



JSC and its contractors are making significant progress in the effort to make longer shuttle missions possible. Story on Page 3.



Cosmonaut Aleksandr Serebov tries out a NASA space suit during a visit to JSC. Photo on Page 4.

Space News Roundup

Vol. 29

June 1, 1990

No. 22



NASA Photo

The crew of STS-35 takes a break in the M113 tracked rescue vehicle during a training exercise at Kennedy Space Center's Pad 39A. From left are Pilot Guy Gardner, Payload Specialist Ron Parise, Commander Vance Brand and Mission Specialists Robert Parker, Jeff Hoffman and Mike Lounge. Missing is Payload Specialist Sam Durrance.

New launch target uncertain

Hydrogen leak forces second Columbia delay

By Kyle Herring

Technicians at Kennedy Space Center have located a hydrogen leak that contributed to Tuesday's scrub of the STS-35 launch, and it appears the soonest possible launch of *Columbia* will be the middle of next week.

Shortly after Tuesday's "go" for taking for the Astro-1 mission, unacceptable levels of hydrogen gas were detected by sensors in the orbiter's aft compartment. The launch team was forced to terminate the loading of super-cold liquid hydrogen and oxygen and postpone the launch.

"With the work we've laid out near term, the middle of next week would probably be the earliest we would consider a launch attempt," Launch Director Bob Sieck said Wednesday afternoon.

Mission managers met throughout the day Thursday to discuss options for a new launch target date. A new target is not expected until the leak is completely understood and a repair operation has been designed.

Wednesday evening, workers finished draining the external tank and took a closer look at the area between the aft end of the orbiter and tank, where the fuel is loaded. They discovered a leak in a quarter-inch diameter flex line connector that is part of the liquid hydrogen (LH₂) manifold.

Sieck said the leak, which was releasing about 16,000 cubic inches of hydrogen per minute when the propellant loading was halted, prob-

ably is about the size of a pinhole or larger.

"The system was tight going into the launch count," Sieck said. "It had passed all of our standard leak tests and we felt good about it, so obviously the problem did not manifest itself until we saw cold, cryogenic temperatures."

Continued troubleshooting will include checks to determine if the leak rate explains the quantity of hydrogen detected in the aft compartment during propellant

loading. Technicians also planned to look for any obvious abrasions in the welds on the joints. Then, the external tank will be pressurized and a small volume of helium will be injected in an effort to duplicate the leak and pinpoint its location on the flex line connector.

Other work involves off-loading the on-board storage tanks filled with propellants that provide power to the orbiter while in space.

Once off-loaded, workers will open *Columbia's* payload bay doors so that the Broad Band X-Ray Telescope payload can be reserviced with argon used to cool the BBXRT while in operation in space.

Sieck noted that this is the first time since the return to flight that an on-board hydrogen leak has been detected.

The scrub occurred before the seven-man crew had boarded *Columbia*. The crew returned to Houston on Wednesday and will continue simulator

Please see **COLUMBIA**, Page 4



STS-35
Astro-1

Three more crews assigned

By Jeff Carr

Astronaut crew assignments have been made for three space shuttle missions scheduled for early to mid-1991, bringing to 12 the total number of shuttle crews currently in training.

The crew members were assigned to STS-44, a dedicated Department of Defense flight aboard *Atlantis* targeted for March; STS-45, a mission to study atmospheric phenomena from the Atlas-1 laboratory aboard *Columbia* in April; and STS-43, a May mission to deploy another Tracking and Data Relay Satellite (TDRS) from *Discovery*.

Navy Capt. David M. Walker will command the five-member STS-44 crew. Air Force Lt. Col. Terence T.

"Tom" Henricks will serve as pilot. Mission specialists for the flight will be Dr. F. Story Musgrave, M.D., Navy Lt. Cmdr. Mario Runco Jr., and Army Lt. Col. James S. Voss.

Walker, 46, will make his third shuttle flight, and his second as commander. He flew as pilot on STS-51A, and was commander for STS-30. Musgrave, 54, has flown three times, on STS-6, STS-51F, and STS-33. Henricks, 37, Voss, 41, and Runco, 38, will make their first space flights.

Marine Col. Charles F. Bolden Jr. will command the seven-member crew of *Columbia* on STS-45. Air Force Maj. Brian Duffy will serve as pilot. Mission specialists on the nine-to-10-day flight are payload com-

mander Dr. Kathryn D. Sullivan, Ph.D., Dr. C. Michael Foale, Ph.D., and Navy Capt. David C. Leestma. Payload specialists for the mission are Dr. Michael L. Lampton, Ph.D., and Dr. Byron K. Lichtenburg, Ph.D. Sullivan, Foale, Lampton, and Lichtenburg had been previously named to the flight.

Bolden, 43, receives his first command after flying as pilot of STS-61C and STS-31. Sullivan, 38, making her third flight, served as mission specialist for STS-41G and STS-31. Leestma, 41, will make his third flight, having flown as mission specialist on STS-41G and on STS-28. Lichtenburg, 42, will make his second space flight. He was payload specialist on

Please see **CREWS**, Page 4

Outreach Program seeks space exploration ideas

NASA has launched an Outreach Program to seek new and innovative ideas, systems and technologies to carry out the nation's Space Exploration Initiative (SEI), NASA Administrator Richard H. Truly announced Thursday.

The Outreach Program is in response to Vice President Dan Quayle's request to "cast the nets widely" for new approaches.

Truly also announced Thursday the appointment of former astronaut Lt. Gen. Thomas P. Stafford, USAF (Retired), as chairman of the Synthesis Group, which will play a key role in the Outreach Program. The group, reporting directly to Truly, will study innovative ideas and recommend two or more significantly different alternative architectures, as well as technology priorities and early milestones.

The Outreach Program seeks approaches to mission and system concepts; and innovative, high-leverage technologies that could significantly affect cost, schedule and performance for SEI, which sets the future course of the U.S. civil space program.

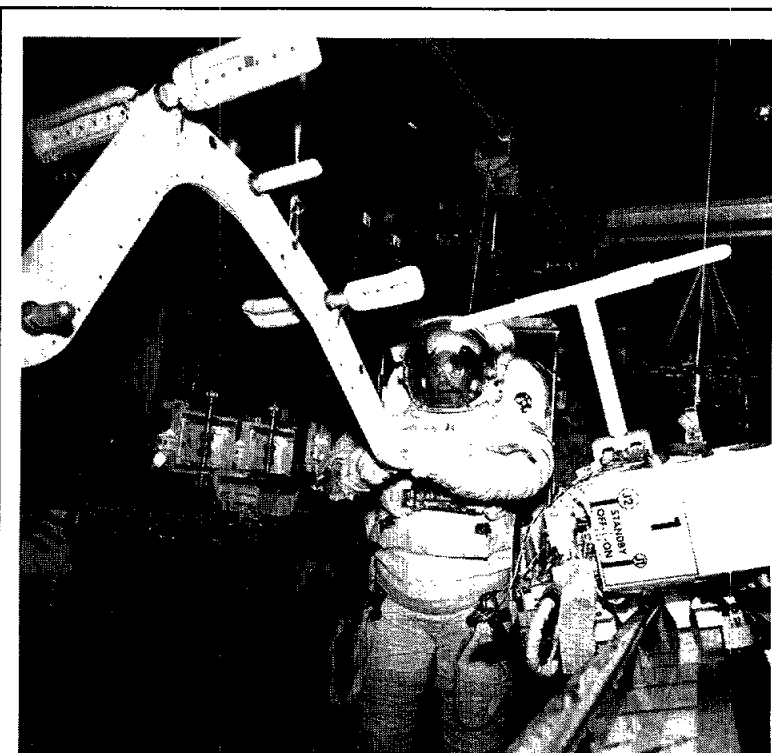
President George Bush announced the SEI on July 20, 1989,

the 20th anniversary of the Apollo 11 lunar landing. At that time, he proposed a long-term continuing commitment to complete Space Station *Freedom*; return permanently to the Moon; and send a manned expedition to Mars. On May 11, 1990, in a speech at Texas A&I University, Bush declared that before the 50th anniversary of the Apollo 11 lunar landing (2019), "the American flag should be planted on Mars."

Truly said the SEI outreach program is "solid and thorough" and "will leave no stone unturned to reach out to the very best and brightest in our nation." To gather information, concepts and data from the most creative minds in government, industry, academia and elsewhere, Truly said the program takes a three-pronged approach. This consists of direct solicitation of ideas, a review of federally sponsored research, and a study by the American Institute of Aeronautics and Astronautics (AIAA).

The solicitation effort will include a letter from Truly to organizations that can provide the highest leverage, such as universities, professional societies, associations and others. It also will include an announcement

Please see **OUTREACH**, Page 4



JSC Photo by Benny Benavides

CETA CHECK—Astronaut Jay Apt works with the Crew and Equipment Translation Aid (CETA) mechanical cart during a rehearsal for a thermal vacuum test. CETA, a spacewalk transportation device proposed for Space Station *Freedom*, will be evaluated by Apt and Jerry Ross during a spacewalk on STS-37. Last week's test subjected CETA hardware to temperatures of minus 130 degrees Fahrenheit, the coldest expected on-orbit, to ensure it will function properly at such extremes.

X-ray mapping ROSAT launch set for today

Another tool in NASA's burgeoning orbital astrophysics research program, the Roentgen Satellite (ROSAT), is scheduled for launch today aboard an unmanned Delta II rocket.

ROSAT's one-hour launch window opens at 4:35 p.m. CDT today at Cape Canaveral Air Force Station's Complex 17. A McDonnell Douglas Delta II is scheduled to carry the satellite into a 360-statute-mile, 53-degree orbit.

The satellite, a cooperative program between the United States and the Federal Republic of Germany, will make a detailed survey of cosmic X-ray sources across the sky, followed by studies of about 1,000 of the anticipated 50,000 to 100,000 sources that will be detected.

The information returned may reveal secrets about high-energy processes in the universe. Such high-energy processes represent a fraction of the energy generated by ordinary stars like the Sun, but they can dominate the output of supernova remnants, quasars and celestial systems containing neutron stars or black holes. They cannot be studied from the ground because the Earth's atmosphere blocks X-rays.

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): \$3.75 each.

AMC Theater (valid until May 1991): \$3.50 each.

Sea World (San Antonio, year long): adults, \$17.25, (2-day, \$21.95); children (3-11) \$14.75, (2-day, \$18.95).

Astroworld (valid 1990 season): season, \$39.95; regular, \$15.97; children, \$9.21; Waterworld, \$8.15; 2 day—AW/WW, \$18.47.

FBA Scholarship Applications (available in Bldg. 1, Rm. 840 and Bldg. 11 Exchange Store): membership is available to civil service employees.

JSC

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 and 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. No sign ups are taken by phone. Payment by exact change or check.

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

Defensive driving—Course is offered from 8 a.m.-5 p.m. July 21 and August 18; cost is \$15.

Weight safety—Required course for those wishing to use the Rec Center weight room. The next classes will be from 8-9:30 p.m. June 6 and June 21; cost is \$4.

Aerobics and exercise—Both classes are ongoing. Sign up at the Rec Center.

Country and Western dance—Lessons begin June 4. This course will be held every Monday for 6 weeks, cost is \$20 per couple.

Summer softball sign-ups—Sign-ups will be held the week of June 18 at the Rec Center.

Men's Open "C" Softball Tournament—The tournament will be June 30. The entry fee is \$95, limited to 16 teams, and is due June 28 by 6 p.m.

Ballroom Dance—Classes begin Aug. 2 and meet every Thursday for 8 weeks. Beginning and advanced classes meet 7-8:15 p.m. Intermediate class meets 8:15-9:30 p.m. Cost is \$60 per couple.

JSC

JSC

Dates & Data

Today

Cafeteria menu—Special: Salisbury steak. Entrees: baked scrod, one-quarter broiled chicken with peach half. Soup: seafood gumbo. Vegetables: cauliflower Au Gratin, mixed vegetables, buttered cabbage, whipped potatoes.

Monday

MPAD wake and reunion—The Mission Planning and Analysis Division (MPAD) plans a wake and reunion (W&R) for the now-defunct branch. All former civil service MPAD'ers are invited to the 4-8 p.m. June 15 event at the Gilruth Recreation Center Pavilion. Deadline for reservations is June 4. For more information, call Gloria Martinez at x38091.

Art exhibition—Mike Sanni will display oil paintings and pencil illustrations of selected manned and unmanned craft "up close" June 4-15 in the Bldg. 2 Visitor Center.

Cafeteria menu—Special: beef and macaroni. Entrees: ham steak, Parmesan steak. Soup: chicken and rice. Vegetables: green beans, carrots, Au Gratin potatoes.

Tuesday

Teleconference open house—The ISD Information Technology Division will host at open house in the JSC Video Teleconference Room June 5-7 in Bldg. 17, Rm. 2026. Thirty-minute sessions are scheduled at 10 and 10:30 a.m. June 5; 1, 1:30 and 2 p.m. June 6; and 1:30 and 2 p.m. June 7. Call Cheri Harrison or Gail Fortson at x32889 for more information.

Cafeteria menu—Special: Mexi-

can dinner. Entrees: potato baked chicken, barbecue spare ribs. Soup: tomato. Vegetables: squash, ranch beans, Spanish rice, broccoli.

Wednesday

Cafeteria menu—Special: baked meatloaf with Creole sauce. Entrees: baked scrod, liver and onions, ham steak. Soup: seafood gumbo. Vegetables: beets, Brussels sprouts, green beans, whipped potatoes.

Thursday

Cafeteria menu—Special: smothered steak with dressing. Entrees: chicken and dumplings, corned beef with cabbage. Soup: beef and barley. Vegetables: spinach, cabbage, cauliflower Au Gratin, parsley potatoes.

June 8

Technical society banquet—The Clear Lake Council of Technical Societies will hold an awards banquet at 6:30 p.m. June 8 in the Rec Center. For more information, call Andy Lindberg, x31474. For reservations call Marcia, x30195.

JSC Astronomical Society—The JSC Astronomical Society will receive "Reports from the Texas Star Party" at 7:30 p.m. June 8 at the Lunar and Planetary Institute. For more information, call Bill Williams at 339-1367.

Cafeteria menu—Special: tuna and salmon Croquette. Entrees: pork chop with yam rosette, Creole baked cod. Soup: seafood gumbo. Vegetables: Brussels sprouts, green beans, buttered corn, whipped potatoes.

June 15

Flashback to the Fifties—A

variety dance will be held from 7 p.m.-1 a.m., June 15, at the Rec Center. Tickets go on sale at 8 a.m. June 4 in at the Bldg. 11 Exchange Store and end June 13. For more information, contact Dick McMinimy, x34037.

June 20

ISMCR symposium—JSC's Automation and Robotics Division will host the first International Symposium on Measurement and Control in Robotics (ISMCR) June 20-22 at the Rec Center. The symposium is sponsored by the international organization, Imeko, and is expected to include representatives from 31 countries. Astronaut Story Musgrave will be keynote speaker. Sessions will run from 8 a.m.-5 p.m. daily, with the conference ending at noon June 22. For more information call Mary Stewart at x31724 or Dr. Zafar Taqvi at 333-6544.

June 26

BAPCO meeting—The Bay Area PC Organization will meet at 7:30 p.m. June 26 at the League City Bank & Trust. For more information call Earl Rubenstein, x34807, or Tom Kelly, 996-5019.

July 16

Spaceweek Banquet—Spaceweek will hold a national banquet at 6:30 p.m. July 16 at the South Shore Harbour Resort & Conference Center, Crystal Ballroom. Dr. Harrison Schmitt will serve as keynote speaker with an introduction by JSC Director Aaron Cohen. Contact Tanya Lyttle, 333-3627, for more information.

Swap Shop

Swap Shop ads are accepted from current and retired NASA civil service employees and on-site contractor employees. Each ad must be submitted on a separate full-sized, revised JSC Form 1452. Deadline is 5 p.m. every Friday, two weeks before the desired date of publication. Send ads to Roundup Swap Shop, Code AP3, or deliver them to the deposit box outside Rm. 147 in Bldg. 2.

Property

Sale: LC 3-2-2, well kept, lg. cul-de-sac., \$50K. Jim, 334-3069.

Rent: Crystal Beach, 2 BR, deck, \$325/wk. plus \$200 dep. (409) 755-1638.

Rent: 2 rooms in LC, \$250/mo. furn., \$225/mo. unfurn., bills split, non-smokers, pets tolerated. Russ, 332-4336.

Sale: El Lago 4-2-2, renov., assum. note, \$83,900. 532-4237.

Sale: '81 Broadmore mobile home on 80x120 lot, city wtr./sewer, stor. shed. 337-1365.

Sale: Fairmont Park East 3-2-2, near JSC, FPL, low \$70's. 470-0925.

Rent: 2-2.5-2 townhouse, new paint/carpet, FPL, all appli, \$775/mo. 488-2664.

Rent: 2-story townhouse, 2-2.5, W/D option, fan, miniblinds, new paint, near JSC, avail. late June, \$625/mo. plus dep. 488-8919.

Sale: Friendswood 3-2-2, Gunite pool, 2,000 sq. ft., new paint/carpet, fans, \$88,500. x34902 or 996-9128.

Sale: Rent property in Galv. duplex, 3 blks. from beach, ex. cond., renting for \$350 ea. side, \$52.9K nego. x36869 or 534-3554.

Sale: 2-110x130 lots, Friendswood Wilderness Trails. 996-9157.

Lease: Sagemeadow 4-2-2, FPL, formal dining, pvt. crtyd., avail. June 29, \$725/mo. plus dep. 480-0667.

Lease: BR in house, 20 min. from NASA, maid serv., most util. pd., furn./unfurn., \$270/\$295. Eric, x38420 or 484-9179.

Sale/Lease: CLC Baywind II condo, 2-2-2, new carpet/miniblinds/paint, FPL, wet bar, W/D, \$525/mo. 280-8796.

Sale/Lease: Heritage Pk. 3-2-2, 1,700 sq. ft., \$75K or \$700/mo. plus dep. x38074.

Sale: Bay house on Caranchua Bay near Palacios, furn., access to ramp/pier, \$40K. (409) 543-2052.

Lease: 4-2-2 in El Lago, near Taylor Lake, all appli., avail. May 1, \$800/mo., low util. 326-6811 or 488-8611.

Rent: Meadowgreen 4-2.5-2, approx. 2,319 sq. ft., cath. ceiling, drapes, fan, micro., FPL, \$1,150/mo. Simon, x30354 or 480-4160.

Lease: 1 BR condo, CLC, FPL, W/D conn., appli, micro., fans, avail. June 1. Jim Briley, 488-7901.

Rent: Galv. condo, sleeps 6, furn., wk./wknd. rates, cable. x33479 or 486-0788.

Sale: 60 acres, 3 mi. from Karnes City, 50 mi. from San Antonio; 2-story house on 1.5 lots w/many fruit trees in El Campo. 783-9164.

Sale: Dickinson 3-2-2, lg. LR, MB. x38078 or 534-2761.

Sale: Big Bend area, 160 acres, \$120/acre, CFD 15% down, 9% for 8 yrs. 337-4011.

Lease: CLC Camino So., 3-2, split BR plan, lg. den, \$600/mo., avail. June 15. Lyn or Don,

333-2359.

Sale: 3-2 mobile home, 24x60, wkshp., stor., all appli, \$39K, \$4K down. 332-3382 or 554-6624.

Rent: Lake Livingston wtrfrnt. house, 3-2, CA/H, furn., decks, ex. cond., wk./wknd. rates. 482-1582.

Lease: Friendswood/Forest Bend, 3-2-2, fan, refrig., new carpet, no pets, \$595/mo. 482-6609.

Sale: Waterview lots near NASA, mid \$30's. Don, x38039 or 333-3313.

Lease: Webs./Eilington, 2-1, \$395/mo. Dave, x38156 or 486-5181 or Herb, x38161.

Sale: lot, Dixie Hollow, Cyprus Hollow St., Pearland. x39530 or 482-5003.

Lease: Short term, 1 BR Nassau Bay apt, avail. thru June 30, rent nego., bills pd., possible ext. Susan, x32444 or 484-3570.

Lease: 1 BR Nassau Bay apt., 800 sq. ft., \$450/mo., bills pd., June discount. Susan, x32444 or 484-3570.

Cars & Trucks

'81 Olds Cutlass Cruiser wagon, ex. cond., \$1,795. David, 282-3827 or 554-5514.

'79 24' Nomad travel trlr., good cond., \$3,500. 334-1883.

'85 Chevy K-5 Blazer, 4x4, Silverado pkg., 59K mi., loaded, ex. cond., \$8,500. OBO. 333-7141.

'76 MG Midget, needs work, \$900. OBO. 474-2610.

'88 Volvo 740 turbo, warr., NADA book value. Phil, 282-3600.

'89 Ford Festiva, ex. cond., \$1K and take up pmts. of \$160/mo. Paula, x35230 or 337-1037.

'88 Hyundai GL, 4-dr. sedan, 5-spd., ex. cond., warr., BO. Becky, x31420 or 488-0556.

'85 Buick Electra Pk. Ave., 4-dr., all pwr., ex. cond., 66K mi., \$6,700. 482-1535.

'85 Corvette, auto., low mi., ex. cond., all pwr., \$14,000. 488-8493.

'73 Dodge Charger, V8, runs good, \$750, extra 360 V8, 727 trans. Mary, x38806 or 488-2271.

'79 Malibu Classic, needs eng. work, \$500. OBO. 482-8827.

'82 Porsche 924, ex. cond., 62K mi., 5-spd., \$7,250. OBO. 280-8796.

'83 Parting Out Honda Accord, 4-dr. w/1750cc eng., 5-spd., 554-3622.

'77 Corvette, good cond., all orig., sell or trade for PU, \$4,950. Bruce, 485-0396.

'78 Thunderbird, sun roof, good cond., \$1,000. OBO. Harry, x31700.

'35' Mallard motor home, loaded, low mi., \$36K. 337-4051.

'84 Honda Civic, DX, 3-dr. htchbk., ex. cond., \$3,500. x31894.

'82 Chev. Caprice, 4-dr., V6, eng. overhauled, needs paint, \$1,750. OBO. Richard, x33184 or 482-8230.

'80 Pontiac Sunbird, 2-dr. coupe, good cond., \$800. OBO. Tammy, 488-9020 or 534-2668.

'2-'78 Ford Broncos, 1 wrecked, the other not, \$2,500. Conrad, x39370 or 534-3071.

'80 GMC Van Rally STX, 8 passenger, loaded. x33656 or 486-8276.

'83 Olds Delta 88, 2-dr., all pwr., \$3,700. Tom,

x33051 or 331-5129.

'76 GMC Van, 400 eng., auto., \$1,800. Tom, x33051 or 331-5129.

Cycles

'78 Kawasaki LTD 1000, 7,500 orig. mi., \$975. 227-0929.

'82 650 Yamaha Heritage, good cond., \$500. Jim, 334-3069.

Schwinn World Sport, 25", \$150. 486-7623.

'85 Suzuki Madura 700cc, 3,500 mi. \$2,200. 538-1479.

'81 Suzuki 850cc motorcycle, vetter fairing/windscreens, foot rests/eng. protectors, ex. cond., \$1,400. Patrick, x32635 or 488-1079.

Boats & Planes

'78 22' MacGregor sailboat, 3 sails, 7.5hp OB trlr., \$4K. OBO. 332-7167.

'19' Flying Scot sailboat w/galv. trlr., spinaker, Seagull motor, \$3K. Phil, 282-3600.

'18' Hobie Cat, galv. trlr., sail box, \$1,650. x31226 or 534-3710.

'14' Jon boat, 7.5hp Johnson, \$475. x31226 or 534-3710.

'79 16' Renegade ski boat, 140hp Evin., SS prop., ex. cond., cust. trlr., \$3,500. OBO. 333-6868 or 486-7846.

'86 17' Thundercraft boat, 140hp, IB/OB, SS prop, trlr., 7-pass., ex. cond., \$6,450. OBO. 486-4963.

'19' Prindle Catamaran, race rigged, 1 dacron main, 2 jibs, trlr. w/sail box, \$5,500. Mike T., 333-6246 or 474-7217.

'15' classic wooden snipe, incl. trlr., \$4,550. OBO. 333-7345 or 474-2339.

Audiovisual & Computers

Home video theatre, Sansui ster. sys., RCA Colorpak 2000 TV, VHS ster. hi-fi VCR, Pioneer compact disk/laserdisc player, \$2,250. 333-7141.

Commodore 64, color monitor, disk drive, 300 baud modem, some SW, BO. 282-4271 or 996-9646.

Ster. Macintosh tube preamplifier/tuner w/cab., \$300. OBO. Ben, x32381.

Zenith computer, 20 MB, color monitor, mouse, printer, Borland Quattro spreadsheet, \$2,500. OBO. 474-2610.

VIC 20 commodore computer w/tape drive, \$75; Atari w/Combat, Basketball, Chess, Space Invaders, \$50. x36149 or 334-1303.

PC-AT, 80286 12.5 MHz EGA graphics, 3.5, 5.25 high den. floppies plus 40 meg fixed disk, 1 meg of RAM, \$1,250. x31367 or 996-1410.

Apple IIe ext. dual drives, Monochrome, Trinitron 15" Imagerwriter II, color printer, SW, desk, \$1,200. 337-5167.

Apple IIe, Amdek color monitor, Panasonic 1041 printer, joystick, desk, \$1,000. OBO. Matt, 332-8288.

Carver TX-11 FM ster. tuner, ex. recep. in difficult recep. areas, \$200. Leonard, 283-4150.

Apple IIC, 12" monitor, ext. drive, 300/1200 modem, mouse, SW, \$600. 538-1479.

Household

Dresser, chest of drwrs., \$200. Phil, 282-3600.

5-pc. dinette, mauve cushions, white table

top, ex. cond., \$150. Paula, x35230 or 337-1037.

DR table, glass top, brass base, 6 cane-backed chairs w/uphol. seats, ex. cond., \$200. OBO. Anne, x34493 or 996-1287.

BR, LR furn., 20 gal. aquar., sofaped, lawn mower (self propelled), 554-2525.

Sofa, loveseat, 9 mos. old, ex. cond., off white w/seafoam accents, \$400. x39166 or 486-3989.

Antique solid maple dresser w/bev. mirror, \$400. OBO. 283-5496 or 332-1614.

Antique mahogany leaded glass hutch w/ stor., 2 drwrs., ex. cond., \$400. 480-6446.

Musical Instruments

Ludwig drum set, base, snare, 3 toms, ex. cond., \$600; upright piano, oak, refin., ex. sound, needs minor repair and tuning, \$200. 488-7490 or x33335.

Antley clarinet, ex. cond., \$250. OBO. x31593 or 480-6292.

Lost & Found

Women's blue topaz and diamond ring, left in restroom in Bldg. 30, 3rd floor on May 7, 1990, approx. 2 ct. stone. x32889.

Photographic

Nikon cam. lens, new auto focus AF 50mm f1.8, \$45; Minolta 50mm 1.7 MD lens, new, \$35. OBO. 464-8694.

Pets & Livestock

Pure bred German Shephard pups, \$200, born, April 23. 946-5198.

Free 2 yr. old fem. cat, Mane Coon var., neutered. 282-4271 or 996-9646.

Baby cockatiels, hand feed or we will. Linda, 484-7834.

Kittens, born March 9, first shots, \$15/ea. Donna, 337-3838 or 283-5453.

Free, 2 Heinz 57 dogs, short, furry. 996-9729.

2 yr. old Golden Ret., regis., w/dog house, house broken, BO. John, x38023 or 554-2988.

Free German Shepherd pups. Toni Lewis, 474-5974.

4 kittens, bottlefed, box trained. Diane, 282-3615 or 337-6495.

Free kittens. x39530.

Wanted

Want cheap working ster. receiver. Ben, x32381.

Want adult 3-wheel cycle in good cond. Ruby, x38542 or 944-5944.

Want Space Camp prog. counselors for summer, flex. hrs. avail. 486-4446.

Want fem. Cocker w/AKC paper to breed w/male Cocker, pick of the litter. Tamela, x36159 or 472-6323.

Want to buy Banana/High Riser bikes and/or components. John, x35715 or 480-6574.

Want roommate to share home, comm. pool, garden, maid, furn. avail., most util. pd., short term or lease from \$270. Eric, x38420 or 484-9179.

Want toy trains and Starwars toys. Ron, 482-1385.

Extending Duration

Alterations will make *Columbia* first true Extended Duration Orbiter

By Kyle Herring

The Extended Duration Orbiter (EDO) program is quickly becoming a reality as the Space Shuttle *Columbia*'s major modification period, set for next May, gets closer.

Many changes are planned during the nearly six months that OV-102 will be at Rockwell International's Palmdale, Calif., manufacturing facility, but the orbiter will look the same from the outside once returned to Kennedy Space Center in November 1991.

Don't let the outside look fool you. The modified *Columbia* will be capable of flying shuttle missions of up to 16 days with two additional days built in for weather wave-offs.

Once back in an Orbiter Processing Facility at KSC, *Columbia* will begin the normal pre-flight processing for the U.S. Microgravity Laboratory-1 (USML-1) mission—the longest shuttle mission to date and the first true EDO flight.

Interest in EDO missions was rekindled when the space science and applications community expressed a desire for more quality time in space with experiments.

"The customers' need for 10 days on orbit (in addition to the two days of adapting to zero-G after launch and two days preparing to come home) began generating renewed interest in flying longer shuttle missions," said Dwayne Weary, deputy manager of the Orbiter Engineering Office. "That renewed interest and some initial 'seed' money in 1988 to get started is when we got our real direction to go off and provide the capability."

The first step was to define actual requirements for the project, Weary said.

"We asked ourselves, what do you have to change?" he said. "We realized we would have to provide power for a longer period of time. We would have to provide an environmental control system that would support the crew for extra days and find some way to provide added storage and handle the waste."

Once the requirements and program costs were defined, the work could begin. The major addition to the orbiter for extended capability is additional cryogenics to feed the fuel cells that generate electrical power to the orbiter. *Columbia* presently is equipped with five "cryo sets" of liquid hydrogen and oxygen tanks. Each set provides about two days of electricity to the vehicle using an average of 18 kilowatts power.

A pallet designed by Rockwell and mounted at the rear of the orbiter's payload bay has the capability of carrying an additional four sets. A series of plumbing lines joins the honeycomb-shaped pallet, which weighs about 6,450 pounds loaded, with the other tanks.

"It's plumbed into the current system so it is essentially an extension of the current cryogenic storage system," Weary said.

The four new tank sets "provide the extra power capability for the 16 plus two days of contingency at roughly 19 kilowatts of average power," he said.

Improving the process of storing solid waste also will be necessary for longer flights due to the storage limitations of the current Waste Containment System (WCS), or space toilet.

"The current WCS has to be removed after each flight for cleaning," said David Saucier, EDO project engineer. "It has a limited capability and won't hold the waste of seven crew members for 16 days."

The improved potty, he said, collects the waste in bags that are then compacted into a storage tube. When the tube is full, a charcoal filter along with odor and bacteria filters are placed on top. The tube is stored in a locker and another tube is placed in the WCS.

"When we get home, we don't have to take out the potty and clean it up," Saucier said. "We only have to take out the tube and dispose of it."

EDO missions also will require an alternative to the lithium hydroxide (LiOH) canisters currently used to remove carbon dioxide (CO₂) from the cabin's air. Now, about two of the canisters are changed each day to provide adequate CO₂ removal. But for longer missions, the extensive stowage required for LiOH canisters would be prohibitive so a carbon dioxide removal system has been developed, Weary said.

The new system is mounted in the orbiter's nose in front of avionics lockers on the middeck. The unit, called a regenerative CO₂ removal system (RCRS), weighs about 325 pounds and works along the same principles as one used during the Skylab program.

In the RCRS, cabin air passes through one of two "beds" of the unit while the other bed is exposed to the space vacuum using a series of valves. The heat generated by the absorption of CO₂ collection in the active bed heats the other bed and drives the CO₂ into space. A foamed aluminum matrix assists the heat transfer. Using the valve system, CO₂ passes through each bed every 15 minutes.

The unit also has the ability to recover some of the nitrogen for reuse. Weary said that this feature "adds some frosting on the cake by minimizing another EDO requirement—additional nitrogen."

To support the need for more nitrogen for longer missions, two additional nitrogen tanks will be placed against *Columbia*'s aft bulkhead under the payload bay.

The extra nitrogen also expands the use of the shuttle for missions other than EDO. It could provide the capability for more space walks if needed or for medical experiments that increase nitrogen usage, like the lower body negative pressure (LBNP) experiment flown on STS-32 in January 1990.

Finding the space for more crew provisions and stowage took some ingenuity.

"We looked at all the nooks and crannies that we could use for stowage," Weary said.

They added lockers behind the sleep station area, temporary storage provisions on the sleep station itself, and repackaged some items to use existing locker space more efficiently.

The need for additional trash stowage also drove the development of a trash compactor. Plans call for reducing the trash volume by about four times by the time of the USML-1 mission.

That flight is scheduled to last 13 days in March 1992, and will provide added time in space for research in a Spacelab environment.

It also will demonstrate the orbiter's capability to support increasingly longer missions from a crew and hardware standpoint.

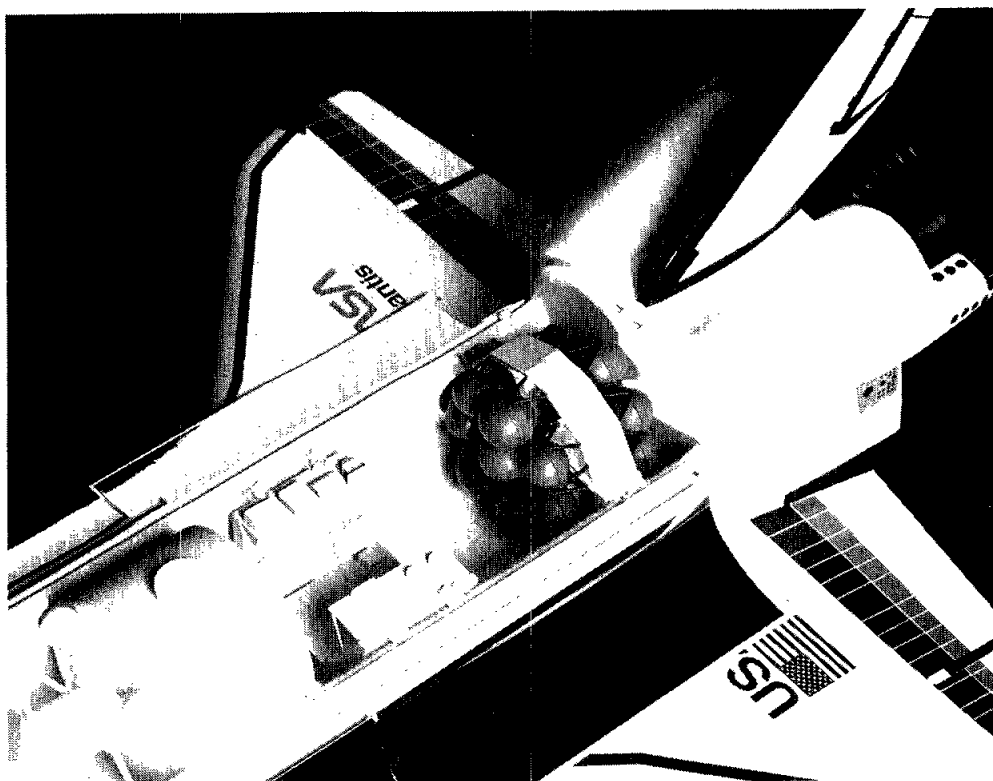
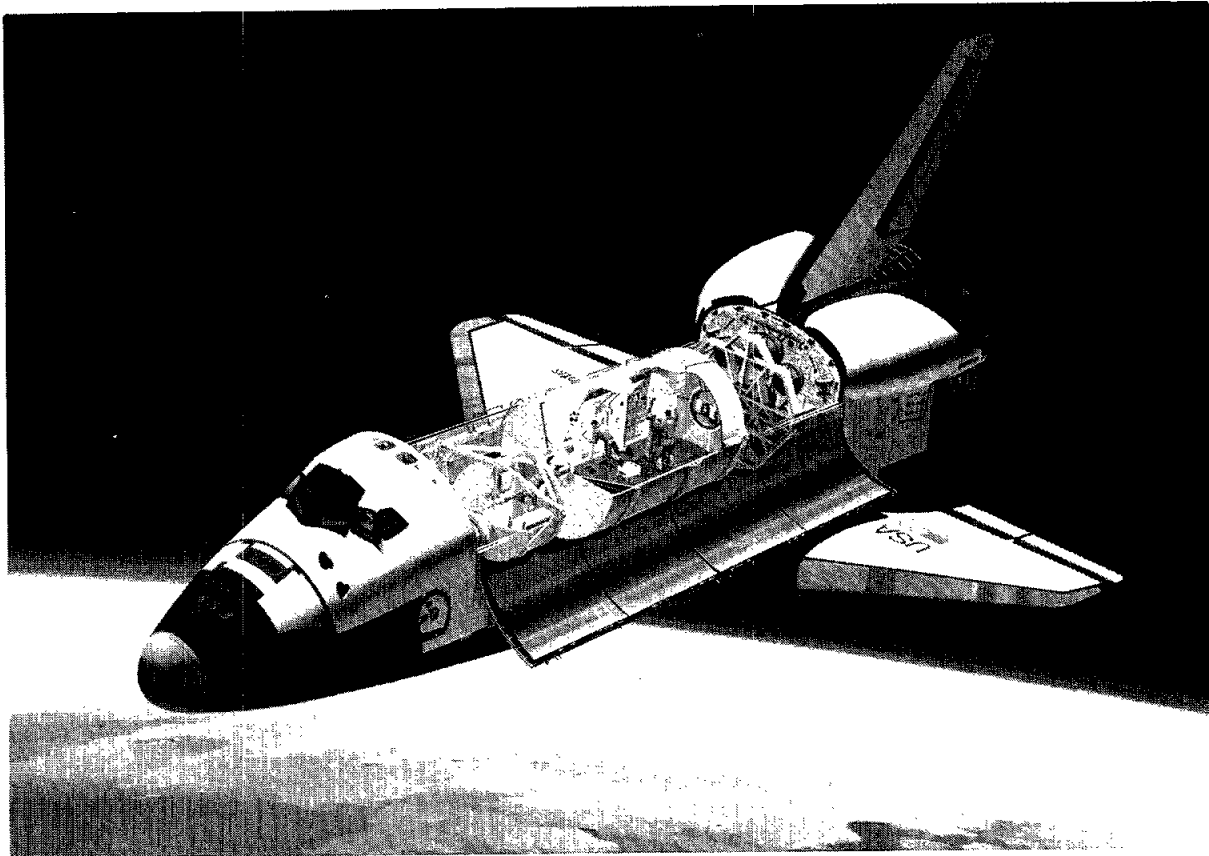
Adapting the crew to Earth's gravity following longer space missions is an important factor in extending the orbiters' capabilities.

This critical need led to an EDO medical program designed to maintain crew health, safety and performance. The program focuses on developing and verifying procedures and countermeasures to ensure the crew can land the vehicle safely and can exit unaided in an emergency.

Through a series of medical flight experiments (detailed supplementary objectives or DSOs), the NASA life sciences community is developing an information base to further prove that crews can support longer duration flights.

With this in mind, several intermediate duration missions have been baselined to expand that database between now and USML-1.

STS-32 in January was the first shuttle mission to begin answering some of the medical questions related to crew adaptation following longer space missions. When poor weather conditions delayed landing by one day, STS-32 became the longest shuttle mission, lasting almost 11 days. It showed that the crew was fully capable of controlling the vehicle during reentry and landing.



Medical DSOs are not the only EDO experiments flying aboard the shuttle. A prototype trash compactor and experimental potty are on *Columbia* during STS-35 for the first time.

"The flight experiments we are flying on *Columbia* are going to be our first real tests of EDO-type hardware," Weary said, prior to the STS-35 launch. "These are prototypes of the hardware and don't look exactly like what we'll fly on EDO missions, but the physics are the same."

Even with the 16-day cryo pallet, "when you get right down to it, it is still the fuel that limits our time on orbit," Weary said. "Studies have shown that only fairly simple, low-risk changes are required to double the stay time on orbit. It's a relatively simple thing to do."

"All the systems are basically qualified for 28 days," he said. "In fact, we designed the 16-day cryo pallet so it can be modified to carry tanks on both sides and give us 28-day capability."

All of the other EDO systems developed for the 16-day orbiter could be upgraded to 28 days if needed.

Currently there are no requirements for a 28-day mission, but Weary said that since the new orbiter *Endeavour* is in an appropriate manufacturing stage, managers decided to "scar" the vehicle for later upgrade to an EDO orbiter. With the necessary wiring and plumbing modifications already in the new orbiter, he said, "we can convert it easily if the need arises for a second 16-day vehicle or later a 28-day vehicle."

"*Columbia* cannot fly missions longer than 16 days because it is the heaviest of the orbiters, making it incapable from a performance standpoint of carrying the extra weight of the second half of the pallet," Saucier said. "If we are to ever have a 28-day vehicle, it will have to be *Endeavour*."

Development of the cryo pallet carries another unique distinction—it represents the first commercialization agreement of any kind related to the orbiters.

The arrangement calls for Rockwell to put up the initial money to build the flight pallet and a test pallet that could later be upgraded to flight status for about \$53 million. After delivery of the pallets, NASA will pay Rockwell back in three equal annual installments, not including any finance charges.

The finance charge becomes Rockwell's investment in the EDO program and the pallet. Rockwell collects a fixed dollar amount from non-government customers for each day on orbit beyond the ninth day. The agreement provides Rockwell a chance not only to recover its cost, but eventually to make a profit.

"Commercialization won't change NASA's total commitment," Weary said, "it will just rephase our money allocation."

The commercialization plan has received tentative approval and is in the final negotiation stage.

Top: An artist's concept drawing shows a space shuttle using a 16-day cryogenics pallet. The pallet contains storage for liquid hydrogen and liquid oxygen, which feed the shuttle's fuel cells to produce electricity. The added consumables will help make possible longer missions with pressurized Spacelab modules. **Left:** A close-up of a model shows how two pallets could be loaded back-to-back to provide a 28-day mission capability. Each pallet contains four "cryo sets," or pairs of liquid hydrogen and oxygen tanks.

NASA Illustrations

Lusk new Cargo Engineering deputy

Marion M. Lusk has been assigned as deputy manager of the Cargo Engineering Office within the Space Shuttle Integration and Operations Office.

Lusk, who also will serve as the Engineering Products Office's acting manager, began his career at JSC in 1962. As deputy manager of the Cargo Engineering Office, Lusk will be responsible for all aspects of payload and cargo integration engineering.

He worked as a preliminary design engineer and participated in spacecraft design study programs in the Apollo era. Since then he has worked

in the Spacecraft Test Branch of the Structures and Mechanics Division, as a test manager of spacecraft testing in JSC's Space Environment

JSC

People

Simulation Laboratory, and as a technical manager for the development of cargo manifest engineering which deals with accommodating payloads within the orbiters.

He most recently was acting

manager of the recently established Engineering Assurance Office and, since March 1988, manager of the Engineering Products Office.

Armendariz receives ABWA's Abby Award

Lupita Armendariz, JSC's Hispanic Employment Program manager, recently received the coveted Abby Award from the Clear Lake Chapter of the American Business Women's Association.

The award is designed to recognize an individual who has done the

most to advance women in their careers by helping or setting a personal example. It was presented at the annual Career Night Abby Award Dinner on May 1.



Lusk



Armendariz



Patrick

Patrick top secretary

Annie M. Patrick, secretary to the chief of the Engineering Directorate's Avionics Systems Division, received the Marilyn J. Bocking Award for

Secretarial Excellence in May.

Considered a key member of the division staff, she is responsible for a long list of duties including typing, filing, screening calls and receiving visitors.

She received a plaque from JSC Director Aaron Cohen and a \$500 stipend for her exemplary work.

AIAA, IEEE JSC sections earn honors

Two JSC affiliated professional organizations recently received honors for their past year's activities.

The Houston section of the American Institute of Aeronautics and Astronautics (AIAA) was awarded the Outstanding Section Award and the Section Special Event Award at the AIAA annual meeting in Washington D.C. Each of the two honors won the section \$350 cash awards.

Walter J. Lueke, of JSC's Structures and Mechanics Division and the 1988-89 section chairman, and Ava Lunsford of Bendix received individual honors for their contributions to Apollo 20th Anniversary observance activities, which led to the national awards.

R. Scott Satterwhite of IBM was recognized for producing the special AIAA Apollo 20th Anniversary booklet titled "Spirit of Apollo."

The Galveston Bay Section of the Institute of Electrical and Electronics Engineers Inc. (IEEE) was honored at regional festivities.

The Galveston Bay Section was named Most Outstanding Section of Region 5 for the third consecutive year.



SOVIET IN A SUIT—Soviet Cosmonaut Aleksandr Alexandrovich Serebrov dons a NASA space suit as Astronaut Jerry Ross holds the helmet during a recent visit to JSC's Bldg. 7. Serebrov remarked that the wrist joints on the U.S. suit will turn, something the Soviet suit won't do.

Television series looks at developing management careers

During the month of June, JSC and the National Technological University (NTU) will offer a series of seminars via satellite intended to assist managers in developing their own career and professional growth for the next decade.

The seminars, "Engineering Your Future—For Technical Managers" are part of the Technical Professional Development Series and will be broadcast on NASA Select each Monday from 10 a.m.-noon (check the channel guide on the morning of each program for the exact channel).

Those who do not have a television monitor nearby may reserve a seat in Bldg. 45, Rm. 203 by calling Sheryl Gates, x33074. Additional information can be obtained by calling Stacy Jackson at x31999.

The basic program schedule includes:

- June 4—"A Blueprint for Career

Success: Characteristics of Successful Managers." Skills and behaviors of successful managers will be examined and personal profiles will illustrate career choices.

- June 11—"Matching Skills with Opportunities: Assessing Your Options." Techniques for evaluating career alternatives will be taught.

- June 18—"Charting Your Course: Making Decisions that Work for You." Discussions on defining success in terms that are personally meaningful and setting powerful goals will be presented.

- June 25—"Overcoming Obstacles: Career Issues for You and Your Employees." Skills needed within organizations to manage careers will be assessed, and tools will be provided to help managers and employees succeed in a commitment to career growth.

NTU is a consortium of 30 member universities around the country.

Advanced solid rocket facilities to be built

NASA has awarded an approximately 3-1/2-year contract to Lockheed Missiles and Space Co., Sunnyvale, Calif., for design and construction of facilities to produce and test the next-generation space shuttle solid rocket motor.

The new shuttle motor, designated the Advanced Solid Rocket Motor (ASRM), will replace the shuttle's current booster motors in the mid-1990s.

The contract, awarded May 25 by Marshall Space Flight Center, is a companion to one awarded to Lockheed on May 11, covering design, development, test and evaluation of the new rocket motor. Lockheed is subcontracting the ASRM facilities work to RUST International, Birmingham, Ala. Design and plant operation subcontractor is the ASRM Division of Aerojet.

The facilities contract is valued at \$550 million, with approximately \$314

million of that designated for design and construction of new buildings or modification of existing structures, and approximately \$236 million for purchase and installation of tooling and equipment.

The manufacturing facilities will be built principally at Yellow Creek, a government-owned site near luka in extreme northeastern Mississippi. In addition, a static motor test-firing stand will be added at NASA's Stennis Space

Center; nozzle production capability will be added at the NASA Michoud Assembly Facility; and test installations at Marshall will be expanded.

The construction effort will employ a peak work force of approximately 1,000 to 1,500 people. More than 60 buildings at Yellow Creek, Stennis and Michoud will be constructed, refurbished or expanded, with Yellow Creek being the site of most of this activity.

JSC employees are among new PSI officers

Six JSC employees are among the officers recently elected by the Clear Lake/NASA Area Chapter of Professional Secretaries International (PSI) for the 1990-91 year.

Diana R. Peterson of JSC's Space and Life Sciences Directorate, was elected secretary.

Committee chairs from JSC include Cynthia Thomasen of the Public Affairs Office, arrangements; Elaine Kemp, Flight Crew Operations Directorate, bulletin; Estela Gillette, Human Resources Office, program; and Peterson, scrapbook. Pat Woolcock of Chevron USA will chair the membership committee, and Geneva Escamilla of Houston Lighting and Power will head the publicity committee.

Tobie A. Williams of Mitre Corp., was elected president; Sheila F. Alban, also of Mitre, was elected vice president; and Bernice Woolsey, of Blackburn Marine, was chosen as treasurer.

National Aero-Space Plane contractor team chosen

The Department of Defense and NASA have established a national team of contractors to continue the challenging research and development of the National Aero-Space Plane (NASP).

With the engineering and technology bases available from Rockwell International, McDonnell Douglas, Pratt and Whitney, General Dynam-

ics and Rocketdyne, the federal government expects to benefit from the collaboration of ideas from these five organizations.

The presidentially directed joint DOD/NASA program objective is to develop and demonstrate hypersonic technologies with the ultimate goal of a single-stage-to-orbit NASP vehicle. The vehicle would be cap-

able of horizontal takeoff and landing and long-range, hypersonic flight within the atmosphere.

With the national contractor team, DOD and NASA take a unique first step in formulating a single team of contractors working together to develop technologies for future hypersonic aircraft. The team will conduct the design and development

activities necessary to proceed with the X-30 research aircraft and develop a competitive technology base for future systems.

The government anticipates that with breakthroughs in technology from efforts such as NASP, the United States will continue to maintain its world leadership position in aerospace technology.

Crews named for 1991 flights

(Continued from Page 1)

STS-9 (Spacelab-1). Duffy, 36, Foale, 33, and Lampton, 49, will make their first space flights.

Air Force Col. John E. Blaha will command the five-day STS-43 TDRS-E mission. Serving as pilot aboard Discovery will be Navy Lt. Cmdr. Michael A. Baker. Mission specialists will be Dr. Shannon W. Lucid, Ph.D., G. David Low, and Army Lt. Col. James C. Adamson.

Blaha, 47, has flown twice previously as pilot on STS-29 and STS-33. Lucid, 47, will make her third flight, having flown as mission specialist on STS-51G and STS-34. Low, 34, making his second shuttle flight, served as mission specialist on STS-32. Adamson, 44, has flown previously as mission specialist on STS-28. Baker, 36, will make his first space flight.

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.

Swap Shop deadline is every Friday, two weeks before the desired date of publication.

Editor Kelly Humphries
Associate Editors . . Pam Alloway
Kari Fluegel

Columbia still on pad due to leak

(Continued from Page 1)

Jeff Hoffman and Robert Parker. Ron Parise and Sam Durrance will be payload specialists.

After launch, the crew will activate the ultraviolet astronomy (ASTRO) telescope package along with the BBXRT.

Middeck payloads include the Air Force Maui Optical Site Calibration Tests (AMOS), and the Shuttle Amateur Radio Experiment (SAREX).

During the 9- to 10-day flight, the crew also will participate in numerous Development Test Objectives and Detailed Supplementary Objectives.

Outreach will study new approaches

(Continued from Page 1)

that can provide the highest leverage, such as universities, professional societies, associations and others. It also will include an announcement in Commerce Business Daily, which reaches aerospace and non-aerospace industries and others.

The Rand Corporation will conduct an initial screening and assessment of submissions and report to an external Synthesis Group composed of government and non-government individuals. This group also will

receive inputs from the Department of Defense, the Department of Energy and other organizations. The results will be made available to the National Research Council for review.

The AIAA study already is under way. Its purpose is to solicit and assess innovative approaches to SEI from AIAA's 40,000-person membership and technical working groups. Reports will be coordinated at an AIAA conference and workshop in September.

NASA-JSC

Correction

Due to a printing error, the two photographs used to illustrate the improved imaging that is being received from the Hubble Space Telescope were transposed in the May 25 issue of Space News Roundup.

As they appeared in the Roundup, the photo on the left was taken by the HST Wide Field/Planetary Camera and the image on the right was taken through a telescope at the Las Campanas Observatory in Chile.

In addition, the story accompanying the photos was in error when it stated that an arc second is 0.36 of a degree. An arc second is one thirty-six hundredth, or .00028, of a degree.