



Plasma power

A JSC-led experiment tests a system designed to dissipate electrical charges from tethered spacecraft. Story on Page 3.



Back in the saddle

Power and Propulsion Division Chief Chet Vaughan returns home to an office full of cobwebs. Photo on Page 4.

Space News Roundup

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No. 26

House votes to continue station work

Measure appropriates \$14.6 billion for NASA

The House of Representatives voted this past week to spend about \$2.1 billion to continue development of NASA's redesigned space station in fiscal 1994.

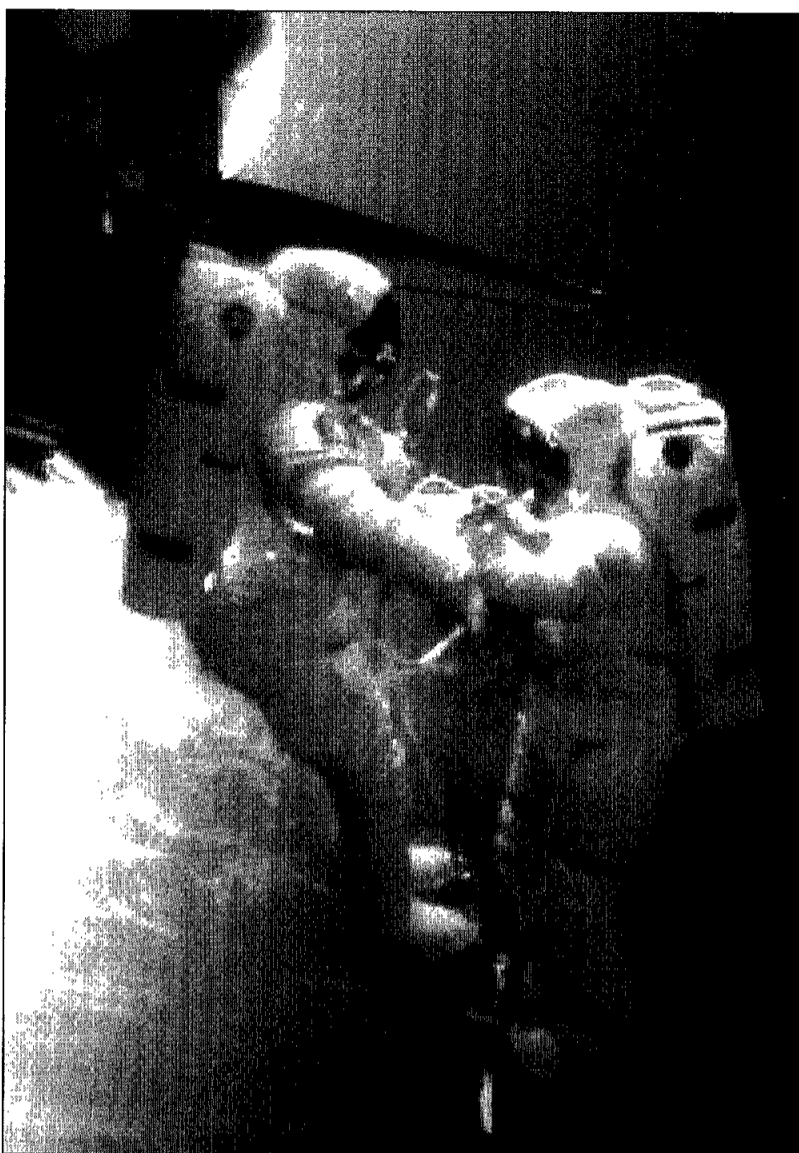
The key was a 220-196 vote Tuesday to kill an amendment sponsored by Reps. Tim Roemer, D-Indiana, and Dick Zimmer, R-N.J., that would have stripped \$1.2 billion out of the project, leaving only \$900,000 to terminate contracts relating to the orbiting laboratory.

The House voted 313-110 on Wednesday to approve the omnibus bill that includes appropriations for Veterans Affairs, Housing and Urban Development and Independent agencies, of which NASA is one. That measure now goes to the Senate, which is expected to take up the measure after a July recess.

NASA's full appropriation under the bill is \$14.6 billion, including \$7.5 billion for research and development, \$4.9 billion for space flight control and data communication, \$5.5 billion for construction of facilities and \$1.6 billion for research and program management, according to NASA Headquarters' legislative affairs office.

The votes validated President Bill Clinton's plan to scale down the space station, reducing costs to

Please see **SPACE**, Page 4



NASA Photo

STS-57 Mission Specialists Jeff Wisoff, left, and G. David Low practice mass-handling techniques high above the Earth in Endeavour's cargo bay. Low is suspended from the portable foot restraint attached to the robot arm.

Endeavour sets down in Florida, satellite in bay

By Kelly Humphries

With the European Retrieval Carrier tucked safely in the payload bay, Commander Ron Grabe brought Endeavour in for a blue-skies landing at 7:52 a.m. CDT Thursday at Kennedy Space Center.

The landing followed two days of weather wave-offs by mission managers striving to bring Endeavour directly home to Florida so that processing of the shuttle for the upcoming Hubble Space Telescope revisit could begin. Endeavour was whisked from the Shuttle Landing Facility to the Orbiter Processing Facility to begin that work Thursday afternoon.

With main gear touchdown at 7:52 a.m. CDT Thursday, Endeavour logged 9 days, 23 hours, 45 minutes in orbit, ending a journey of some 4,118,037 miles.

As the crew—Grabe, Pilot Brian Duffy and Mission Specialists G. David Low, Nancy Sherlock, Janice Voss and Jeff Wisoff—prepared to leave Endeavour, it received a call from another shuttle crew undergoing its final launch dress rehearsal

aboard Discovery on Launch Pad 39B.

"If we'd known you were over there, we'd have done a fly-by of the pad," Grabe told STS-51 Commander Frank Culbertson.

"We just wanted to congratulate you from STS-51 on a very productive mission, a great landing and let you know we're right on your heels," Culbertson replied.



Among the STS-57 highlights were EURECA retrieval and a space walk by Low and Wisoff that was lengthened to a total of 5 hours, 50-minutes so that Low could gently push EURECA's two antennas in place against the satellite's body for return to Earth.

European Space Agency controllers had been unable to fully retract the two seven-foot-long antennas with ground commands and requested Low's help in putting the antennas in place so that the latching mechanisms could work properly.

The effort took longer than had been anticipated, and forced the

Please see **ENDEAVOUR**, Page 4

Astronauts to help with redesign

Shepherd, Wetherbee get Headquarters appointments

Two astronauts have been appointed to provide oversight for technical programs and help lead the transition activities for the space station redesign program at NASA Headquarters.

William M. Shepherd and James D. Wetherbee were appointed assistant deputy administrators-technical by NASA Administrator Daniel S. Goldin. In these senior management positions, they also will serve as acting leaders of the station transition activities being headed by Bryan O'Connor, director space station redesign.

Shepherd is a veteran of three space shuttle missions and more than 440 hours in space. He flew on STS-27, a Department of Defense mission, in December 1988; STS-41, which deployed the Ulysses solar polar probe in October 1990; and STS-52, which deployed the Laser Geodynamic Satellite in November 1992.

A 1971 Naval Academy graduate, he earned degrees in ocean engineering and mechanical engineering from the Massachusetts Institute of Technology in 1978.

Wetherbee was serving as chief of

the Astronaut Office Mission Support Branch. He has flown two space shuttle missions, logging a total of 497 hours in space. He piloted STS-32, which retrieved the Long Duration Exposure Facility in January 1990, and commanded the STS-52 flight.

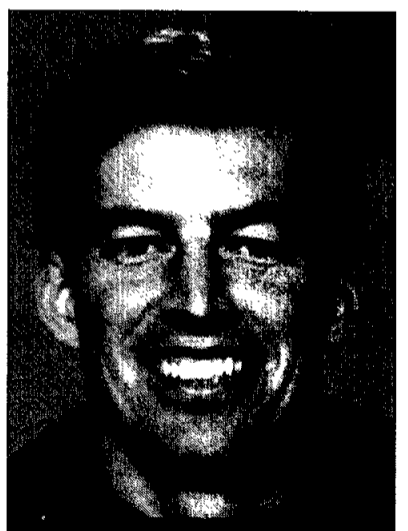
A graduate of the University of Notre Dame and a 1974 graduate of the U.S. Naval Test Pilot School.

Wetherbee has logged more than 4,000 hours of flying time and made 345 carrier landings.

Both were selected as a astronaut candidates in 1984.



William Shepherd



James Wetherbee

Room for improvement one key to process identification

By Araceli Olivas

To successfully implement a process and improve productivity, organizations must learn to look for areas that have a lot of room for improvement and prioritize, participants at a work process identification workshop were told Tuesday morning.

About 70 people attended the workshop hosted by JSC's Process Improvement Subcommittee in Bldg. 1, Rm. 966. One highlight was a presentation by John Bitzer, director of product assurance at Martin Marietta Flight Systems in Denver.

"There is an external demand to do things better, faster and cheaper," Bitzer said. "I believe the answer is improvement through process management. An exemplary facility must be

able to show improvement in the way it does business."

Identifying the work processes being used is the first step, and one of the best ways to do that is by creating a flow chart, he said.

"Flow charting is something you really want to train on and learn," Bitzer said.

Seeing everything on paper enables teams to see what they have to work with and the changes that need to be made. And, Bitzer added, the person or team involved must ask the questions, "If I'm going to improve this process how will these improvements show up? What can I expect to see?"

Bitzer said that communication is important for getting needed support from top managers, who must have a clear understanding of what

Please see **WORKSHOP**, Page 4



JSC Photo by Jack Jacob

John Bitzer, director of product assurance at Martin Marietta Flight Systems in Denver, talks to a packed room about successful techniques for identifying processes that need to be improved. The workshop was sponsored by JSC's Process Improvement Subcommittee.

Daily distribution of Space Fax Roundup begins

JSC's Public Affairs Office is now producing a Daily Space Fax Roundup and is in the process of trying to expand its distribution. The single-page, daily publication contains breaking news stories, news releases and notices of upcoming events.

All organizations and contractors are being asked to post the SFR on bulletin boards or doors where the greatest number of employees will have an opportunity to see it. They are also asked not to reproduce it for all employees, since this is too expensive, or circulate it, since this causes much delay in conveying timely information.

Because of staffing limitations, the SFR may not always be available during space shuttle missions.

Organizations attached to the JSC Information Network through a

Please see **DAILY**, Page 4

JSC

Ticket Window

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

EAA Ringling Bros. & Barnum & Bailey Circus (11 a.m. July 17, Summit): \$9.

EAA River Rafting Trip — July 17: \$36 per person includes transportation, guided raft trip and barbecue dinner. On sale until July 9.

Texas Folklife Festival Trip (Aug. 7-8, San Antonio): \$125 per person, \$49 per child accompanied by two adults, includes lodging, two-day admission.

Moody Gardens — Discount tickets to three of five attractions: \$14.

Six Flags Over Texas — Discount tickets: one-day pass, \$19.95; two-day pass, adult \$24.95 and children under four feet, \$18.95.

Splash Town USA — Discount tickets: \$10.50.

Astroworld — Discount tickets: adult, \$18.95; children under 54 inches, \$15.95.

Waterworld — Discount tickets: \$9.95.

Sea World in San Antonio — Discount tickets: adult, \$19.75; child (3-11), \$13.15.

Fiesta Texas, San Antonio — Discount tickets: adult, \$18.35; child (6-11) \$12.75.

Space Center Houston — Discount tickets: adult, \$7.50; child (3-11) \$4.50; commemorative: \$8.75.

Metro tickets — Passes, books and single tickets available.

Movie discounts — General Cinema, \$4.50; AMC Theater, \$3.75; Loews Theater, \$4.

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 badge or EAA membership card. Classes tend to fill up four weeks in advance. For more information, call x30304.

EAA badges — Dependents and spouses may apply for photo identification badges from 6:30-9 p.m. Monday through Friday. Dependents must be between 16 and 23 years old.

Defensive driving — Course is offered from 8 a.m.-4:30 p.m. July 17. Cost is \$19.

Weight Safety — Required course for employees wishing to use the Gilruth weight room is offered from 8-9:30 p.m. July 14. Pre-registration is required; cost is \$5.

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

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

Aikido — Martial arts class meets Tuesdays from 5-7:30 p.m. Cost is \$15 per month.

Golf — Group lessons will meet Mondays for seven weeks at the Clear Lake Golf Course through July 19. Cost is \$90. Loaner clubs are available for those who need them.

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

Volleyball workshop — A beginner's volleyball workshop will meet from 2-4:45 p.m. Saturdays for eight weeks beginning July 10. Cost is \$25.

Intercenter Run — T-shirts are now available to pick-up at the Gilruth.

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

Sale: Dickinson, 4-3-2D, lg ktl w/ceramic tile, study, game rm, WB, FPL, screened porch, fenced, \$122K. Shirley, 335-1607 or 335-0641.

Sale: Univ Green, 3-2-2, new AC, ceiling fans, deck, custom miniblinds, drapes, all appl, 9.5% no approval assume loan, \$87.5K, ex cond. 488-0345.

Rent: Piper's Meadow, 4-2-2, alarm, FPL, fans, storage shed, 1720 sq ft, \$875/mo. + dep, avail 7-15. 488-1552.

Lease: Piper's Meadow, 3-2-2A, ceiling fan, fenced, new high eff AC, \$740/mo. x31275 or 486-0315.

Sale/Trade: Newport on Lake Houston, 2 adj lots, consider trade for house equity, late model car or stock. Joe, 333-7357 or 944-6513.

Sale: Lake Livingston, Impala Woods, 30 x 70 lot, camp or build, 1/2 mi. off water, util avail, paved roads, \$3k. Teena, x37787 or 422-6369.

Sale: '81 American MH, 14x70, 3-2, \$12K. 946-7386.

Sale: Pearland/Sunset Meadows, 3-2-5-2, formals, study, lg master BR, upgrades, 2.5 yrs old, \$108.9k. Jim, 482-8800.

Sale: Lake Livingston cabin, 2 BR, 2 wooded acres, FPL, satellite dish, close to lake and marina. \$32.5k or \$6k and assume \$367/mo pymts. 409-377-2947.

Rent: Baywind II condo, 2-2, new carpet, paint, appl, patio, W/D conn, no pets, \$570/mo. + \$400 dep. Jack or Emma, 286-7046.

Sale: Friendswood/Wedgewood, 3-2-5-2, lg living rm, patio, trees, fenced, \$60's. 482-6609.

Lease: Univ Trace condo, 1 BR/study, W/D, fans, \$460/mo. + dep, avail immedi. 488-2946.

Sale: Deer Park, 3-2-2, FPL, cov patio, vinyl siding w/warr, nice sz backyard, dbl windows, gas, low util, FHA assumable, \$68K OBO. Darryl, 476-5035.

Sale: League City lot, 82' x 130', \$9.5k. x36514.

Rent: Southern Colorado, 2 BR, fun, sleeps 5, close to skiing, fishing, national forest area, no smoking, no pets, day/wk/mo or longer. Bob, x30825 or 998-7372.

Sale: Forest Bend, 3-2-2, new roof, paint, child's playhouse, lg backyard, upgrades, \$72k nego. Ted, x36894 or 992-4814.

Sale: LC, 3-2-2, all brick, new appl, 5 ceiling fans, new wallpaper, paint, lg lot, no MUD tax, CCISD, \$76k. 332-7908.

Rent: Colorado, winter park condo, furn, sleeps 6, low summer rates thru Oct, hiking, biking, fishing, golf, etc. 488-4453.

Rent/Sale: Egret Bay condo, 1-1-, FPL, fans, W/D, dishwasher, microwave, balcony w/2 glass drs, 2 outdoor closets, cov parking, \$530 + dep, Karl, x33031 or 286-9822.

Sale: Pearland, 3-1-2, outside util, lg storage area attached to gar, new roof, some new paint, all wood, appl, sits on 3 lots, \$33k. Rene, x47289 or 998-2176.

Cars & Trucks

'83 Toyota Corolla, runs well, needs work, \$800. Mike, x38682 or 332-7205.

'85 Ford EXP, orig owner, \$1k. David, x45381.

'85 Crown Victoria, loaded, 69k mi, ex cond, \$4.5k; '59 Chevy Cheyene PU, \$600 OBO. 334-2335.

'84 Mitsubishi Cordia, turbo, AC, PS, 5 spd, 102k mi, \$1.6k OBO. x37984 or 326-3359.

'87 MRA, blue, AC, stand, t-tops, loaded, 93k mi, \$4k. Doug, x45422 or 482-0167.

'88 S-10 Blazer, 2 DR, 4.3V6, 79k mi, gray, AC, auto, pwr windows/locks, ex cond, \$8.9k. 280-2208 or 486-1049.

'77 Silverado Suburban, \$3k; '65 Fairlane 500, ex cond, \$2k. 921-5330.

'87 Nissan Sentra Sport Coupe, 2 DR, AM/FM, stereo, AC, 5 spd, good cond, \$2850. 947-6321.

Pop up camper, sleeps 6, sink, stove, heater, \$1.2k. x36696 or 332-9102.

'89 T-Bird, navy blue, leather int, loaded, cd player, new tires, 70k mi, \$7.9k. 283-1220.

'78 Porsche 928, brwn w/leather int, auto, 75k mi, ex cond, \$8.5k. Bill, x48889.

'83 Pontiac Grand Prix, V8, AC, maroon, dependable, \$2k. Jenny, x45077 or 992-7004.

'84 Monte Carlo, new tires, shocks, brakes, AC, ex cond, \$2.8k OBO. 487-3552.

'77 Cutlass Supreme Brougham, rebuilt trans, \$1150 nego. David, 334-6737.

'87 Honda Accord LX, 5 spd, hatchback w/louvered rear window, PSPB, Alpine stereo, Michelin radials, 87k mi, \$5.6k. x38395 or 992-3249.

Boats & Planes

'88 Commercial Johnson 20hp w/low hours, '65 Lone Star 15' v hull, \$1K OBO. Damon, 283-6911 or 480-5426.

'89 Four Winns 180 Horizon, 18.5', 175 hp I/O, ss prop, standard prop, integrated platform, Brougham seating; detach tongue, extras, low hours, \$10,995 OBO. Bill, 493-1000.

Aircraft handheld radio, KX-99, new, \$450. Hugh, x31714 or 554-5412.

2 back-to-back boat seats, beige, \$35/ea or both \$50; boat canopy, \$25; 19' boat cover, \$40; rowing machine, \$30. Tony, x35966.

18' fishing/ski tri-hull w/'83 90 hp Evinrude, low miles, good cond, rigged/equipped for bay/jetty fishing, \$2795. Dan, x31716 or 488-3106.

'79 Baja 16' tri hull ski boat, 115 hp Merc O/B, needs work, pwr tilt/trim, blue/silver metallic, trlr, coast guard/ski equipped, \$2k. George, x34387 or 538-1355.

'88 Hurricane, 19k mi, \$2.7k OBO. x34204 or 480-2954.

Girl's 16" Fischer Price bike, ex cond, \$50. Layna, x32096.

'83 Honda Shadow 500cc, 16k mi, \$750. x49860 or 554-2869.

'85 Kawasaki KLR 250, 2k mi, ex cond, \$1.2k. Eddy, x35710 or 286-2958.

JSC

Dates & Data

Today

Independence Day — Most JSC offices will be closed July 5 in observance of the Independence Day holiday.

Tuesday

Cafeteria menu — Special: pepper steak. Entrees: baked lasagna, pork chop and fried rice, turkey a la king, baked chicken, French dip sandwich. Soup: black bean and rice. Vegetables: breaded squash, steamed spinach, baby carrots, navy beans.

Wednesday

Cafeteria menu — Special: Mexican dinner. Entrees: broccoli cheese quiche, catfish and hush puppies, spare ribs and sauerkraut, steamed fish, Reuben sandwich. Soup: seafood gumbo. Vegetables: Spanish rice, pinto beans, peas, broccoli.

Thursday

SSQ meets — The Society for Software Quality will meet at 5:30 p.m. July 8 at the Days Inn on NASA Road 1. Alan Taylor, president of Oxford Technologies, will discuss international software standards. For more information, call Felix Balderas at x31945.

Cafeteria menu — Special: hamburger steak with onion gravy. Entrees: corned beef, cabbage and new potatoes, chicken and dumplings, meat ravioli, French dip sandwich. Soup: broccoli cheese and rice. Vegetables: navy beans, cabbage, cauliflower, green beans.

Friday

Cafeteria menu — Special: tuna noodle casserole. Entrees: deviled crabs, broiled pollock, liver and onions, broiled chicken with peach half, Reuben sandwich. Soup: seafood gumbo. Vegetables: Italian green beans, cauliflower au gratin, steamed rice, vegetable sticks.

Monday

Space Society meets — The Clear Lake Area Chapter of the National Space Society will meet at 7 p.m. July 12 at the Freeman Memorial Library. For more information, contact Marianne Dyson at 486-4747.

Cafeteria menu — Special: Italian outlet. Entrees: barbecue beef, spare ribs with kraut, steamed pollock, French dip sandwich. Soup: black bean and rice. Vegetables: California mix, okra and tomatoes, vegetable sticks, ranch style beans.

July 14

Freedom Fighters meet — The Space Station Freedom Fighters will meet at noon and 5 p.m. July 14 in Rm. 160 at the McDonnell Douglas Tower. For more information, call David Cochran at 482-7005.

July 20

TSP briefing — A briefing on the Thrift Savings Plan is scheduled for 9:30 a.m. July 20 in Bldg. 45, Rm. 119. Open season for TSP runs from May 15-July 31. For more information, call the Employee Services Section at x32681.

July 28

Freedom Fighters meet — The Space Station Freedom Fighters will meet at noon and 5 p.m. July 28 in Rm. 160 at the McDonnell Douglas Tower. For more information, call David Cochran at 482-7005.

Aug. 1

Call for papers — Space 94: Engineering, Construction and Operations in Space and its co-located conference, Robotics for Challenging Environments are seeking papers for the Feb. 26-March 3 gathering. Organized by the American Society of Civil Engineers, the conference will accept abstracts of draft papers for peer review until Aug. 1. For more information, call 1-800-SPACE94 or Stewart Johnson at 505-848-4013.

Aug. 4

SOAR '93 — JSC will host the seventh annual Space Operations, Applications and Research Symposium and Exhibition Aug. 3-5 at the Gilruth Center. Keynote speakers will be Gregory Reck, acting NASA associate administrator for advanced concepts and technology, and Dr. Earl Good, director of geophysics at the Air Force's Phillips Laboratory. For more information, call Chris Orates at x31904, Carla Armstrong at x39071, or Dick Rogers at x48476.

Aug. 10

Blood drive — Loral will sponsor a blood drive from 8:30-11:30 a.m. Aug. 10-18 at 1322 Space Park Dr. For more information, contact Ed Bareka at 335-5023.

Miscellaneous

Weight bench, \$15; chain link fence stretch, \$10; 8x4 3/8" plywood sheets, \$10/ea; timing lite; compression tester, \$15; tv/VCR cart, \$30; antique sewing machine w/glass top tbl, \$90; arched chrome glass shelf, \$140; horizontal book shelf, \$45. 334-2335.

5' x 8' Lo-Boy trlr, \$400. x39034 or 474-2660.

Stereo sys, AM/FM, turntable, w/spkrs, \$50; motorcycle helmet, \$20; space heater, \$10; wide slice toaster, \$10; oak cab w/tile top, \$50; 16 pc stoneware set, \$15. 326-3359.

Igloos style doghouse, lg sz, \$50; round dog bed w/cover, cedar-filled, \$30. 482-5173.

Spaulding exec golf clubs, irons, 3-pw, ping 2 iron, \$75; student desk, \$10; man's 10 spd bike, \$25; boy's bike motorcross helmet, free. Steve, x37626.

Woman's ice skates, sz 6.5, blades not set, \$100. Karen, x37389 or 992-3783.

Nordic Track Pro, good cond, \$300. Chrystal, 333-2263.

US stamp collection, 25 sheets of 8 cents mint commem, \$110. Jeff, 333-7010 or 482-5393.

DP Airgometer sprint exerc bike, \$150; '76 Marvel Comics Spider-Man wrist watch, \$125. 333-6943 or 490-948-3039.

Ping pong tbl, adjusts for solo play, \$60 or trade for card tbl. 474-3667.

Century car seat, \$40; portacrib w/matt, \$30; high chair, \$30; 1 pnk, sz 7; 1 blue-grn, sz 9, 1 peach, sz 9 formal dresses; elec train, \$20. 212-1320 or 486-7621.

Iron cycle ramp, \$35; 26 gal fish tank w/2 pwr heads, lid, lt, \$40. Mace, x47984 or 332-7092.

Small one drwr metal cab, \$10; lt flashing sign, \$20; heavy duty G.I. gas can, \$7; shop vac, \$20; 25# portable scale, \$7; stool, \$6. 488-5564.

Four new tires, mounted, balanced, rally wheels, 32.5 x 10 off road tread, fits Chevy 6 lug, 15", \$350. Rogers, x38851 or 944-7042.

Cannon Typewriter 6 elec typewriter, portable, case, extras, \$90. 282-6432 or 796-1833.

Roadmaster treadmill 550, scan program, time, distance, spd, calorie count, \$150; 10 spd 24" boys bike, \$30. x36529 or 538-1497.

14 x 7" chrome spoke wheels, fits early 5 hole Mercedes, \$400 OBO. 280-4681 or 480-5479.

Wedding gown/veil, all silk, fitted beaded bodice w/chapel length train, puff short sleeves, sz 12, was \$1.6k, now \$850. Jenny, 474-7370.

Singer sewing machine, stylist special zigzag, model 418, w/fashion and flexi-stitch discs, \$85. Linda, x31352 or 409-945-3501.

Rdtrip Southwest airline tickets, anywhere, \$175, expires 7-30-93. Ann, 486-0638.

Shark fishing rig, trophy 110 lb custom rod, #14 penn reel, \$350; sport shimping trowl net, \$150 OBO. x37464 or 337-1470.

Tunturi exercise cycle, computer readout, \$175. x34637 or 559-2858.

Elec hospital bed, \$800. Dan, x32533 or 393-3213.

5 copies of Death of Superman, newstand first printing, \$8/ea; 2 copies of Adventures of Superman 500, \$5/ea. Ron, x30887.

Infant clothes, some new, infant carrier, ex cond. Valerie, x49691.

Musical Instruments

Yamaha PSR 90 disc capable kybd, foot pedal, stand incl, \$300. x39034 or 474-2660.

Fender 12 str acoustic, \$250; engraved bass, \$300; Gibson explorer, \$400; all with cases, prices nego. David, 334-6737.

Guild acoustic guitar w/hard case, 6 string, ex cond, \$450. x39814 or 480-7338.

Kimball organ, "Entertainer II", best offer, x38976 or 409-925-5991.

Household

Mitsubishi lg screen tv, 45", stereo, all features/options, was \$3.3k, now \$1.6k or trade for working car. 488-0345.

Dining tbl, rattan, glass, 4 chairs, good cond, \$145. 326-5150.

Kg sz waterbed, dk pedestal, bookcase/hdbd, semi-motionless, heater, padded rails/bedding, \$275; matching chest of drws, dresser/mirror, \$250. 998-8090.

Baby crib w/matt, maple finish, ex cond, \$150. 333-6198 or 532-2163.

2 nonmatching sofas, \$50/ea. Karen, x37389 or 992-3783.

2 LR chairs, traditional, brwn, \$65; 1 tortise shell hanging lamp, \$20. x33640.

Two 5 shelf bookcases, good cond, \$30/ea. Chrystal, 333-2263.

Dinettes set, heavy glass top tbl, chrome legs, 4 chairs, \$175; child's wagon, \$30; tv tbl or for microwave, \$10; peruvian rug, \$50; pair of cushioned chairs, \$60. 488-5564.

5 pc master BR set, oak qn bed, 2 nites-tands, lg dresser w/mirror, armoire, \$850; 4 pc girls BR set, twin bed, dresser, mirror, chest w/hutch/nitstand, \$500. 333-6246 or 480-3986.

Twin sz Balloons & Confetti comforter/sheet set, primary colors, white pillowcase, \$25; apt sz portable washing machine, connects to kitchen sink, was \$400, now \$200; dk wood-frame couch w/brwn tweed cushions, \$75; 2 matching tan chairs w/matching ottoman, \$100/set. x35188.

Wards refig, frostfree, water/ice front door, icecream maker, \$150; Maytag lg cap washer, gas dryer, ex cond, \$150/ea. Joe, 335-2506 or 335-1812.

Kenmore microwave, \$30; Kenmore elec dryer, needs belt, \$25; GE VCR, needs play head, \$20. Bill, 489-9312.

Rectangle oak coffee tbl, \$175; lg wood papasan chair w/flower print, cushion, \$30. x36529 or 992-1907.

Desk w/attached typing tbl, matching bookcase, \$90; twin sz futon w/frame, \$50; dining rm tbl, \$75. Mike or Jenny, x39147 or 474-7370.

Oreck XL 9300G commercial vacuum cleaner, high spd upright, 3 yrs left on warr, ex cond, \$150 OBO. Bob or Anne, 488-7036.

Polished brass tbl lamp, off-wht pleated shade, \$30; brass floor lamp, \$10. Shawn, 472-7526.

Two twin beds, fbds, hdbds, frames, matt, comforters, ex cond, \$100/ea; stairstepper, \$50. 660-9526.

Brwn sofa, you pick up, \$20. James, x36222 or 481-8077.

19 cu ft refig, \$220; microwave, \$60, both for \$250. 538-1887.

Wanted

Want direct drive turntable. x33640 or 486-2414.

Want other '93 Renaissance Fest entertainers to start CLC area carpool for all rehearsals/performances starting 8-7. Nancy, x36795 or 474-3581.

Want motorcycle helmet for dirt bike, full face type. Andy, 332-9105.

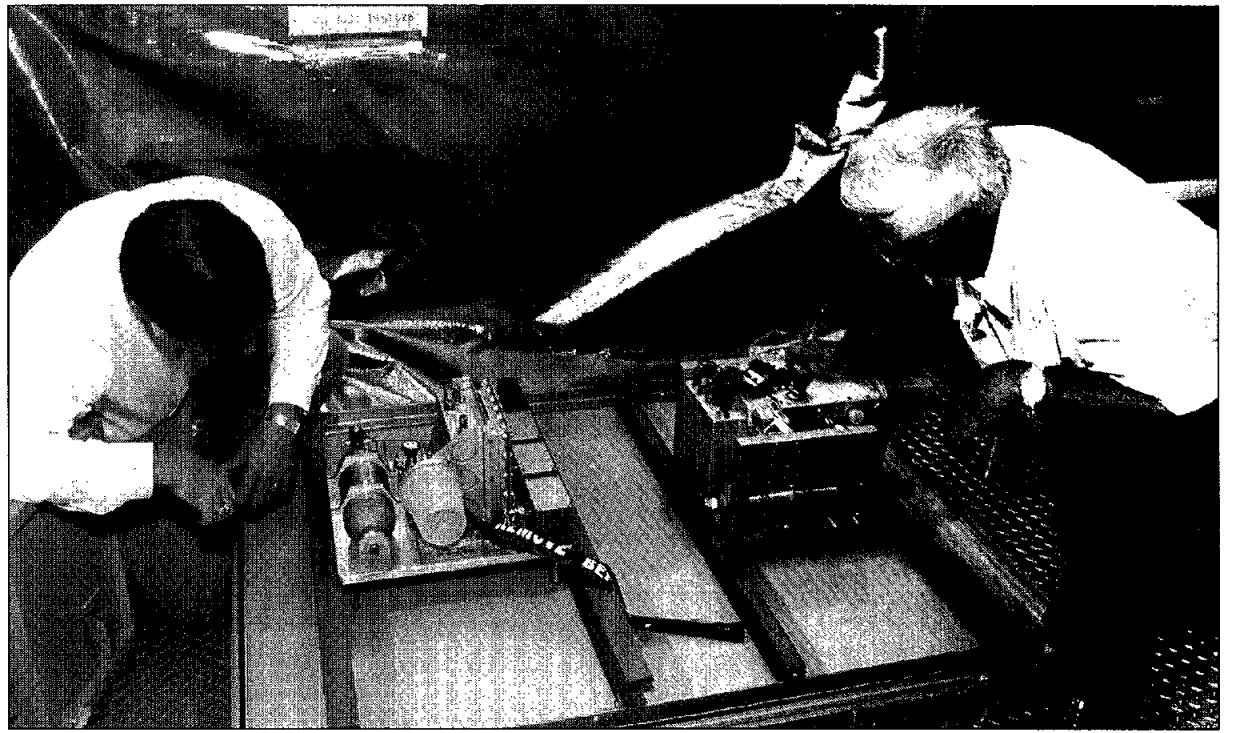
Want VPSI vanpool leaving Meyerland Park/Ride to JSC, 7:05 a.m. Looking for 6 to 8 people. T. Moebes, x45765 or D. Pipkins, x35346.

Want childrens educational software for Amiga computer. x35145.

Want to contact other individuals caught at the Saturn speed trap. Don, x47667.

Current Research

JSC researchers evaluate electrodynamic tether system that holds promise for power management, propulsion



NASA Photo

Kennedy Space Center's Gene Parker, left, launch complex support engineer for the Plasma Motor Generator, and JSC's Bob Weggemann, Lockheed test engineer for the project, inspect the experiment's near and far-end packages before launch.

By Kari Fluegel

Tests of a system that would efficiently built an electrical bridge from a spacecraft top the ionosphere were successful this weekend when JSC's Plasma Motor Generator took to orbit.

A Delta II rocket carrying an Air Force Navstar Global Positioning Satellite as its primary payload and the PMG as a secondary payload was launched from Florida at 8:27 a.m. CDT June 26. Twenty-five minutes later the Delta's third stage carrying the GPS left the second stage carrying the PMG in an 103 by 467 nautical mile orbit, and the electrodynamic tether experiment began.

"We are extremely pleased," said Principal Investigator James McCoy of JSC's Space Science Branch. "It went very well. We achieved everything we hoped we would. Our results went well beyond our primary requirements."

Second in Series

The Plasma Motor Generator is the second in a series of three Delta-launched tether application payloads that are part of the Flight Demonstration Program sponsored by the Office of Space System Development. It was designed to assess the effectiveness of using hollow cathode assemblies to produce an ionized gas that will "ground" electrical currents by discharging the energy to space.

All of the flights were part of the Flight Demonstration Program sponsored by NASA's Office of Space System Development.

The PMG project manager was Christine O'Neill of JSC. Suzanne Sawyer served as project engineer and John Stanley was the project manager for

ground-based measurements. The co-investigator team included Dr. M. Grossi of the Smithsonian Astrophysical Observatory, Dr. M. Dobrowolny of IFSI of Italy; Dr. R. Chris Olsen of the University of Alabama, and Dr. R. Jerry Jost of System Planning Corp.

McCoy said a spacecraft can build up an electrical charge while moving in orbit, either due to natural phenomena or due to operation of high power electrical devices on the spacecraft. Typically, electrical build up is not seen with the shuttle in low-Earth orbit. It is, however, seen among

satellites in geosynchronous orbit that are exposed to magnetic storms from solar events. Charging also can occur with large spacecraft using high power electrical loads such as a space station or high voltage experimental systems.

In all such cases, the electrical charge buildup is due to an imbalance between electron or ion currents reaching the spacecraft from its surrounding space environment and the total current leaving the spacecraft due to operation of electrical devices, McCoy said. To eliminate this charge build up, the spacecraft needs to complete an additional circuit path between itself and the surrounding environment (the

ionosphere), thereby "grounding" itself to the ionosphere.

Earth as a Magnet

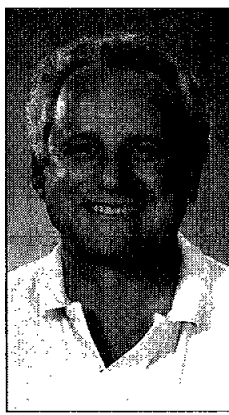
PMG and its 1,600-foot electrodynamic tether were designed to produce this kind of charge in a strong and controllable manner so that it could be studied and better understood, McCoy said. As well as testing the plasma contactors, this system allowed the team to study the behavior of a new electrodynamic tether system capable of much higher current levels than previous experiments. "In order to

understand the operation of an electrodynamic tether system, the Earth can be thought of as a giant magnet, a principle used for direction-finding with a magnetic compass," he said.

If a copper wire is placed in orbit around

By using a fraction of a space platform's power output, you could save tons of rocket propellant for orbit maintenance or maneuvering.

—Jim McCoy,
Plasma Motor Generator
principal investigator



the Earth, it will move through the Earth's magnetic field and a voltage will be induced in the wire. The wire will function like the armature in an electrical generator or motor, and the Earth itself will act as the magnetic pole-piece and frame against which the resulting forces on the "armature" wire react. If an electric current is allowed to flow through the tether wire by grounding it to space at both ends, the wire conductor will experience a mechanical force. This force can be either thrust or drag, depending on the direction of the current flow.

PMG is designed to demonstrate a good bi-polar electrical contact with the ionosphere. The PMG also seeks to demonstrate the theoretical prediction that electrical power can be generated, and that thrust can be induced.

Power for Propulsion

The application of this technology could help lengthen the lives of future long-duration spacecraft and become a significant source of power for experiments or propulsion, McCoy said.

"For space station, they need to keep their power system grounded accurately so they won't bombard the surface of the station with atomic oxygen ions. That would degrade the surface coatings much more quickly, and could reduce the lifetime of critical surfaces on the station," McCoy said. "Beyond space station, when we're working in orbit on a routine basis, the electrodynamic propulsion capabilities of a high current tether have to become very important.

"This experiment validates some studies we have sponsored that indicate high power tether systems could be used not only for power management, but also for on-orbit propulsion. By using a fraction of a space platform's power output, you could save tons of rocket propellant for orbit maintenance or maneuvering."

The PMG's mission began shortly after

the Delta's third stage separated to take the GPS to its semisynchronous orbit leaving the second stage behind. At that point, the power and telemetry units of the Delta's second stage were controlled by the experiment sequencer. A spring ejected the 60-pound Far End Package on an electrodynamic tether wire which spooled out trailing the little "spacecraft" to a distance of about 1,600 feet. The Near End Package stayed fixed to the rocket body and used the stage's remaining power for the experiment.

The deployment device was developed by JSC and Tether Applications Inc. The deployer, which weighed only 25 pounds, used a passive "spinning reel" concept with no moving parts.

McCoy said the system deployed fully in the time expected and that no "rebound," or springing back of the system, was seen. Radar measurements from the ground confirmed that the two packages were separated by more than 400 meters.

Before releasing the Far End Package, plasma contactors were energized to release the ionized xenon gas from 1/4 inch diameter cathode tubes on each of the packages. The gas then created a plasma ball, a pocket of ionized gas, that served as the "ground" for electrical charges carried through the tether.

Charge Collected

The Far End Package collected an electrical charge of about a third of an amp as it moved through space, McCoy said.

"We had hoped for a current in the range of one-tenth of an amp to an amp," he said. "This was right in the middle of our estimates."

After it was collected, the charge moved through the tether to the Near End Package which allowed it to dissipate into space.

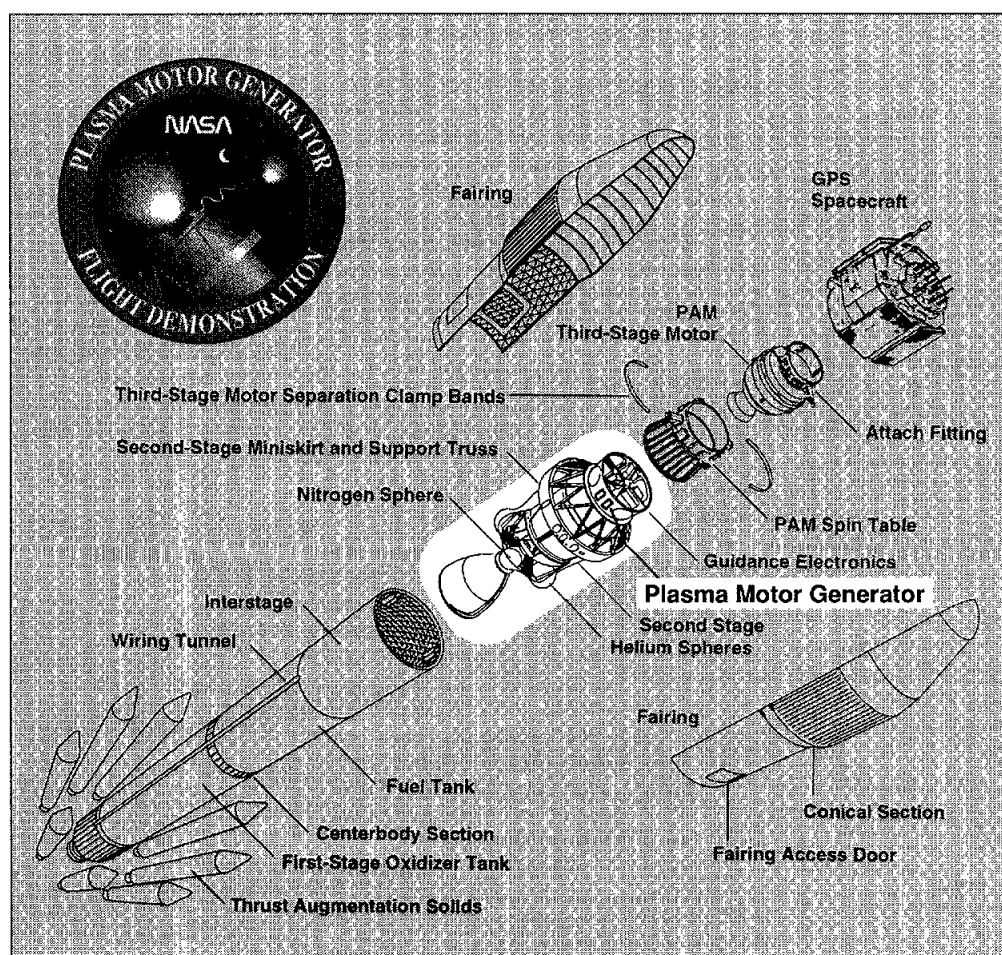
A series of tests was conducted to better understand the performance of the hollow cathode tubes. During "motor" operations, the direction of current flow was reversed to collect a charge at the Near End Package and release it at the Far End Package.

Though the complete telemetry has not been received by the investigators for the tallying of final results, McCoy said the team was successful in using the current to drive the system to change altitudes by about 30 feet in one mode and an estimated 300 feet in another mode.

The experiment lasted only four hours and ended when the rocket stage's battery power was exhausted.

A combination of onboard instrumentation and ground-based sensors was used to evaluate the performance of the flight demonstration. Observations from about 10 ground-based radars, magnetometers and optical sensors provided independent evaluations of the overall PMG performance from both the dynamics and plasma interaction standpoints.

NASA's Lewis Research Center in Cleveland provided for the Plasma Diagnostics Package and Marshall Space Flight Center provided the Small Expendable Deployer System electronic box. Goddard Space Flight Center integrated the PMG into the Delta II. □



Recorders recover data from shuttle's atmospheric laboratory

Important ozone data was saved by a new tape recorder during an April's Atmospheric Laboratory for Applications and Science-2 mission.

Despite transmitting problems, the Atmospheric Trace Molecule Spectroscopy instrument's on-board data recovery system captured 103 orbital sunrises and sunsets, measuring up to 40 gases that affect global ozone levels.

On STS-56, the Space Shuttle *Discovery* followed an orbital path that allowed ATMOS to measure the gases over high northern latitudes during the early spring, when the atmosphere was changing from winter to summer circulation patterns. These circulation patterns affect the weather conditions that can lead to

ozone depletion.

During the flight, the shuttle's telemetry system, which would have transmitted ATMOS data to the ground during flight, ran into problems. ATMOS/Spacelab controllers and the shuttle flight team developed a plan that allowed the Spacelab's high data rate recorder to record some data on the orbiter data system and transmit it at a reduced rate. Unfortunately the data included some errors, project officials said, rendering most of it useless.

The ATMOS team was able to rely on its recorder subsystem, a separate, dedicated data recording system that uses a

tape recorder manufactured by Schlumberger Industries, a French company. The recorder saved the atmospheric observations, said ATMOS Assistant Project Manager Greg Goodson. The data tape was played back for the first time in early June at NASA's Jet Propulsion Laboratory, Pasadena, Calif., and scientists found the data's quality to be excellent.

ATMOS has flown aboard the shuttle two other times but the April flight, designated STS-56, was an engineering test flight for the ATMOS recorder subsystem. The new recorder subsystem, which has a 44-gigabyte

(353 billion bits) storage capacity, recorded more than half of the scheduled ATMOS observations — nearly 6-1/2 hours of data. Results of the data analysis, which is already under way, are expected to be published within the year, Goodson said. The results will present a better understanding of the gases that damage the ozone layer.

The ATLAS series, which began in 1992, is part of NASA's Mission to Planet Earth, which uses the unique global perspective available from space to study how the environment changes. The ATLAS instruments observe the chemical makeup of the atmosphere and the energy output of the Sun, two of the key factors in the creation and depletion of ozone.



Space station redesign plan details eyed

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taxpayers while preserving critical research and ensuring international cooperation and technology development.

The Clinton administration plans to work with Congress, NASA and America's international partners during the next 90 days to make the best use of the simplified design, which is expected to cost about \$18 billion less than the previous design over the projected two-decade life of the program.

Vice President Al Gore and his National Performance Review team also will continue work with NASA to develop management changes.

It was the second time in a week that space station supporters had defeated station-killing amendments to Veterans Affairs, Housing and Urban Development and Independent Agencies spending measures. The House voted last week to authorize spending by a margin of only one vote.



TANGLED WEB — Co-workers in Engineering's Propulsion and Power Division welcome back division chief Chet Vaughan with a cobweb-decorated office. Vaughan had just completed a three-month assignment at NASA Headquarters leading the development of Option C in the space station redesign effort. From left are Chris Brown, Vaughan, Marian Gordner, Ralph Taeuber and Rex Delventhal. Delventhal is holding a plant that died during Vaughan's absence.

JSC Photo by Mark Sowa

Endeavour crew brings home commercial bacon

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two space walkers to slightly abbreviate their development test objectives, which are designed to give astronauts, flight controllers and extravehicular activity planners more experience working in space.

Low and Wisoff reported that mass handling and mass fine alignment were much easier with the use of the portable foot restraint attached to *Endeavour's* robot arm. That information was expected to be valuable to planners of the Hubble revisit mission, which is scheduled to include a record five space walks.

The crew also worked with 13 commercial materials processing and biotechnology experiments in the new Spacehab module.

Five of the investigations involving biotechnology and human factors, including the first on-orbit growth of cells in a rotating wall bioreactor, were sponsored by JSC researchers.

The pressurized Spacehab module quadruples the work space for crew-tended experiments. By increasing access, NASA is supporting the commercial devel-

opment of space so that private sector researchers can test and evaluate processing techniques in the microgravity environment.

Sherlock grew bacteria in the Bioserve Pilot Laboratory in the Spacehab, Voss studied the growth of highly pure crystals via a "floating zone" method with the Liquid Encapsulated Melt Zone experiment, and Duffy soldered and desoldered several electrical connections at a special workbench in the Spacehab, the first time such an operation had been attempted by Americans in microgravity.

An impromptu plumbing job by Sherlock was unable to bring the space station experiment, called Environmental Control and Life Support System Flight experiment, into operation. EFE was stricken by a partial filter clog and flight controllers decided not to spend any more time working on the water recycling project after five hours of in-flight maintenance still left some leaks in the system.

In between the engine burns needed to rendezvous *Endeavour* with EURECA, Grabe also flipped the shuttle end over end for a test run with the Superfluid

Helium On-Orbit Transfer experiment which is mounted on a platform in the cargo bay. The somersaults, the fastest taking about two minutes to complete, were designed to slosh the helium in the SHOOT tanks so engineers on the ground could study the effects.

SHOOT studied technology that may one day be used to refill satellite-mounted telescopes with liquid helium, used for cooling of some instruments. For the experiment, superfluid helium, the coldest substance known to man at almost absolute zero or minus 459 degrees Fahrenheit, was transferred between two tanks.

Sherlock reported getting some excellent photography of the Bahama Islands for the CAN-DO project, a student experiment mounted in Get-Away Special canisters in the cargo bay.

Students in the Charleston County School District, South Carolina, assembled the experiment that featured a camera to take more than a thousand photographs of Earth, which will be compared with photos taken during the Skylab missions for studies of how the environment has changed over the years.

Managers set July 17 target for *Discovery*

Shuttle managers Thursday set July 17 as the target date for launch of the Space Shuttle *Discovery* on the STS-51 mission.

If all goes as schedule, launch will be at 8:22 a.m. CDT. A 1 hour, 22 minute launch window is being driven by lighting conditions necessary for deployment of the Advanced Communications Technology Satellite and its transfer orbit stage.

The managers met with the crew—Commander Frank Culbertson, Pilot Bill Readdy and Mission Specialists Dan Bursch, Jim Newman and Carl Walz—were in *Discovery's* cockpit on Launch Pad 39B, participating in the terminal demonstration countdown test.

Discovery also will carry the Orbiting and Retrievable Far and Extreme Ultraviolet Satellite into orbit.

Amazon deforestation threatens edge species

Tropical deforestation and adverse effects on tropical forest habitat have increased in the Brazilian Amazon Basin since the late 1970s, a University of New Hampshire—NASA study has revealed.

Data from the Landsat-4 and -5 satellites covering 1978-88 indicate that although the extent of deforestation is less than expected, deforestation has increased substantially and created adverse "edge effects" that pose a substantial threat to the habitat of plant and animal species.

The study indicates that between 1978 and 1988, the rate of deforestation in the Brazilian Amazon Basin was 6,000 square miles (15,000 square kilometers) per year. Results of the study, conducted at Goddard Space Flight Center and the University of New Hampshire, Durham, was published in the June 25 issue of *Science* magazine.

"We are seeing less deforestation than had been expected," said David Skole, Ph.D., a research assistant professor with the Institute for the Study of Earth, Oceans and Space at the University of New Hampshire. Skole is the lead author of the *Science* paper. "Our study helps clarify actual greenhouse gas emissions, such as carbon dioxide, resulting from tropical deforestation."

"Although we found lower deforestation than previously estimated, the effect upon biological diversity is greater," said Compton Tucker, Ph.D., a research scientist in the Laboratory for Terrestrial Physics at Goddard. Tucker was co-author on the paper.

Skole and Tucker studied more than 200 Landsat satellite images, covering the entire forested portion of the Brazilian Amazon Basin. Using Landsat images and a computerized geographic information system, they made specific measurements of deforestation, fragmented forest and edge effects. A fragmented forest is forest surrounded by deforested area. "Edge effects" are the destruction or degradation of natural habitat that occur on the fringes of fragmented forests. These effects include greater exposure to wind, weather, foraging livestock, other non-forest animals and humans.

Daily news sheet arrives

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Novell network may receive the SFR on their computer printers automatically every morning between 8:30 and 9 a.m. Organizations that would like to begin receiving the SFR should send the name of the server being used, the names of the print queues the SFR is to be printed on (one per branch) and the type of printer attached to that queue to Kelly Humphries at AP3 or fax number 244-5165. Each server's GUEST account will need to be active, but with rights only to create a file in the designated print queue.

Off-site contractors and organizations that are not on the JIN may receive the SFR via fax, simply by sending their fax numbers to Humphries at mail code AP3. For more information, call 244-5050.

Workshop gives improvement tips

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the processes are and how they function.

The hands-on portion of the workshop was conducted by Peter Lange, senior consultant for KPMG Peat Marwick. Lange asserted that prioritizing is the key to successful implementation of processes.

"We want to look at those areas that have a lot of room for improvement and work on them first," Lange explained. "It's important to find out where you can most effectively spend your resources."

Lange asked participants to fill out a worksheet designed to help them set the criteria with which to determine priorities. "It's important to have criteria that can help you establish priorities," said Lange.

A panel of speakers participated in an interactive discussion with participants: Truda Stevens, manager of quality engineering at CAE-Link; Glenn Freedman, associate vice president for institutional advancement at the University of Houston; and Mark Morgan, man-

ager of quality and productivity improvement at Grumman.

The panel discussed issues such as determining how an organization interfaces with customers and whether this improves the process quality, develops a shared terminology and understands what is meant by "process." JSC Deputy Comptroller Clyde Lowmore also emphasized the value of flow charts and suggested that organizations make process identification a group activity.

Three JSC speakers discussed NASA team initiatives: Joe Maloy, of the engineering directorate; Aldo Bordano and Stephen Lamkin, of the navigation control and aeronautics division. They touched on issues such as the need to have small teams, getting them to agree on their approach to flow charting, documenting the steps in every process and using flow charts to identify problems such as redundancy, overlaps and gaps.

Future workshops are scheduled to take place at three-month intervals.

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