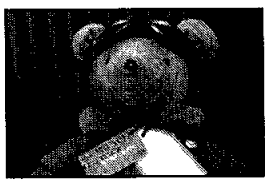
National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, Texas

JSC retrospective

The third of four excerpts from *Suddenly Came Tomorrow...* continues to chronicle JSC's past. Story on Page 3.



Bears hoping

This bear hopes to fly as an education specialist on a future Spacehab mission. Story on Page 4.

Space News Roundup

Vol. 33 | February 18, 1994 | No. 7

JSC Photo by Robert Markowitz

Sergei Krikalev, the first Russian cosmonaut to fly on an American spacecraft, prepares to sign an autograph following the crew welcome home ceremony Saturday at Ellington Field.

Crew returns from history-making flight

By Eileen Hawley

The STS-60 crew returned home to a crowd of well-wishers at Ellington Field Saturday following its eight-day mission in space.

Weather forced the orbiter to wave-off the first landing opportunity at Kennedy Space Center and continued poor weather delayed the crew return until Saturday morning. The crew—Commander Charlie Bolden, Pilot Ken Reightler, and Mission Specialists Frankin Chang-Diaz, Jan Davis, Ron Sega and Sergei Krikalev—was met by an enthusiastic crowd including friends, family, and a Russian delegation to welcome home Krikalev, the first cosmonaut to fly on an American spacecraft.

Center Director Dr. Carolyn Huntoon welcomed the crew back to Houston along with a number of dignitaries who were on hand to mark the occasion, including Yuri Koptev, general director of the Russian Space Agency, NASA Administrator Daniel S. Goldin, and U.S. Rep. Nick Smith, from the seventh congressional district in Michigan.

In brief comments, Koptev congratulated the crew for its successful mission and said he shared their feelings of "joy and accomplishment and the feelings of their families as well as they return back to Earth safely." Goldin also congratulated the crew on a successful flight and joked that Bolden's landing in Florida deserved a score of 3.999 in the "shuttle olympics."

An emotional Bolden introduced his crew acknowledging the hard work and efforts of each while in

Please see **CREW**, Page 4

Columbia's crew in final stretch for STS-62 launch

By James Hartsfield

With *Discovery*'s luggage not yet unpacked, *Columbia* and crew entered the final stretch of launch preparations this week with a practice countdown at the launch pad.

The STS-62 crew—Commander John Casper, Pilot Andy Allen and Mission Specialists Pierre Thuot, Sam Gemar and Marsha Ivins—was to finish the dress rehearsal countdown Thursday at Kennedy Space Center.

During the weekend, technicians will begin fueling *Columbia* with the hypergolic propellants, propellants that ignite on contact with one another, that are used in its orbital thrusters. This week, the electrical and hydraulic systems of the main engines were tested, the shuttle's hydraulic circulation was checked out and the steering jets were cleaned by flushing them with water.

Columbia's cargoes—the United States Microgravity Package 2 and the Office of Aeronautics and Space Technology 2—were loaded onboard during the weekend.

Elsewhere, preparations are going smoothly on *Endeavour* for shuttle mission STS-59 to launch in early April. Work in the Bay 1 hangar at KSC this week included cleaning of the cargo bay, inspections of the windows and cleaning the steering jets. During the weekend, the Space Radar Laboratory-1 is scheduled to be installed.

Realignment continues center reorganization

In a center-wide announcement earlier this month, Center Director Dr. Carolyn Huntoon announced the abolishment of the New Initiatives Office as part of a series of moves designed to more effectively support the challenges JSC will face in the future.

That reorganization currently is under way with a number of employees and organizations being reassigned to other JSC directorates.

Effective Feb. 25, William Huffstetler will retire and his deputy, Humboldt Mandell will return to the Administration Directorate. Other NIO employees on the director's staff will be reassigned to the Engineering Directorate.

Employees of the Strategy and Planning Office also will move to the Administration Directorate where its continuing functions will be combined with the Management Analysis Office. Lyn Gordon-Winkler has been named chief of the combined organization and Wanda Thrower will be her deputy.

Members of the Special Projects Office are being reassigned to the Space and Life Sciences Directorate, as are members of the Commercial Middeck Augmentation Module Project Office. The CMAM project office staff will remain intact and become part of the Science Payloads Management Office within Space and Life Sciences.

The majority of employees within the Planetary Projects Office, Technology and Commercial Projects Office and Human Transportation Projects Office will be reassigned to the Engineering Directorate, reporting initially to the manager of the Technology Office.

As roles evolve further, additional reassignments within the engineering directorate will be made. A small number of employees from the planetary probes office will

Please see **NIO**, Page 4

Series of probes to explore Mars

NASA will continue its efforts to explore Mars with a new strategy calling for development of a small orbiter to be launched in November 1996 to study the surface of the red planet.

The Mars Surveyor orbiter will lay the foundation for a series of missions to Mars in a decade-long program of exploration. The missions will take advantage of launch opportunities about every two years as Mars comes into alignment with Earth.

The orbiter will be small enough to be launched on a Delta expendable launch vehicle and will carry roughly half of the science payload that flew on Mars Observer, which was lost last year. The specific instruments will be selected later.

NASA's Jet Propulsion Laboratory will issue a request for proposals to industry in mid-March to solicit potential spacecraft designs with selection of a contractor to build the spacecraft anticipated in July.

The project envisions an orbiter/lander pair of spacecraft as the next in this series of robotic missions to Mars. The orbiter planned for launch in 1998 would be even smaller than the initial Mars Surveyor orbiter and carry the remainder of the Mars Observer science instruments. It would act as a communications relay satellite for a companion lander, launched the same year, and other landers in the future, such as the Russian Mars '96 lander. The U.S. Pathfinder lander, set to land on Mars in 1997, will operate independently of the Mars orbiter.

JPL will manage mission design and spacecraft operations of the Mars Surveyor for NASA's Office of Space Science, Washington, D.C.

Robot holds the future in its grasp

By Barbara Schwartz

Demonstrating that science is catching up to science fiction, a robotic arm using its own vision-guided intelligent system grasped a freely moving ball aboard the KC-135 reduced gravity aircraft Feb. 10, 1994. The Extravehicular Activity Helper/Retriever robotic system tests are the first to prove that autonomous robots can use computer vision to guide robotic manipulation and grasp of moving objects in microgravity.

"The significance of this successful achievement is that it is a major step towards intelligent robots that can perceive and respond to unstructured environments at the pace imposed by their environments while applying knowledge and skills to accomplish stated goals," said Jon Erickson chief scientist of the Automation and Robotics Division.

A team of JSC engineers and support service contractors led by project manager Keith Grimm of the Robotic Intelligence Section has been working on the system for about a year and a half at a cost of less than $1 million. Grimm said it was worth the "roller coaster" ride on the KC-135 to obtain the better-than-anticipated results.

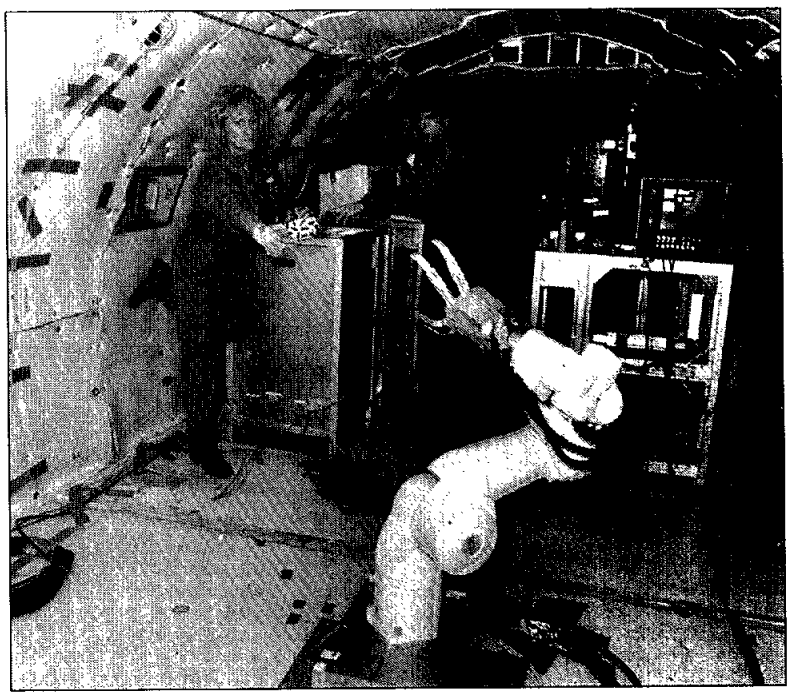
The robot arm and dextrous hand with its three active and two passive fingers caught the freely-moving four-inch ball seven times in a number of tries during the brief periods of microgravity induced on the aircraft.

The EVA Helper/Retriever's vision system is a commercial real-time stereo camera pair on a pan and tilt unit and a computer processor. The system continuously determines an object's position and velocity and feeds the measurements to the controls that direct the movements of the 7-degrees-of-freedom arm and its hand. The hand has a force-limited adaptive grasp that is able to catch the object without damaging or dropping it.

The commercial manipulator equipment was adapted to increase its speed. The hand was custom designed and built at JSC. Almost all of the computer software for autonomous operation of the system was designed, implemented, and tested at JSC. Grimm hopes that the proof-of-concept leads to continued development of more complex systems and testing on a future shuttle flight.

"The robotics that we are working on are in the spirit of human and robot teams working together. This is not robots in place of humans. This is robots augmenting humans, making it easier for them to do the things they need to do," Erickson said.

Erickson added that this work is a good example of dual-use technology. The robotics systems being developed for use in space can easily be adapted by industry to benefit the public.



The Extravehicular Activity Helper/Retriever undergoes testing on board NASA's KC-135 aircraft. The prototype robot shows potential for space station and other space applications.

JSC

Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Store from 10 a.m.-2 p.m. Monday-Thursday and 9 a.m.-3 p.m. Friday. For more information, call x35350 or x30990.

Mardi Gras dance — Tickets are on sale for the Mardi Gras dinner and dance to be held from 7 p.m.-midnight Feb. 26. Cost is $15 per person.

Moody Gardens — Discount tickets for two of three different attractions: $9

Entertainment '94 Coupon Books — Bay Area/Galveston/Downtown or FM 1960/Downtown: $30 each, $1 off first book for civil servants. Gold C Books: $8

Space Center Houston — Discount tickets: adult, $7.50; child (3-11), $4.50; commemorative, $9.95.

Metro tickets — Passes, books and single tickets available.

Movie discounts — General Cinema, $4.50; AMC Theater, $3.75; Loew's Theater, $4.

Stamps: Book of 20, $5.80.

JSC

Gilruth Center News

Sign up policy — All classes and athletic activities are first come, first served. Sign up in person at the Gilruth Center and show a NASA badge or yellow EAA dependent badge. Classes tend to fill up two weeks in advance. Payment must be made in full, in exact change or by check, at the time of registration. No registration will be taken by telephone. For more information, call x30304.

EAA badges — Dependents and spouses may apply for photo identification badges from 6:30-9 p.m. Monday-Friday; 9-11 a.m., 1-3 p.m. and 6:30-9 p.m. Wednesdays; and 8 a.m.-4 p.m. Saturdays. Dependents must be between 16 and 23 years old.

Weight safety — Required course for employees wishing to use the weight room is offered from 8-9:30 p.m. Feb. 24. Pre-registration is required. Cost is $5.

Defensive driving — Course is offered from 8:15 a.m.-3 p.m. Saturday. Next class is March 5. Cost is $19.

Self-defense workshop — Free self-defense workshop is offered from 5-6 p.m. March 16.

Aerobics — High/low-impact class meets from 5:15-6:15 p.m. Tuesdays and Thursdays. Cost is $32 for eight weeks.

Exercise — Low-impact class meets from 5:15-6:15 p.m. Mondays and Wednesdays. Cost is $24 for eight weeks.

Aikido — Martial arts class meets from 5-7:30 p.m. Tuesdays and 6:15-8:15 p.m. Wednesdays. Black Belt class from 6-8 p.m. Fridays, requires instructor permission. Cost is $25 per month.

Spring softball — Sign up for Mixed C recreational league March 1. Men's C registration is March 2; Men's B and Mixed B on March 3; and Men's A and Men's Over 40 on March 4. Non-badged teams for all leagues will be able to sign up only after 4:30 p.m. March 4.

Softball tournament — Men's Open C pre-season softball tournament will be held March 26-27. Registration deadline is 7 p.m. March 24. Cost is $100.

Stamp club — JSC Stamp Club will meet from 7-9 p.m. every other Monday. For more information, call Dianne Kerkhove at 554-2764

Fitness program — Health Related Fitness Program includes a medical examination screening and a 12-week individually prescribed exercise program. For more information, call Larry Weir at x30301.

JSC

Dates & Data

Today

Cafeteria menu — Special: baked chicken. Total Health: roast beef au jus. Entrees: deviled crab, Creole baked cod, baked chicken, beef cannelloni, Reuben sandwich. Soup: seafood gumbo. Vegetables: seasoned carrots, peas, breaded okra, steamed cauliflower.

Sunday

Open house — The University of Houston-Clear Lake will host a graduate studies open house from 1-4 p.m. in the Bayou Bldg. For additional information, call 283-2516 or 283-2508.

Monday

Presidents Day — Most JSC offices will be closed in observance of the Presidents Day Holiday.

Tuesday

Parenting series — A lunch time Brown Bag video "On the Move" will be shown at 11:30 a.m. Feb. 22 in Bldg. 45, Rm. 551. For additional information, call ext. 34734.

Blood drive — Martin Marietta will host a blood drive from 8-11 a.m. Feb. 22 at 1050 Bay Area Blvd. For additional information, contact Eddie Rangel at 280-2582.

Cafeteria menu — Special: turkey and dressing. Total Health: roast turkey. Entrees: baked meatloaf, barbecue spare ribs, liver and onions, baked chicken, French dip sandwich. Soup: black bean and rice. Vegetables: steamed broccoli, California vegetables, breaded squash, savory dressing.

Wednesday

Toastmasters meets — Spaceland Toastmasters Club meets at 7 a.m. Feb. 23 at the House of Prayer Lutheran Church. For additional information, contact Dale Denais at x30432 or Steve Shields at x31941.

Cafeteria menu — Special: Mexican dinner. Total Health: ground turkey tacos. Entrees: Parmesan steak, beef cannelloni, catfish and hush puppies, steamed fish, Reuben sandwich. Soup: seafood gumbo. Vegetables: peas and carrots, ranch beans, mustard greens, Spanish rice.

Thursday

AIAA meets — The Houston section of the American Institute of Aeronautics and Astronautics will meet at 5:30 p.m. Feb. 24 at the Gilruth Center. Douglas Stone, Space Station Vehicle Integrated Product Team Manger for Boeing will be the featured speaker. Reservations deadline is noon today. For additional information, contact Frankie Hap, 333-6064; Ardell Broussard, 283-1040; Mary Ann Bivona, 483-1350; or Sara Leggio, 282-3160.

NCMA workshop — The Space City Houston Chapter of the National Contracts Management Association will sponsor a free workshop on contract terminations beginning at 8:15 a.m. at McDonnell Douglas Tower II. For registration or other information, contact Keith Blevins, 280-5950; or Garry Fender, 244-7689.

AFCEA meets — The Houston Space Chapter meeting of the Armed Forces Communications and Electronics Association will meet at 11:30 a.m. Feb. 24 at the Holiday Inn, NASA Road 1. John Garman, deputy director of information systems will talk about "Restructuring the Management of Information Technology." For reservations, contact Linda Hinton at 282-7682.

Russian speakers — Practice Russian language skills from 11 a.m.-1 p.m. Feb. 24 in the Bldg. 3 cafeteria. For more information, call Jack Bacon, x38725, or Amy Mendez, x38066.

Blood drive — Lockheed will host a blood drive from 8-11:30 a.m. and 1-3:30 p.m. Feb. 24 at Lockheed Plaza I, second floor conference room. For additional information, contact Joe Victor at 483-4791.

Cafeteria menu — Special: smothered steak. Total Health: steamed pollock. Entrees: chicken and dumplings, corned beef and cabbage, broccoli cheese quiche, steamed fish, French dip sandwich. Soup: navy bean soup. Vegetables: steamed cabbage, cauliflower au gratin, buttered carrots, lima beans.

Friday

Cafeteria menu — Special: baked meatloaf. Total Health: lite macaroni and cheese. Entrees: baked scrod with Hollandaise, broiled chicken, pork and beef egg rolls, steamed fish, Reuben sandwich. Soup: seafood gumbo. Vegetables: stewed tomatoes, seasoned spinach, cut corn, macaroni and cheese.

Feb. 26

Astronomy seminar — The JSC Astronomy Seminar will meet at noon Feb. 23 in Bldg. 31, Rm. 129. Phillip Kopiske will speak on the "Past, Present and Future of the Delta Clipper." For more information, call Al Jackson, 333-7679.

JSC

Swap Shop

Swap Shop ads are accepted from current and retired NASA civil service employees and on-site contractor employees. Each ad must be submitted on a separate full-sized, revised JSC Form 1452. Deadline is 5 p.m. every Friday, two weeks before the desired date of publication. Ads may be run only once. Send ads to Roundup Swap Shop, Code AP3, or deliver them to the deposit box outside Rm. 147 in Bldg. 2. No phone or fax ads accepted.

Property:

Rent: Winter Park, CO, furn, 2-2, sleeps 6. 488-4453.

Rent: Wolf Creek, CO, 3 BDR, sleeps 6, no smoking/pets, dly/wkly/mo. Bob, x30825 or 998-7372.

Sale: Chambers County, 95' x 210' lots, util, Barbers Hill ISD, financing. 488-5058.

Rent: Arkansas cottage, Blue Mt Lake, furn, 4 ac, $250/wkly/$50/dly. x33005 or 334-7531.

Sale: Lometa, TX, 894 ac ranch, 2 houses, 2.5 mi on FM 3415, $525/ac. 488-5058.

Rent: Galveston beach house, dly/wkly, CA/ H, furn. Ed Shumilak, x37686 or 326-4795.

Sale: Galveston beach house, 3-2, CA/H, furn. Ed, X37686 or 326-4795.

Sale: Piper's Meadow, 3-2-2, FPL, study, $82.9k. Diana, x31512 or 286-9822.

Waterfront marina townhome, LC, 2-2, $99.5k. Steve Brody, 202-358-0889 or 703-532-3415.

Sale: 2 lots, Lake Livingston, $5k, owner finance. James, x36666 or 487-5730.

Lease: University Green townhouse, 2-2-2, FPL, $750. 713-339-1121.

Sale: Meadow Green, 3-2-2, 1910 sq ft, $112.5k. x39018 or 480-7610.

Sale: Sterling Wood, 4-2.5-2, dbl formals, jacuzzi, FPL, $180.4k. 482-8595.

Sale: Ft Lauderdale, Fl, condo, time share, have video & floor plans, $12.5k. x36851 or 332-8017.

Rent: Clear Lake/Ellington, 2 BR, W/D conn, ceiling fans, $450/mo + dep. 326-1761.

Rent: Galveston, beach house,wkly/wknd. 485-1730.

Sale: Friendswood/Heritage Park, 3-2-2, 1850 sq ft. jacuzzi FPL, fenced, $89.9k. 996-5076.

Lease: Townhome, 1-1.5 loft, cov parking, W/D conn, $495/mo + dep. 474-9262.

Sale: Clear Lake Shores, 3-1, $89.7k. 538-1849.

Sale: Pearland, 3-2-2, FPL, ceiling fans, $79.5k. 997-2006.

Rent/Sale: Baywind I condo, 1-1-1. ceiling fans, appl, $400/mo + dep or $29k. Bill, 332-3649.

Cars & Trucks

'90 Acura Integra LS, 5 spd, ex cond, 58k mi, A/C, $9.5k. Bobby, 538-1835.

'90 Mercury Topaz GS, 35k mi, $5950. Gene, x38020 or 334-1505.

'91 Ford Festiva, red, 5 spd, 39k mi, ex cond, $4k OBO. x30993 or 920-2276.

'90 Chevy Cl500 Silverado, 25k mi, short-bed, ex cond, $11k. Jeff, 333-7745 or 286-9636.

'81 Jeep CJ7, 6 cyl, 4 spd, 4 WD, PS/PB, hard drs, soft top, $4.2k. x30244 or 482-9162.

'74 VW Bug, rebuilt eng. John, 244-9816 or 486-0097.

'82 Chevrolet Caprice Classic, 4 dr, auto, 115k mi, $800. x45826 or 486-2022.

'84 S-10 Blazer, blk/silver, 2 dr, auto,V-6, AM/FM, $2.5 OBO. 282-4345 or 486-4916.

'74 VW Bug, A/C, orange, 88K mi, $1.9k. Bob, x39577.

'83 Ford Custom van, 108k mi, AT/OD, cruise, AC, AM/FM/CB, $2.7k. John, x36486 or 488-2276.

'82 Dodge Stakebed, sideboards, $5k OBO. 713-485-7274 or 639-3138.

'81 Chevrolet Caprice station wagon, brown, $500. 286-4774.

'83 Chevy Camaro, AM/FM, new tires, ex cond, $2995 OBO. x35105.

'82 Ford Escort wagon, blue, $500. Bob, x31143 or 488-4415.

'93 Honda Accord EX, 15k mi, loaded, $17k. 488-8781.

'82 Camaro, A/C, auto, 2.8 L, V8, AM/FM/ cass, ex cond, $2.5k OBO. 991-5280.

'84 BMW 318i, new eng, $4.2k. Rob Kelso, x35483, 480-2997.

'87 Ford Tempo, needs work. 338-1040.

'92 Toyota Paseo, 5 spd, moon roof, cass, 55k mi, $9.5 OBO. Suresh Patel, x49659 or 488-5329.

'84 Toyota Supra, 91k mi, pwr sun roof, $3.7k. 333-1856.

Boats & Planes

Chrysler 22' Saliboat, sleeps 6, w/galley & head, 5 hp outboard, mainsail & 2 jibs, slip in CL, $2.8k. 282-1727.

22.5' Sea Ray Cuddy cruiser, 228 hp merc, New Alpha One I/O, 6" color Furuno depth finder, VHF, ex cond, $8.5k. Mark, x38013 or 992-4132.

'86 Aqusport 222 Express Fisherman, 22', walk-around cuddy, 175 hp O/B, Loranc/depth finder/VHF, $13.9k. x39382 or 585-6447.

Santana 22' sailboat, main, jib, spinnaker, $2750. x34063 or 532-1730.

224 Chaparral, v-bunk cuddy cabin w/head, 200 hp Johnson w/SS prop, electronics, w/trailer, ex cond. Jim, 286-9632.

38' Shrimp boat, 6V92 diesel, 2 to 1 BW, Loran, VHF, color depth meter, 4-60' nets, 4-32' nets, 3 oyster dredges, $10k. x35180 or 326-3706

18' VIP Vision, 130 hp/OMC/I/O. access, ex cond, $9.9k. Jennifer, x38668 or 286-0507.

Cycles

Trade team Fuji racing bike, 12 spd, suntour equip, ex cond, for comparable mt bike. James, 282-3215 or 480-9448.

Girls 16" bicycle, $25; men's 10 spd bicycle, $55. James, x31693 or 992-0202.

Audiovisual & Computers

Hyundai Super 286E AT-comp computer, 12-MHz,1 MB RAM, 40 MB HD, 2400-bps MNP5 int modem, 6 exp slots, 14" VGA monitor, mouse, $275 OBO. Luis, x37478 or 486-8155.

Blue Chip Daisy wheel printer, $100. 482-1505.

Macintosh SE, superdrive, 40 MB HD, 2 MB RAM, mouse & ext kybd, $650. Bill, x30629 or 474-2585.

Macintosh Classic w/Mobius accelerator 25Mhz, 15" monitor, 16 MB RAM, 40 MB HD, 2400 baud modem, software, $1k. Joe, 996-1667.

Complete Nintendo sys, games. Nolan, 489-7494.

Panasonic SKP 2124 computer printer, acess, $275. 681-4126.

NEC-286 computer, 640k RAM, 44 MB HD, 2 FD, color monitor, kybrd, software,$600; Panasonic KXP-1180 printer, $60. Earl Rubenstein, 480-1998.

286 AT computer w/ 5 1/4" floppy drive & 32 MB HD, 13" color EGA monitor, Panasonic printer, $400; computer workstation, $50. Linus, 488-3984.

Star-Dot Matrix printer SL-10C, printer std, Commodore 128D PC, Teknika MJ-10 color monitor, $500/ Gwen, x31782 or 337-1755.

Nintendo w/ten games, $75 OBO. Bill, 992-5836.

Musical Instruments

Yamaha kybd w/80 watt amplifier, $200. x39034 or 474-2660.

AM/FM stereo receiver 25wpc w/bass refelx spkrs, $75. x36851 or 332-8017.

Peavey Intl 115 spkr cabinet, $175. Joe, 996-1667.

Artley closed hole student flute, ex cond, $250. 286-7736.

Buescher Sax, $650. Brad, x33678 or 489-7494.

Pets & Livestock

Chihuahuas, AKC, 7 wks, shots, wormed, $200. 534-4667.

Red Lored Amazon & Blue Front Amazon, deluxe cage + 2 cages, $800. John, 244-0215.

AKC reg Boston terrier puppies, 2 female, 4 male, Feb-2-94. Mike, x31907 or 489-4558.

AKC reg Siberian Husky, female, blk/wht, $150 OBO. 991-5280.

Lost & Found

Lost Tie clasp, gold color, alligator clip. Earl Rubenstein, 480-1998.

Household

Microwave oven, $50. Bill, 992-5836.

Dinette set w/four chairs, $15; coffee tbl, $10. James, x36666.

Qn sz hdbd, dk oak, $50; custom coffee/ cocktail tbl, 24" x 60", 3/4" beveled glass, 17" wrought iron base, $200. 282-4345 or 486-4916.

Beveled glass DR table w/brass base; full sz bed frame. 286-7736.

Two capt chairs, $35 both; laundry hamper, $10; single file drwr w/locking top, $8; sm lighted "Bar-Open" sign, $10; Peruvian wall hanging, $65. 488-5564.

Couch/loveseat, pastel colors, $150; table w/lamp, $25. x35376 or 943-3842.

DR set, mahogany veneer, table w/5 chrs, buffet, china cabinet w/glass drs, $800. Lisa, 474-5609.

Rugs, 9 x 12 color mauve & 4 x 6 blue, $50 both. x38339 or 488-3101.

Sony Trinitron color TV, 26 in. console, cable & stereo ready w/remote, $350 OBO. x31025.

Waterbed, kg sz, semi-motionless, lighted cabinets, ex cond, $200 OBO. Sharon, x33019 or 554-6741.

Waterbed, qn sz, motionless w/bass, padded side rails, hdbd, $75 OBO. x30157.

Eureka upright vacuum cleaner, $35. Bob, 283-1193.

Microwave tbl, $50; red metal bunkbed, twin/full, $150. Sam, 332-3168.

Wanted

Want greenhouses, will dissassemble and remove from property. Rob or Linda, 339-1385.

Want riders for Van Pool, West Loop park & ride to NASA/contractors. Richard, x37557.

Want female roommate to share 3 BR house in LC, $250/mo + half util, avail 2/1. Dora, 332-2220.

Want to buy good riding lawnmower, reasonable. x38510 or 399-0980.

Want Capezio dance shoes, leather soles, western boots, leather, both w/low to med heels & med width, in-line skates, sz 8.5"-9. 486-9605.

Want meat grinder sz 12 or larger, and sausage stuffer. X35520 or 485-0237.

Want Roto tiller in good working cond. James, x31693 or 992-0202.

Want late model custom or minivan. ex cond. x38510 or 399-0980.

Want non-smoking roommate to share house in CL, $250/mo + util. 286-5248.

Want non-smoking housemate, no pets, furn home in LC, $300/mo + 1/2 util. Ian, x34853.

Want to buy '89 Chrysler New Yorker in good cond. 485-6074.

Want carpool from 1960 & 290 to NASA, 7:30 to 4:00 or 8:00 to 4:30 flexible. Cindy, x39468.

Want Nordic Track, good cond. Paul, x38766.

Miscellaneous

Vertical blinds, 3.5" fabric w/val, 78" x 84", H/W includ, $60 ea. Ed, 481-4889.

Liquidating collection, 50 plate "Collectables" various artists, $15 ea or 2 for $25. Earl Rubenstein, 480-1998.

Telephone answering machine, $20; set of 2 sm stereo spkrs, $20; classic sz Franklin planner, OBO. Ed, 481-4889.

Yonex ADX 100 driver clone, Graphite shaft & head, ex cond, $75. Bob, x33149.

Orthopedic chair, $10; end tbl, $8; Astronomy mag, color TV, $12; 3 HO train sets, $75. Paul, x31883.

Pres & First Lady Charter Gold membership, fixed lifetime dues, $75/yrly, $600. Rich Delgado, x47257 or 996-7630.

Ladies winter coats, sz 12, full lgth leather, $45 OBO; mid-lgth lavendar coat, $30 OBO. 474-9262.

30" riding lawn mower, 11 hp, 8 spds, ex cond, $575. Mark, x38013 or 992-4132.

Desk w/credenza & 3-drwr file, wht melamine, 60 x 35, $225. x39588 or 487-1883.

Typewriter w/monitor, $200; Sanyo VM-8 Camcorder w/case, $450; wireless home alarm sys w/dialer & remote, $80; kg sz waterbed w/capts pedestal, $500; dresser w/mirror/cabinets, hi-boy night stds, $500; workbench w/ vice, $100; McKinstry enclosure w/13x9 sub-panel, $75. 333-1856.

Oak draft tbl, 45" x 72", tilt, w drwrs, chrs, $500. x37678 or 661-4789.

Rear step bumper for GMC/Chevy full sz fleetside P/U, blk, $125; tailgate for GMC full sz fleetside P/U, full lgth dia Palte protector, indigo blue, $250. Curtis, 333-7027.

1 pr of blk Justin Ropers, 12e, $50. Tom, 333-6592.

Ford car shop manual, '75-'76, $10. Jim, x31224.

Key map of Harris county, $10; self-propelled vacuum cleaner, $50; pink umbrella stroller, $15; computer printer tble, $15. Ed, 481-4889.

Wooden office desk, $175; Coleman gas lantern, $17; fifty pre-'64 Roosevelt dimes, $17. 482-8827.

Side-by-side dbl baby stroller w/canopy, $50; Jenny Lind crib w/matt, $90; Baby stroller w/umbrella, $10; Grayco highchair, $20 OBO. Walt, x35939 or 480-0226.

Hubble Space telescope mural by R. McCall, framed, ex cond, $200 OBO. Steve, 339-1136.

Graco dbl duet stroller & Century 3000 toddler car seat, ex cond. 486-5239.

Hobbie horse, $40; windup baby swing, $40; Playschool car, slide & picnic tbl, $20 ea; tbl lamps, $15 ea; battery pwr car, $30; 26" boy & girl bike $20 ea. Sam, 332-3168.

Two toddlers/childrens Bell bicycle helmets, sm & med sz, & infant/child bicycle seat. Rich, x47257 or 996-7630.

Fiberglass camper top, long/wide bed Ford truck, ex cond, $450. Jim, 713-286-9632.

Love seat, new $800, sell $250; mink stroller, $895. 488-5564.

Authier Flash snow skis 150 cm, $50; Heirling ski boots, ladies sz 5, $25; blk stretch ski pants, ladies sz 8, $25. Stacie, x41036 or 333-4577.

Solar water heater, complete, $650. x33678 or 489-7494.

Troy tiller, 8 hp, ex cond, $900. 482-0275.

Wedding dress, wht, chiffon, beaded, sz 8/10, hat included, new $700, sell $350 OBO. Christine, 483-1251.

Fairbanks-Morse submersible sump pump, 115 v, $30; camping stoves, 2 kerosene sing burner, $10 ea; 1 dbl burner propane, $15; Sears hen egg-laying nesting box-10 compartments, ex cond, $45; port galvanized steel fence, 7 sect 42"h x 48"w, $10. Jim, x39229 or 482-7873.

3 rodeo Vince Gill tickets, Sat Mar 5th. 486-9760.

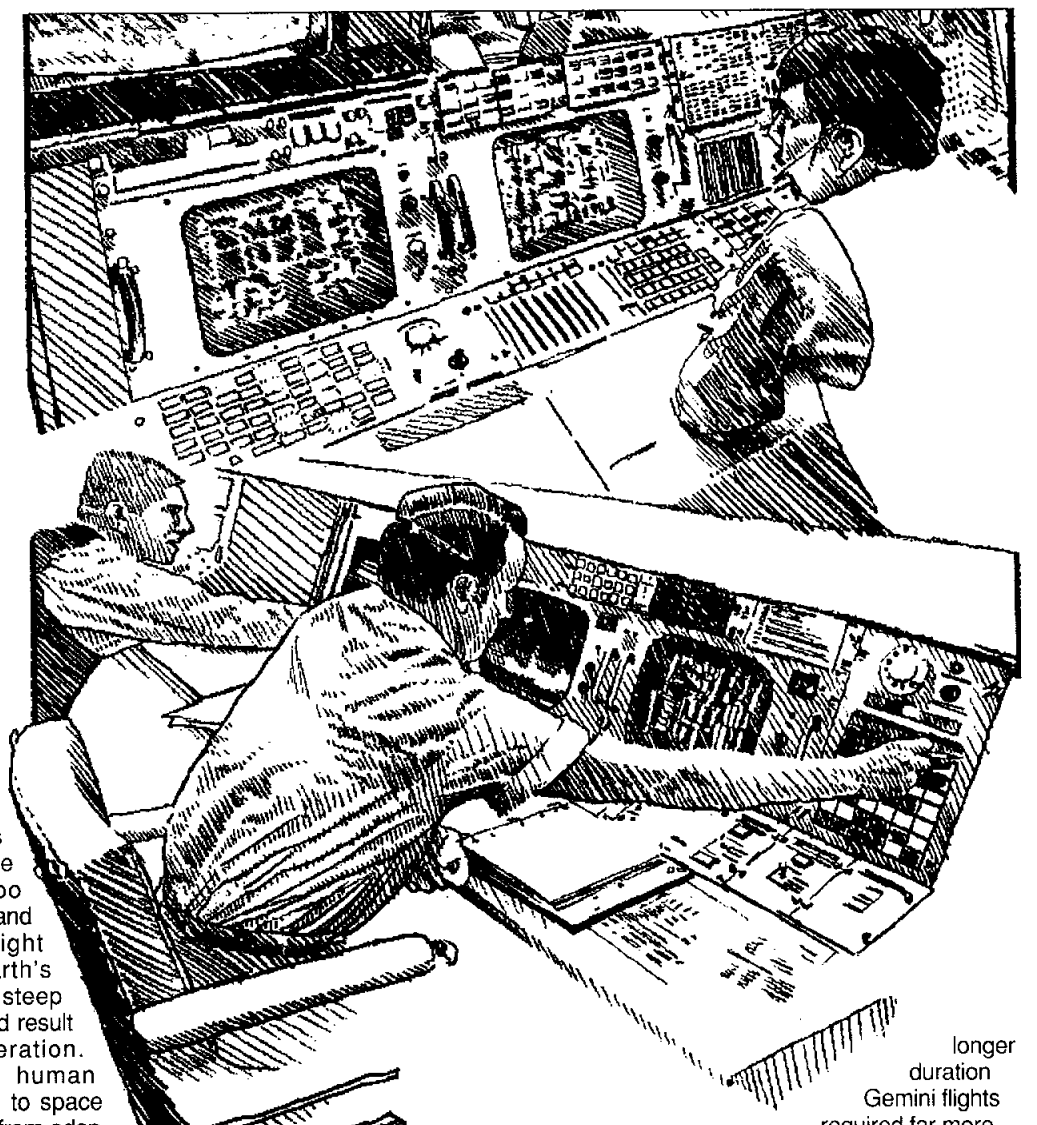
Automag II by AMT, 22 WMR, stainless, $270, John Wade, 482-8713 oe 431-2066.

100 Mexican sleeping hammocks, $150 OBO. Greg, x37318 or 335-8102.

Wedding dress, wht, sz 5, long sleeves, v-back, full lgth, yellow & wht veil, new $500, sell $275. 474-3857.

Suddenly, Tomorrow Came...

Chapter 9: The Flight of Apollo



[Editor's note: This is theThird of four excerpts from the official history of the Johnson Space Center, the newest addition to the NASA History Series. The book, produced in-house at JSC, will be available in March.]

By Henry C. Dethloff

The design and engineering of machines capable of taking humans into space evolved over time, and so too did the philosophy and procedures for operating those machines in a space environment. MSC personnel not only managed the design and construction of spacecraft, but the operation of those craft as well. Through the Mission Control Center, a mission control team with electronic tentacles linked the Apollo spacecraft and its three astronauts with components throughout the MSC, NASA, and the world. Through the flights of Apollo, MSC became a much more visible component of the NASA organization, and operations seemingly became a dominant focus of its energies. Successful flight operations required having instant access to all of the engineering expertise that went into the design and fabrication of the spacecraft and the ability to draw upon a host of supporting groups and activities.

N. Wayne Hale, Jr., who became a flight director for the later Space Transportation System (STS), or Space Shuttle, missions, compared the flights of Apollo and the Shuttle as equivalent to operating a very large and very complex battleship. Apollo had a flight crew of only three while the Shuttle had seven. Instead of the thousands on board being physically involved in operating the battleship, the thousands who helped the astronauts fly Apollo were on the ground and tied to the command and lunar modules by the very sophisticated and advanced electronic and computer apparatus housed in Mission Control. The flights of Apollo for the first time in history brought humans from Earth to walk upon another celestial body.

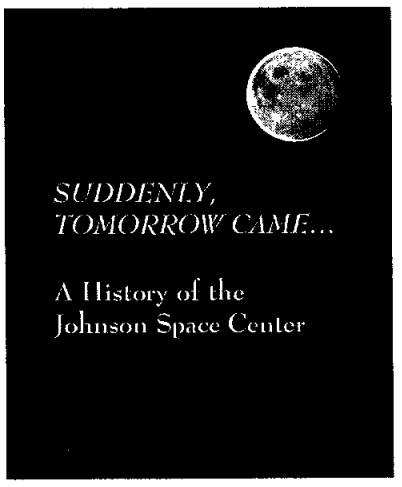
Apollo is perceived in modern times as the ancients' sun-god, a god of light and of the heavens whose chariot raced across the night skies like a shooting star. Greek mythology ascribes to Apollo much earlier and more simple roles. He appears in Greek writings variously as the god of agriculture, the protector of cattle and herds, the deity of youth and manhood, a warlike god, and a god of prophecy, of healing, and of music (so long as that music came from the lyre). At the height of Greek civilization, as Athens particularly began to colonize throughout Ionia and the Mediterranean world, Apollo became a maritime deity, the "dolphin" god who accompanied emigrants on their voyages. Thus in modern times, fittingly perhaps, another Apollo carried the first voyagers from Earth to a distant heavenly body. "Houston, Tranquility Base here, the Eagle has landed," astronaut Neil Armstrong radioed from the lunar surface to the Mission Control Center as the Apollo 11 mission touched down on July 20, 1969. The journey from here to there had been fraught with peril, difficulties, and bold decisions, and had been made possible by tens of thousands of people who never left Earth.

Other than the astronauts, those most directly involved in the Apollo flights were the personnel at MSC who held and managed those fragile, invisible, extended lifelines to the command service module (CSM) and the lunar excursion module (LEM). (The LEM later became known simply as the lunar module (LM) after NASA's associate administrator for Manned Space Flight, George Mueller, protested that "excursion" in the title sounded a bit frivolous.) In coordination with Goddard Space Flight Center, Mission Control linked the spacecraft to its launch and recovery crews; to a worldwide tracking and communications network; to elements of the technical and scientific personnel at every NASA center; to engineers and specialists at Kennedy Space Center, Marshall Space Flight Center, MSC, and other NASA centers as needed; and to a host of contractor engineers scattered around the United States and the world. The Department of Defense (DoD) supported flight operations in staffing and maintaining the tracking and communications network, in the operation of recovery fleets, and in the deployment of medical and rescue forces. The National Weather Service and the National Oceanic and Atmospheric Administration constantly monitored weather and ocean conditions for launch, flight and recovery operations. The National Laboratories, particularly the Los Alamos Laboratory, provided support for the development and operation of lunar surface experiments. For every astronaut in space, there were many thousands of persons on duty on Earth.

The Apollo program included 11 piloted missions: 9 went to the vicinity of the Moon, and 6 of those landed men on the Moon. The first manned Apollo flight, an Earth-orbital mission lofted by the Saturn IB, flew on October 11, 1968, only 5 days after NASA Administrator James Webb retired and relinquished his duties to Thomas Paine, who became the Acting Administrator. In December 1968, astronauts orbited the Moon; in March 1969, rendezvous and docking procedures were checked in an Earth orbit; in May, Apollo 10 tested equipment and procedures in a lunar orbit and in July, NASA achieved John Kennedy's goal of landing men on the Moon and returning them safely to Earth. There followed in November another, more extended, sojourn on the lunar surface. Then Apollo 13, the only Apollo flight of 1970, failed in its mission but succeeded in returning its passengers safely to Earth. Not only had the design and engineering of machines capable of taking humans into space evolved over time, but so too did the philosophy and procedures for operating those machines in a space environment.

In 1961, when manned lunar flights were being seriously debated, Max Faget recalled that "the basic understanding of the venture was quite primitive." A ship returning from a lunar voyage faced a much more difficult injection into the Earth's atmosphere than did one in Earth orbit. It would be traveling much faster. It had to hit the Earth's atmosphere at the right angle. Too shallow an angle and the vehicle might "skip" off the Earth's atmosphere; too steep an approach would result in certain incineration. Moreover, the human body's adaptation to space might be different from adaptation to Earth orbit. Communications and control over vastly greater distances than Earth orbit were untested. The unknown weighed far more heavily than the known. That, of course, is precisely what made the enterprise so challenging and exciting.

Faget pointed out that the decision to land a vehicle on the Moon from lunar orbit had a major impact on the



design and construction of Apollo. Lunar rendezvous meant that Apollo would require two spacecraft: a command and service module for the flight to lunar orbit and back and a separate lunar module for descent to the surface of the Moon and return to lunar orbit rendezvous with the command ship. Moreover the lunar orbit decision markedly affected operational techniques.

Eugene F. Kranz, who served as Chief of the Flight Control Division at MSC throughout the Apollo flights, reconstructed the progression in flight operations from Mercury to Apollo. He described Mercury operations (where he served as head of the Flight Operations Section in the Flight Control Operations Branch under John Hodge) as a "part-time" business. "The thought processes [for Mercury] were closely attuned to conventional aircraft, that is they were five-mile-a-minute thought processes." Operations people spent perhaps 3 weeks planning a Mercury mission. Mission rules and pilot operating procedures were contained in a 10- to 12-page pilot's handbook similar to that used for a military aircraft mission. The approach to Mercury was simplistic. Spaceflight operations were novel, and operators were novices. First Mercury and then Gemini flight experiences provided critical training for Apollo flights. Operating teams learned particularly that space was a vastly different environment, that part-time operations would not work, and that flight planning, training, preparation, and new organizational structures and greatly broadened support bases must be developed.

John Hodge, Assistant Chief for Flight Control, agreed that the entire concept of flight operations was being constructed out of "whole cloth." But the conceptual design of the Mission Control Center and the basic principles of Apollo operations were completed even before Alan Shepard made the first suborbital flight on a Redstone rocket in May 1961. Flight operations required a great deal of foresight and a lot of learning by doing.

Kranz's association with flight began at a relatively early age and covered the full spectrum of NASA history from Mercury through the Shuttle. During World War II, his mother ran a boardinghouse located close to a USO (United Services Organization) which attracted a continual stream of transient military types. One of these, he remembered, was Billy Huffman, a combat photographer who flew numerous Ruhr bombing missions; and another was Rinehart Brandt who flew in the Battle of the Coral Sea among other engagements. Kranz developed a keen interest in flying and spent his free time around Franklin Field, Ohio. In high school he wrote his thesis on interplanetary flight and then attended Parks College of St. Louis University where he received a degree in aeronautical engineering. After a time as a test pilot with McDonnell Aircraft, he entered the Air Force near the close of the Korean War, spending time at Lackland, Spence, Laughlin, and Williams Air Force Bases, before a 15-month Asian tour with the 13th Air Task Force "showing the flag." When General Curtis LeMay decided that the Air Force did not need anymore fighter pilots and scheduled Kranz for "tanker" school, he opted to return to the more challenging and exciting life as a McDonnell flight test engineer.

Kranz, in Formosa when the Soviets launched Sputnik, was indelibly impressed. The Soviets had it and the United States did not! When the Space Task Group was formed, Chris C. Critzos, who became Christopher C. Kraft's executive assistant in the Flight Operations Division, encouraged Kranz to join them. Gene Kranz said that his wife also encouraged him, thinking that their family life would become more stable and that he could also enroll in school in Virginia for graduate study. So the Kranz family went to Virginia, and in short order moved to Houston.

He became personally involved in every Mercury, Gemini, and Apollo flight. As programs shifted from Mercury to Gemini to Apollo, operations management became complex and deeply layered. "We applied the 'new knowledge' obtained from Mercury on Gemini," he said. The longer duration Gemini flights required far more intensive and sophisticated flight planning and preparation. Operations were now geared to a real-time, one-on-one interface with the astronauts. Flight control teams stood mission "watches." Flight directors began to develop flight "gouge" sheets, which established responses for given conditions and situations. Ed Nieman compiled the information into a formal systems handbook for flight operations. Finally, about the time of Gemini flights 6 and 7, flight controllers began to address the problem of malfunction procedures (that is, the development of conditioned responses to difficulties). The very critical problem-solving function during flight operations began to become systematized. Spaceflight operations largely involved real-time (instant) problem solving.

For example, during the flight of Gemini 8, the vehicle began a rolling motion shortly after a redocking maneuver and as it passed out of contact with the ground stations. Assuming that the Agena rocket rather than the Gemini spacecraft was at fault, flight controllers ordered a shutdown of the attitude control systems which only accelerated the motion. Then, when ground control decided to separate the two vehicles, "everything went to hell in a handbag." The point was we had made a "100 percent wrong call." That taught us, among other things, that problems with the system needed to be fully resolved before flight, that all malfunction procedures needed to be carefully reviewed, and that the flight operations teams and astronauts required intensive training in malfunction procedures. In the Gemini 8 case, close attention to mission rules, reliance on thought processes and reactions ingrained by practice and simulation, plus (John Hodge thought) some heroic piloting by Neil Armstrong resulted in stabilizing the vehicle and a safe return. Overall, although flight remained a continual learning process, Gemini experiences generated confidence in the equipment and in operations procedures.

Max Faget agreed that Gemini was indispensable in developing the flight control techniques and procedures necessary for Apollo orbital rendezvous. Mercury and Gemini flight experiences defined the general philosophy of the interplay between the Mission Control Center in Houston and the astronauts in the spacecraft, and established the flight interrelationship between the NASA operating teams, hardware contractors, and contractor flight controllers. By the time Apollo 8 rolled out on the launch pad, flight operations, while always a learning process, had sharpened and improved in comparison to early Mercury and Gemini operations. ❑

Scientists track Earth movement from California quake

Scientists at NASA's Jet Propulsion Laboratory are measuring Earth movement as a result of the Jan. 17 California earthquake using Global Positioning Satellite System instruments.

"This is mountain building in progress," said Andrea Donnellan, a JPL geophysicist. She said the 6.6 quake occurred on a fault at the southern and eastern edge of the Ventura Basin.

Donnellan said the 6.6 quake occurred on a fault at the southern and eastern edge of the Ventura Basin, a 62-mile by 6-mile sub-surface feature that stretches from the Pacific Ocean to the San Fernando Valley. At 9.3 miles deep, the basin is one of the deepest sedimentary basins on Earth, she said.

Donnellan had been studying the basin since 1987 and came to the conclusion that its deep faults were capable of causing a serious earthquake. In a paper she published in the science journal Nature last November, she predicted the basin could suffer an approximately 6.4-magnitude earthquake. Her studies, using the GPS instruments, indicated the basin was being squeezed from north and south about 0.3 inches a year by the movement of the Santa Susana and Santa Ynez ranges.

"It's a north-south closure of the valley," she said. The figures come from analysis of data recorded in the GPS receivers at several locations around the basin. She said she and her colleagues used computer modeling to look at the faults beneath the basin from a considerable depth up to the surface and saw they were locked, that is, not slipping to relieve strain. From that model they calculated the potential magnitude of a quake that could strike the region. Although the scientists predicted the locale and size of the earthquake, they could not predict when such a quake might occur.

NASA's Airborne Science and Applications program also has been conducting surveys of the damage in the area. Data from instruments aboard NASA's C-130 and ER-2 aircraft has been provided to the Federal Emergency Management Administration and local governments to help them assess the damage.

Both JPL's GPS studies and the aircraft surveys, managed by Ames Research Center, are funded by NASA's Office of Mission to Planet Earth. Mission to Planet Earth studies how Earth's global environment is changing. Using the unique perspective available from space, NASA is observing, monitoring and assessing large-scale environmental processes, focusing on climate change.

NIO staff changes part of center realignment

(Continued from Page 1)

move to Space and Life Sciences to support planetary activities being conducted within that organization.

Finally, the Cost Engineering Office and Cost Containment and Process Improvement Offices will remain intact within the Administration Directorate. Employees of the Resource, Schedule and Configuration Management Office will be reassigned to the Comptroller's Office.

In making the announcements, which were effective Feb. 11, Huntoon said she "believes these steps will achieve significant efficiencies for us during a time of diminishing resources."

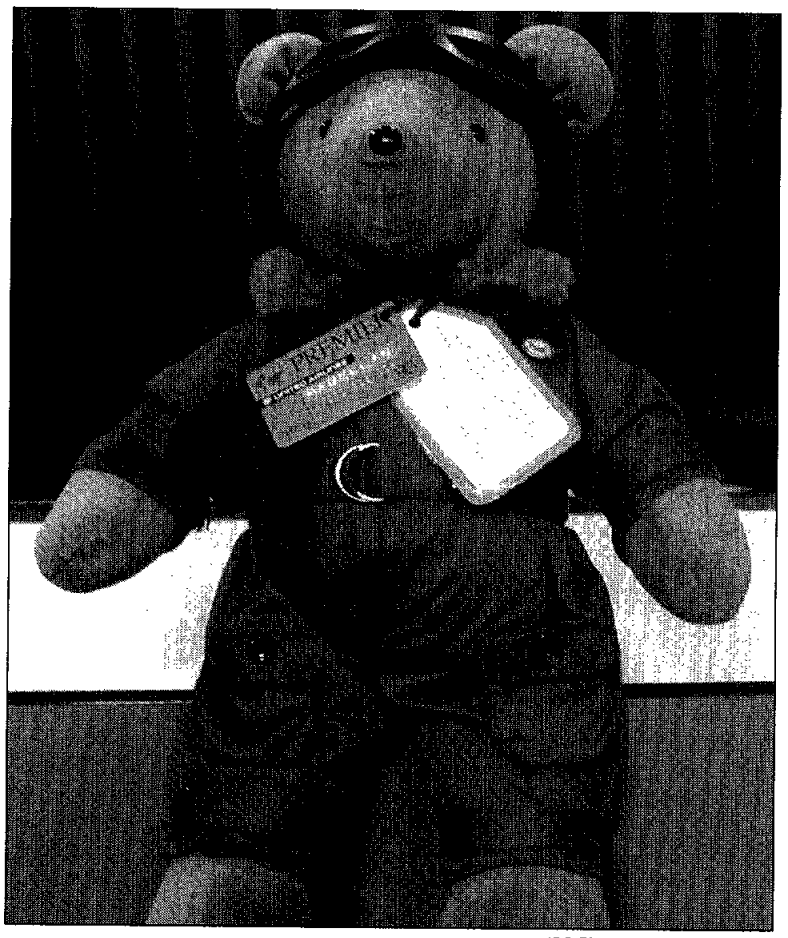
Expo seeks help

JSC employees have the opportunity to volunteer a few hours of their time in an effort to encourage middle and high school students to study math and science.

The Pathways Math & Science Student Career Expo begins Monday, March 22 at the Pasadena Convention Center. Volunteers are needed during two shifts, running from 8:30-11 a.m. or 11 a.m.-2 p.m. during the two-day event. This is the third year for the exposition which features exhibits and speakers focusing on the necessity of math and science in particular careers.

The event is sponsored by the Partnership Center for Education, an organization which brings together industry, government and education to encourage the study of math and science for elementary and high school students. JSC is a member of the Partnership Center, along with a number of other organizations, including Lockheed, Rockwell, Hernandez Engineering, McDonnell Douglas, Boeing, and the Lunar Planetary Institute.

To volunteer your time, or for additional information, contact Kaz Hall, ext. 38066.



JSC Photo by Andrew Patnesky

Magellan Bear sports a flight suit, goggles and frequent-flyer identification as he trains for his possible assignment as an education specialist on board a Spacehab mission currently targeted for January, 1995. The world-traveler is sponsored by the children of Elk Creek Elementary School in Colorado.

Education specialist inspires

Another Magellan bears hopes of flight

By Eileen Hawley

While Spacehab-2 was orbiting the Earth tucked inside *Discovery*'s payload bay, the education specialist hoping to fly on Spacehab-3 next January, was busy training at JSC.

That education specialist is Magellan T. Bear, a 20 inch tall, roughly three-pound stuffed blue bear sponsored by the 525 students of Elk Creek Elementary School in Pine, Col.

Magellan began his training Feb. 2 as he observed launch preparations for Spacehab-2 at the Spacehab Payload Processing Facility in Florida and watched the liftoff of STS-60 from Kennedy Space Center. The well-traveled bear then came to JSC to observe Spacehab ground controllers working with the STS-60 crew members during the mission.

It was the efforts of the Elk Creek students that brought Magellan to this point in his career. With the assistance of United Airlines flight crews, Magellan has traveled around the world helping students learn about geography, multiculturalism, math and science.

Last year, Magellan began the journey that took him more than 49,000 miles and to 22 cities worldwide on United Airlines. At each stop Magellan—and his flight-crew friends—would send the Elk Creek students postcards and photographs of the people and places he visited. When his around-the-world travel adventure came to an end, the school contacted Spacehab, Inc. to inquire about education specialist slots on board Spacehab.

"Magellan is a well-qualified candidate to be a Spacehab education specialist," said Rebecca Gray, manager of government and public relations for Spacehab. "He has a lot of experience inspiring students to approach learning in a creative way." Traveling on a space-available basis on the next Spacehab mission, Magellan will continue his efforts to inspire students to study science and mathematics by demonstrating how those subjects apply to real life activities, and to living and working in space.

Crew returns to Houston

(Continued from Page 1)

training and during the mission.

The historic significance of the flight was not lost on its crew. Reightler said "I think our flight will be remembered for the significance that for the first time a crew of people came together from the United States and Russia...and we hope that is going to set the stage for a whole new era of similar missions and cooperation in space." Those sentiments were echoed by crewmate Davis who said that the mission showed "what the world can do with international cooperation."

Krikalev, the first Russian cosmonaut to fly on board an American spacecraft demonstrated the extent of cultural exchange by greeting the well wishers with a hearty "glad to see y'all." Krikalev also said he was pleased that the crew "worked together not only as a group of colleagues, but as a group of friends."

The STS-60 crew members will receive their Space Flight Medals and brief JSC employees on the mission at 10:45 a.m. Thursday in Teague Auditorium. The crew is also set to appear at Space Center Houston at 1 p.m. Feb. 25.

JSC loses friend and colleague

Natalie Karakulko, program manager at TechTrans and long-time member of the JSC family, passed away Feb. 10.

Karakulko had provided Russian language support to JSC since the Apollo/Soyuz mission in 1972 and had continued to act as interpreter and translator for all subsequent NASA programs with the Soviet Union and Russia. Most recently, Karakulko supported all current JSC and NASA Headquarters programs with Russia.

"Beginning with the Apollo-Soyuz program, Natalie has been an integral part of our JSC family," said Center Director Dr. Carolyn Huntoon. "Her courage and intelligence, tempered by grace, were hallmarks of her unique contribution to JSC and the space program. I am saddened by Natalie's passing and will sorely miss her joyous spirit."

Karakulko was active in the community and sang with the Houston Grand Opera, Bay Area Chorus and directed the St. Vladimir Eastern Orthodox Church choir. She is survived by her husband, Walt, two children, Nicholas and Nina and grandson, Alexander.

JSC Shuttle Bus *Effective March 1, 1994*

Route A

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