocker Spaniel puppies, AKC, Champion sired, \$150. Robyn, 283-6505 or 488-4190.

Springer Spaniel puppies, blk. Lab sire, spaniel markings, liver/white, tails docked. Steve, x36725.

Shih-Tzu male, AKC, 6 mos. old, brindle/white, \$200. 554-6701.

Siberian Husky, fem., B/W, blue eyes, 1-yr. old, \$200. 554-6701.

Champion bred Shar-Pei, 1-yr. old, \$500. Hanan, x33198 or 333-9181.

Free Britany Spaniel, male, 1-yr. old. Steve, x38651 or 996-7742.

Cocka Poo puppies, blk., \$75 cash, regis., parents on premises. x30852 or 996-0981.

## Wanted

Want '70-'74 Dodge Challenger or Plymouth Barracuda, parts or complete car. Michael, 282-5443 or 863-8710.

2 male non-smoking roommates for lg. 4-BR house, Clear Lake near NASA, \$250/mo., 1/3 util. Dow, 486-5220 or 282-3957.

Want Starwars: Spaceships, toys, figures and books. Ron, 482-1385.

Want to carpool with someone from Lake Jackson area. Turner, x30918 or (409) 297-7038.

Want to trade concert/church elec. organ for 30' plus cabin cruiser. 337-4051.

Want male roommate to share condo at Villas, 2-2, FPL, W/D, balcony, cable, cov. park., sec. gate, pool, clubhouse, boat launch, \$335, util. incl. Greg, 335-1957.

Want Yamaha jog scooter, '86 preferred, also scooter tires, 2.75-10-4pr., and dog house. 944-0493 or 488-8111.

Want Volvo 15" Turbo Wheel, 5 spokes in good cond. Vincent, x30874 or 333-1316.

Want anything of value, property to vehicles, furn. to appl., buy single or house full. 333-

IBM compat. Tandy 1000, 640 K, 16 color CGA, color monitor, 20 meg hard disk, two 5 1/4" 360K floppy drives, clock, 1200 Baud modem, printer cable, software, \$900, OBO. Kit, 474-3100.

## Household

Box spring and matt., both for \$15. 996-7443. Dbl. sofa bed, off-white, tweed, good cond., \$75. x30415.

King-sz. waterbed, w/drawers, semi-motionless, pads and heater, new, \$600. Laura, x31312.

Sleeper sofa and matching loveseat, high-back, beautiful, \$450. Matt, x34285 or 486-7260.

Trundle bed w/2 matt., \$75; maple twin bed w/box springs and matt., \$75; 10' x 12' beige carpet, \$35. Steve, x34176 or 486-8424.

25 cu. ft. chest freezer, BO. 474-5558. Couch, loveseat, chair, \$200; lg. microwave, many features, \$125; VCR, ex. cond., \$75; TV, \$125. 488-7750.

## Miscellaneous

Canon AE-1 camera w/Canon 50mm f1.8 FD lens, 35mm f2.8 lens, 135mm f2.8 lens (both auto aperture), Vivitar 3500 flash, \$250. Chris, 333-6866 or 532-1198.

## Musical Instruments

Conn coronet, great cond., \$125, OBO. Randy, 282-4857 or 486-4940.

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6558 or 339-1337.

Want someone to share cottage off Egret Bay Blvd., 5-7 min. from JSC, \$210/mo. plus 1/2 util. Rick Davis, x36042 or 332-7695.

Want longboard-type surfboard, approx. 8 or 9' long. Billy, x31339 or 534-4780.

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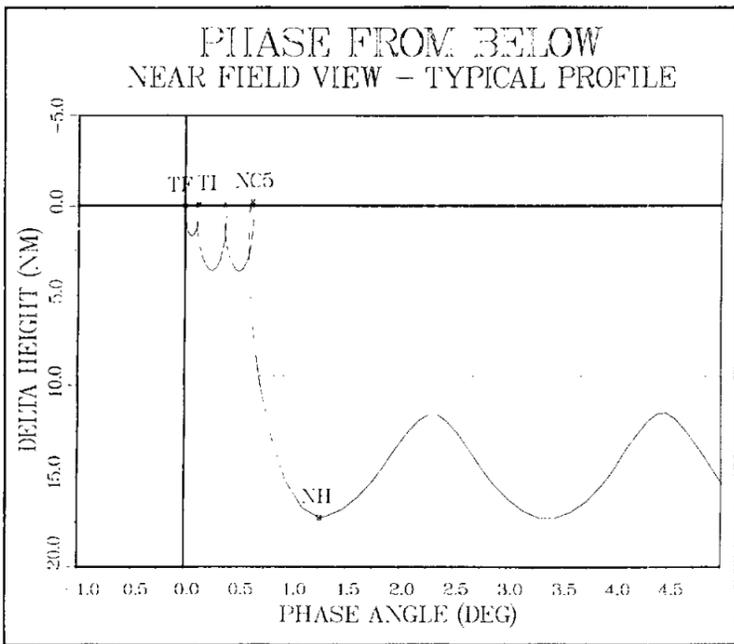
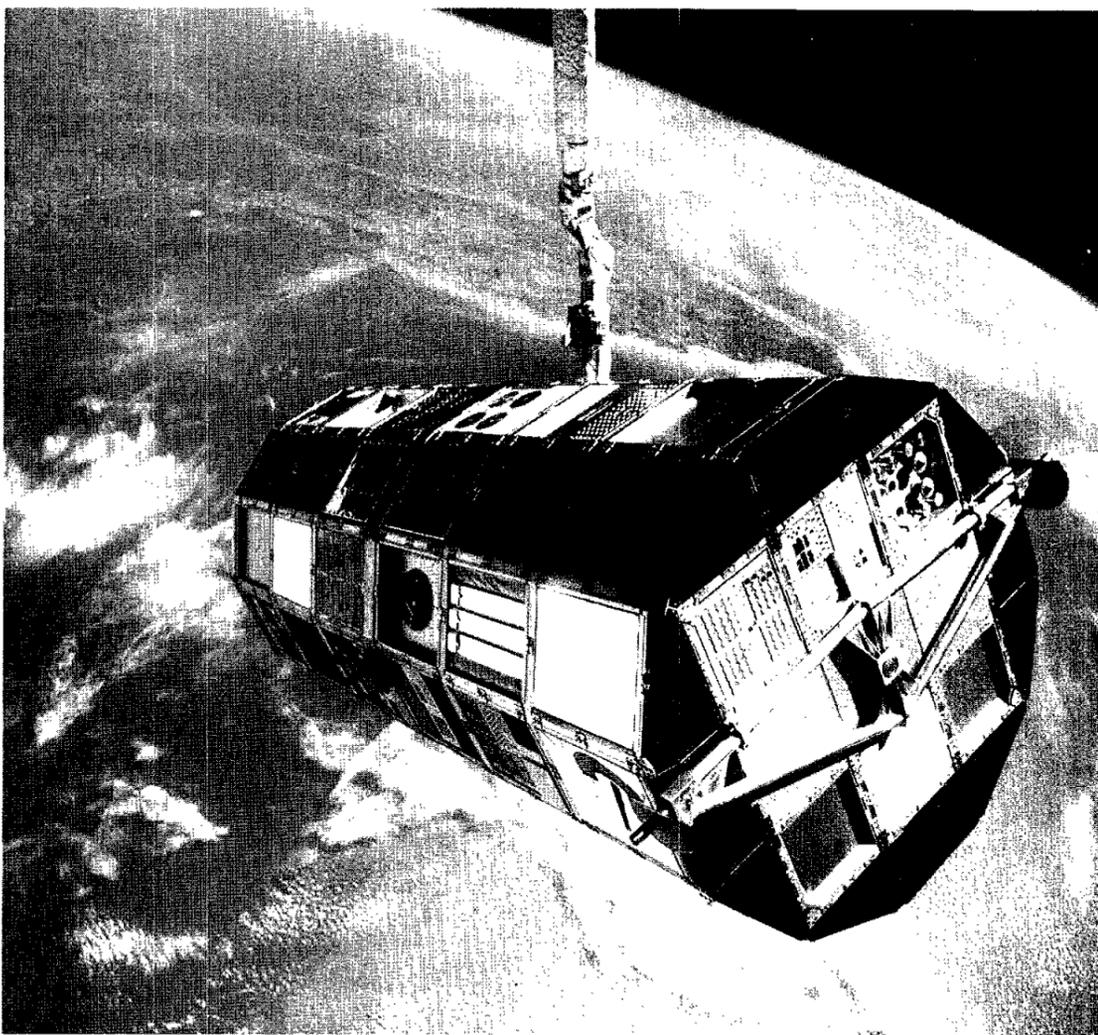
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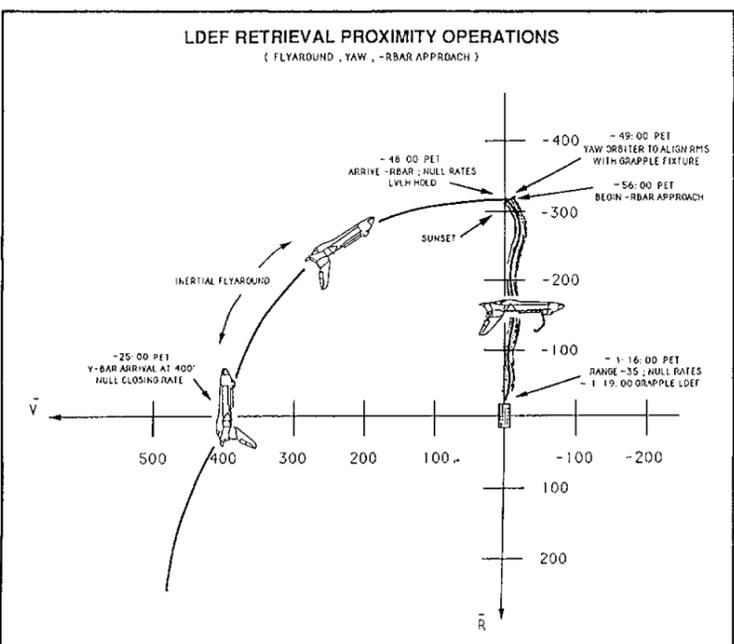
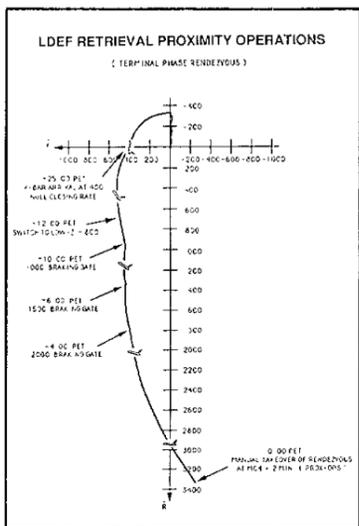
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# CATCHING UP WITH LDEF



These charts represent rendezvous and proximity operations similar to those *Columbia* and her crew will go through before capturing and returning the Long Duration Exposure Facility. From top to bottom, the charts zoom in on the maneuvers. Above: a typical rendezvous-from-below profile, ending with the start of the terminal phase; each loop indicates the end of an orbit. Right: an overall look at the terminal phase beginning where Commander Dan Brandenstein will take over manual control of the shuttle. Below: a closer view of the final maneuvers, including the fly around, yaw maneuver and "R-bar" approach to LDEF.



**By Kelly Humphries**

Getting the space shuttle close enough to retrieve the Long Duration Exposure Facility (LDEF) is a challenge that has kept JSC workers busy for almost six years, and it will continue to keep them busy until the last minute.

That's because the laws of motion and orbital mechanics will, essentially, write the flight plan and choose the rendezvous profile after launch.

Both launch time and rendezvous profile are dependent on when LDEF's orbit crosses over Kennedy Space Center, so the crew and flight controllers must be prepared to follow any one of a number of different rendezvous scenarios in addition to dealing with the usual launch and mission constraints.

"We won't know our actual profile until we lift off," says Lynda Slifer, the rendezvous analyst who has been designing the rendezvous for the past two years. "We don't even know what day we're going to rendezvous until we lift off."

As Lead Flight Director Granvil A. "Al" Pennington explains, getting the Space Shuttle *Columbia* into the same orbital plane as LDEF is like lane changing in a car.

"There's a multi-lane highway up there," he says, and LDEF will be in one of them. "We have some options by using the yaw steering capability of the main engines to be able to steer that vehicle into one of those lanes."

Once *Columbia* is in the correct "lane," Commander Dan Brandenstein and Pilot Jim Wetherbee will have to close the gap. That's where the work of Slifer and the Orbit Dynamics Section of the Orbit Analysis Branch come into play.

"We've got to go out and catch it," says Pennington. "It's like a timed pass play pattern in football."

In effect, he explains, the shuttle will be a receiver that runs a preset pattern. When the receiver reaches the end of the pattern, the ball—or in this case LDEF—should be there. But while a real quarterback must put the ball in exactly the right place to enable the receiver to catch it, in this game the shuttle will be able to make some last-minute adjustments.

"This is a passed ball that's in a constant velocity up there in orbit and we're trying to run out in front and get it. To do that, we have to figure out exactly where it is, what its altitude is, and then try to get in front of it."

Slifer, who will be supporting Flight Dynamics Officer Mark Haynes in Mission Control from the Trajectory Multi-Purpose Support Room, says there are several terms helpful in explaining orbital rendezvous.

A "phase angle" is similar to the distance between two orbiting bodies. Imagine poles extending from two spacecraft down to the center of the

Earth; where the two poles intersect, an angle is created. That angle is the "phase angle."

A "phasing burn," designated NC, is a rocket engine burn that adjusts the catch-up rate of the shuttle as it attempts to rendezvous with another object.

A "plane change burn," designated NPC, is a maneuver that adjusts the orbital plane of the shuttle to coincide with its target's orbital plane.

A "coelliptic burn," designated NSR, aligns the elliptical orbits of the shuttle and its target.

A "height adjustment burn," designated NH, adjusts the shuttle's altitude relative to its target.

A "terminal phase initiation burn," designated TI, puts the shuttle on an intercept course with its target. If no further adjustments are made after the TI burn the two will collide.

The STS-32 flight plan calls for *Columbia* to be launched into a 190-by-110 (minimum) nautical mile (nm) orbit. LDEF is currently orbiting at about 201 nm and is expected to have decayed to about 180 nm by Christmas. The Syncom IV satellite deployment is built right into the rendezvous profile. Once Syncom is deployed, *Columbia* will finish maneuvering for a rendezvous with LDEF, coming up from behind and below. Exactly when the maneuvers will begin and what profile will be used depends on the phase angle at launch, Slifer says.

If the launch takes place as scheduled on Dec. 18, the first rendezvous opportunity will be Flight Day 4. But *Columbia* will begin maneuvering on Flight Day 1. The first maneuver will be a phasing burn by the orbital maneuvering system (OMS) that will begin the shuttle's catch-up with LDEF. Toward the end of that same day, a plane change burn will make sure they are in the same orbital plane.

In the morning on Flight Day 2, another phasing burn will occur. About midday, Syncom is scheduled to be deployed and a separation burn will take the shuttle away from the satellite.

Toward the end of Flight Day 3, there will be two burns. One will be the coelliptic burn to make the two spacecraft's elliptical orbits parallel, and the other will be a phasing burn to set up desired lighting conditions for the next day's approach to grapple LDEF.

Early in Flight Day 4, a height adjustment burn will take *Columbia* and her crew still closer to LDEF. Half a revolution later, the spacecraft commander will execute the last of the ground-computed phasing burns. Up to this point, all of the burns will have been computed on the ground. After that burn, an NC, the crew will take over and make two Startracker passes that triangulate on the target by obtaining multiple "marks" on its position. Two revolutions later, the terminal phase initiation burn (TI) will

take place, Slifer says. The crew will then make several midcourse corrections and then begin proximity operations.

According to Mark Schrock, the RSOC proximity operations analyst in charge of designing the STS-32 terminal phase rendezvous, even that will be unusual.

This will be the first time the shuttle has done a "minus R-bar approach." R-bar stands for the radial vector that extends from the center of the Earth through the longitudinal axis of LDEF (remember the imaginary poles). In previous rendezvous, the shuttle has always approached its target along the "V-bar," or the velocity vector that is the same as the target's orbit.

This time, Schrock says, *Columbia* will come up from behind LDEF, pass in front of it, fly around and come back down on top of it along the R-bar. The reason for using the R-bar approach is that LDEF is in a gravity-gradient position with one end of its cylinder pointing toward Earth and the other toward space. It has RMS grapple fixtures on its side, but ground controllers are not precisely sure where they will be when *Columbia* arrives. The R-bar approach provides the flexibility to grapple regardless of the grapple fixture position.

The shuttle will come down from above and yaw on its central axis until the RMS and the grapple fixture are aligned.

"We are using this new approach because we're not sure exactly where grapple fixture is going to be," says Schrock, who has been designing the close maneuvers for a year and a half.

Another variation is that the crew will go into the low-Z mode early to reduce contamination, says Schrock. A "low-Z" approach will use the shuttle's fore and aft reaction control system (RCS) jets to help minimize the contamination of LDEF's experiment surfaces. Usually, the shuttle doesn't begin low-Z maneuvers until it closes within 200 feet. This time, low-Z maneuvers will begin 800 to 900 feet away.

After Brandenstein gets the shuttle close enough, Mission Specialist Bonnie Dunbar will grapple LDEF with the robot arm. She will rotate the satellite so that it can be photographed extensively before it is placed in the payload bay for return to Earth.

But Slifer says there are still more interesting features about the rendezvous profiles. If the launch is postponed until after mid-January, the rendezvous may have to be done by phasing from above instead of below, and the profiles will be almost mirror images of the rendezvous-from-below profiles that are normally flown.

"We've designed it to death and know it well, but this could be the first time we'll fly a phase-from-above profile," she says.

# JSC leases space in South Shore Harbour complex

By Linda Copley

JSC has leased 20,249 square feet of office space, capable of providing space for approximately 150 center employees at the One Harbour Square office building in the South Shore Harbour complex in League City.

The building, 4.8 miles from JSC on the south side of Clear Lake, becomes the center's most remote off-site lease location.

The lack of office space in onsite JSC buildings, as well as in offsite leased facilities available to accommodate the projected needs of the Lunar Mars Initiative program, prompted the action.

"The space was procured by a competitive two-step bid process," said Melody Goss, real property accountable officer, Facility Development Division. "Falcon Development Group Inc., part of the South Shore Harbour community was awarded the low bid of \$196,166 for a one-year firm contract to begin Dec. 1," she said.

The contract carries two one-year options, Goss said. The cost includes complete build-out, telecommunications, and utilities (including overtime air conditioning usage). Patsy Mitchell, 283-5490, Facility Development Div-

ision, is the off-site leased facility contact for the building.

"Our lease includes the entire third floor," said Goss. Government furnished furniture, portable partitions and support equipment will be moved into the building by the second week of December and occupancy can begin at that time. The center will provide its own janitorial and taxi service to the One Harbour Square building.

Although the final decision has not been made, one of the primary candidates for the use of the newly acquired space, according to Procurement's Bill Drastata, will be to house Source Evalua-

tion Boards (SEBs).

"From 25 to 50 people serve on a single SEB," said Drastata. "And on some major procurements, we can have as many as 100, when Headquarters and personnel from other NASA centers participate.

"The number of SEBs we have in process at any given time varies according to center requirements," said Drastata, "but we have been averaging at least six to eight SEBs in various stages of the selection process at one time. I expect to see SEB activity continue at that level," he said.

The requirements of SEB for security and isolation when

selecting office space, according to Security's Dick McMinimy, makes the South Shore quarters a "natural" area to consider.

The building owners will provide controlled access to the third floor as part of the contract agreement, McMinimy said.

"This will be the same type of security in effect in our other off-site buildings housing SEB functions," he said.

The South Shore JSC tenants will have all the normal security services afforded other off-site tenants, including checks by security personnel during non-working hours.

## Tornado kills three Marshall employees

A tornado that caused extensive damage in Huntsville, Ala., Wednesday night killed at least three Marshall Space Flight Center workers and injured or affected at least 50 more.

Marshall officials reported that the center itself received only minor damage, with the only reportable damage being lost power transmission lines in its west test area.

The storm hit southeast of the middle of Huntsville, and early local news media reports indicated 17 people were killed and 300 to 400 injured.

One Marshall civil servant, James B. Summerour, a laboratory technician, was killed. Two Boeing Computer Support Services con-

tractor employees, Tom Fry and Allen D. Cruse, also died.

At least 50 other employees were either injured, suffered property damage or had family members who were killed, hurt or otherwise affected.

JSC Acting Director P.J. Weitz expressed his condolences to Marshall employees in a message to Marshall Director Jack Lee.

"All of us at JSC were deeply saddened by the news that our fellow NASA workers were among the victims of this storm," he wrote. "We express our heartfelt condolences to everyone who was affected, especially to the families of those who were hurt or killed. We wish your community a speedy recovery."

## Special mission hours set for STS-33

Special hours will be in effect for JSC's Space Center Blvd. gate and both cafeterias during the upcoming mission, STS-33.

Beginning the day of launch, now scheduled for Wednesday evening, the Space Center Blvd. gate will be open 24 hours. The main gate on NASA Road 1 will remain open 24 hours as usual.

The Bldg. 11 cafeteria will be open from 6:30 a.m. to 2 p.m. weekdays, and from 6:30 to 10 a.m. on Thanksgiving Day. The Bldg. 3 cafeteria will be open normal hours on weekdays and from 6:30 a.m. to 4:30 p.m. on weekends. On Thanksgiving Day, Bldg. 3 will be open from 10 a.m. to 4:30 p.m.

## STS-33 homecoming details to be announced

JSC employees should call the recorded Employee Information Service for details of the STS-33 crew return ceremony.

Because the Department of Defense-dedicated mission is classified, the landing time won't

be announced until 24 hours before the end of the mission.

Call the Employee Information Service at x36765 after the announcement for the most up-to-date information on the ceremony.

# Mission will be only second 10-day shuttle journey

(Continued from Page 1)

German D-1 Spacelab mission that carried the largest crew to fly in space—eight. Dunbar, formerly a payload officer at JSC before her selection as an astronaut, recalled the size of that crew when asked about coping with the upcoming flight's 10-day duration.

"Although we had the additional space in the Spacelab module and worked in shifts, there were times when our shifts overlapped. After you've spent seven days with eight people, five is going to seem a lot

less crowded," she said.

Brandenstein added that, of course, "some choreography is required in planning how to allow each crewperson enough space in which to work." The crew, he noted, has been training together for a long time and no real problems are anticipated.

Dunbar's prime responsibilities on this flight will be operating the remote manipulator system (RMS), the mechanical arm, and with LDEF preflight and postflight activities.

Dunbar also is designated as EVA-2, assigned to perform any extravehicular activity that might be required during the flight along with EVA-1, crew member David Low.

"MI," Mission Specialist-2 Marsha Ivins, making her first flight, will serve as flight engineer for ascent and entry, seated on the flight deck with Brandenstein and Wetherbee. Once on orbit, she is responsible for secondary experiments, and will serve as photo-TV expert.

"Besides working with the crys-

tal growth, circadian rhythm, cardiovascular, and mesoscale lighting experiments, we hope to get some spectacular footage for the new IMAX film, 'The Blue Planet,' now in production," Ivins said.

G. David Low, Mission Specialist-3, bears no nickname, "because his name's too short to begin with," Brandenstein said. Low, also making his first flight worked in spacecraft design at NASA's Jet Propulsion Laboratory in California before his selection as an astronaut

in 1984. His responsibilities aboard STS-34 include the Frisbee-style deploy of the Syncom IV-05 satellite on Flight Day 2, the medical detailed supplementary objective (DSO) tests, and serving as EVA-1 in case a spacewalk should be required during the flight.

"We need to understand changes to the body that happen in microgravity, how those changes affect the way the crew performs, and how to determine effective countermeasures for those changes," he said.



JSC Photo by Kyle Herring

Astronaut John Young, sporting a cowboy hat, and accompanied by his wife, Susy, to his left, make their way through the crowded fajita line at the FCOD Fajita Fiesta.

## Fun, fanfare and fajitas for FCOD

By Jeff Carr

The Flight Crew Operations Directorate recently took time out to kick up its collective boot heels with family and friends during the seventh annual Fajita Fiesta.

In the big-sky setting of hangar 990 at Ellington field, about 800 revelers enjoyed great food, fellowship, and the rock 'n roll tunes of the all-astronaut band, Max-Q.

The yearly event brought FCOD personnel and friends together for a family-style reunion to celebrate, get acquainted, and to just plain relax.

Amid the fun, fanfare, and fajitas, FCOD boss

Donald Puddy also took time to recognize friends and colleagues for their special roles in support of shuttle flight crew operations.

The Mission Operations Directorate, represented by flight director Bill Reeves, was presented with a large plaque-mounted mission operations patch flown on shuttle flight STS-26 in recognition of its outstanding and unique contributions to the preparation of astronaut crews for space flight.

Honorees also included local Precinct 8 Constable Bill Bailey, for his special support of public events such as crew return ceremonies and traffic escorts for crews and families.

## J.R. Thompson visits JSC

(Continued from Page 1)

line with our appetite."

In reiterating the necessity of planning for both success and failure, Thompson told his audience, "We need to be working on a sixth orbiter.

"The shuttle is the best, most reliable vehicle in the world today, with 97 percent reliability," he noted. But when that one, two, or three percent chance of failure does occur, he continued, NASA needs to be prepared.

Thompson stressed his view that where space station was concerned, he wants to "go with the minimum," in order to get it in orbit. We can grow, we can add on, he said, but what we need is to get it up there.

"The longer we keep it on the

ground, the more chance there is that it will never fly," he said.

Thompson answered questions, including one regarding his much-publicized remarks concerning civil service versus contractor strength within the agency.

"Our civil servant strength is one of our biggest vulnerabilities," he said. "We need more people to provide basic oversight capabilities. But even as our budget increases, the agency, which had 22,000 civil servants at the time of the Challenger accident and has about 23,000 now, will not go over 30,000, even by 1999," he said.

"We're going to have to be choosy," he warned. "There may come a time when we have to turn down a program."

## Space News Roundup

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Editor ..... Kelly Humphries  
Associate Editor .... Linda Copley

## Budget reduction still possible

(Continued from Page 1)

the deficit.

Congress has not yet decided whether to rescind the cuts, largely because the budget reconciliation bill has not been passed.

If the cuts do stand, NASA will have to absorb the \$589 million cut, which would reduce the agency's 1990 budget to \$11.8 billion,

he said.

"Right now we're watching to see what happens," Draper said. "Contingency plans on how to absorb the cuts are currently being formulated at the Headquarters level."

Any cut would not affect the 3.6 percent salary increase for civil servants that takes effect Jan. 1, 1990.

## Shanghai Astronautical Society banquet set

The Houston Section of the American Institute of Aeronautics and Astronautics (AIAA) is hosting a banquet in honor of the Shanghai Astronautical Society delegation, visiting JSC from the People's Republic of China.

The banquet is planned for

Tuesday at the American Host Hotel. Cocktails begin at 6 p.m., with dinner at 7. Tickets are \$11 each for AIAA members and \$12 for non-members. Reservations must be made by 4 p.m. today, by calling Andre Sylvester at x31537 or Jim McLain, 488-0312.