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

Pneumatic news

JSC engineers are looking at ways to use pressurized air to move mountains on the Moon. Story on Page 3.

Pilot to pilot

The Air Force's Thunderbirds take time out from their air show performances to visit JSC astronauts. Photo on Page 4.

Space News Roundup

Vol. 30 | November 1, 1991 | No. 43

Truly sees belt tightening, restraint

But money crunch won't stop NASA's space accomplishments

By Kelly Humphries

The next several years will be a time of belt tightening, tough management and restraint, but space supporters should remember that NASA's greatest mission is just around the corner, NASA Administrator Richard Truly said Tuesday in League City.

Addressing participants at Space Exploration '91, the NASA Alumni League-sponsored conference and exhibition, Truly said that tight budgets for space exploration will continue in the near term because of a national money crunch of major proportions.

"But at the same time, you will be seeing enormous accomplishment in space, as the projects already launched or on the pad begin to return data, and the space station begins to take shape," he said. "There is the potential for information that will upset hallowed scientific theories and change our perspective of the universe."

In spite of Congress' determination to reduce the federal deficit, lower revenues because of economic conditions, skyrocketing domestic social needs and intense funding competition among competing social programs, NASA did very well in the most recent budget debate. The agency received a 3 percent increase, which did not keep up with inflation, and word that more of the same is on the horizon. But that, he said, was much better than other agencies that suffered reductions and can look forward to severe contraction.

"It is clear that congressional demands on NASA for stellar management and performance by NASA were never greater," Truly said. "Our projects must be on time and within budget. We must be more convincing about the payoffs we envision. We must demonstrate clear-cut links between proposals and objectives."

Truly said that many organizational changes have been made following the report of the National Advisory Committee on the Future of the U.S. Space Program, but that "NASA will

Please see **EXPO**, Page 4

Galileo snaps first close-ups of an asteroid

By Kyle Herring

The Galileo spacecraft took 150 photographs of the asteroid Gaspra from just 1,000 miles away Wednesday as was planned prior to the spacecraft's launch aboard *Atlantis* in October 1989.

"For the first time, we will be able to see features on the surface of an asteroid," said Project Manager Bill O'Neil.

The images collected by the spacecraft should provide scientists the first close-up look at material believed to be a remnant of that which formed the planets of the solar system.

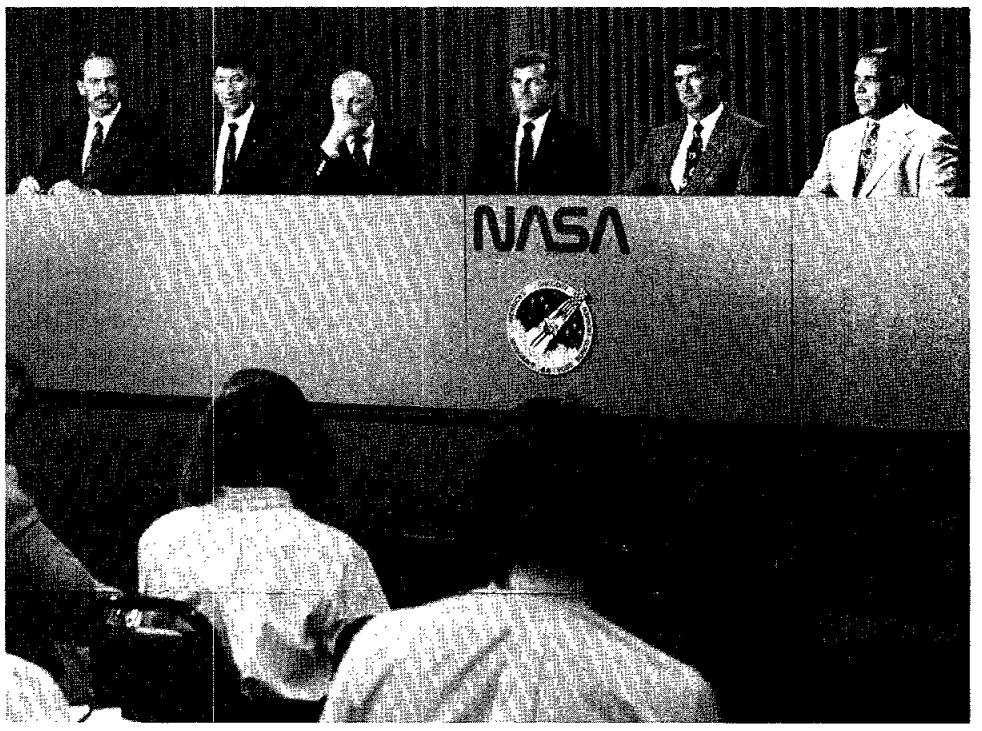
"We're interested (in studying asteroids) because they represent our best shot at looking at the types of things that went into putting planets together back at that period of time," said Torrence Johnson, chief scientist for the Galileo project.

"We scored a perfect bull's eye," according to Mission Director Neal Ausman, referring to the precise course corrections made in early October putting the spacecraft on the exact course to intercept the oblong asteroid.

The encounter was closely monitored by flight controllers at NASA's Jet Propulsion Laboratory as they watched data showing the camera shutter was working properly.

Data and photographs were stored onboard Galileo and will be transmitted back to Earth when the high gain antenna is completely unfurled in December or when the spacecraft makes its final gravity assist flyby of Earth late next year. The antenna has not opened fully due to three stuck locking pins.

Galileo is 256 million miles from Earth traveling 35,000 mph on its complex course to its final destination — Jupiter — in 1995.



JSC Photo by Benny Benavides

The STS-44 crew meets the press in Bldg. 2 on Monday. From left are Paylod Specialist Tom Hennen, Mission Specialists Mario Runco Jr., Story Musgrave and Jim Voss, Pilot Tom Henricks and Commander Fred Gregory. The unclassified 10-day Department of Defense mission is tentatively scheduled for launch on Nov. 19.

Bags packed, *Atlantis* nearly ready to hit road in November

By James Hartsfield

With the curtain call of a final rehearsal countdown today, the stage is set for *Atlantis*' launch on the 44th space shuttle flight on Nov. 19.

The STS-44 crew — Commander Fred Gregory, Pilot Tom Henricks, Mission Specialists Jim Voss, Story Musgrave and Mario Runco Jr., and Payload Specialist Tom Hennen — traveled to Kennedy Space Center on Halloween for the countdown rehearsal and will return to JSC today.

The prime cargo for STS-44, the Defense Support Program satellite, was loaded into the payload bay on Thursday. With bags packed, the remaining work on *Atlantis* consists of final fueling of various systems, final checkouts and a general battening down of the hatches for its trip to orbit. Shuttle managers are planning to meet Thursday and Friday at KSC for a final review of all preparations for the mission. An official launch target date is expected to be announced at the conclusion of that meeting.

In other work at Launch Pad 39A this week, hypergolic propellants, fuels that ignite when they contact one another, were loaded into the fuel tanks of *Atlantis*' orbital propulsion systems. The pad was cleared of all nonessential personnel through Wednesday for the fueling operations.

At the same time, hydrazine was loaded into the fuel tanks for *Atlantis*' auxiliary power units,

Please see ***ATLANTIS***, Page 4

'Great crew' looks forward to open flight

By Kelly Humphries

STS-44 Commander Fred Gregory said Monday he is expecially excited about the upcoming military mission because it won't be classified.

"On my last mission, which was STS-33, it was totally classified and I couldn't even wave to my wife on Earth," said Gregory, who will be commanding his second flight and making his third.

"We have a great crew," he added. "We've been training now for about a year. I think at this point, we're fully prepared to go and not only accomplish all the mission, but also enjoy ourselves at the same time."

Atlantis is scheduled to lift off at 5:51 p.m. CST Nov. 19 from Launch Pad 39A and roar due east into a 195 nautical mile orbit. Shortly after midnight, Mission Specialist Jim Voss will deploy the Defense Support Program satellite, an infrared telescope that will be used to detect real-time missile launches, space launches and nuclear detonations. A two-stage solid rocket inertial upper stage will then boost DSP to its prescribed orbit.

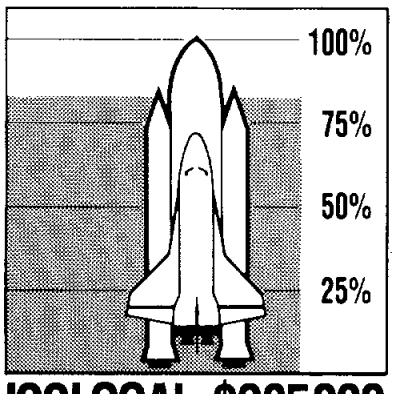
During the 9 day, 19 hour mission, *Atlantis* will serve as a platform for several other DOD experiments, including Terra Scout, an earth observation system used to visually detect and characterize targets on Earth from orbit, and Military Man in Space (M88-1), a collection of special optics and communication equipment to check the ability of orbiting observers to enhance military land, sea and air operations.

The orbiter also will serve as a laboratory for medical evaluations relating to space adaptation, including cardiac rhythm abnormalities, cardiovascular response during launch and landing, visual and balance interaction studies, aerobic exercise, head and gaze stability and fluid shifts.

"This flight presents itself in a good fashion to think seriously about some of the extended duration orbiter concerns we might have," said Lead Flight Director Milt Heflin. In addition to medical concerns, new food packages and an improved trash compactor will be tested.

Pilot Tom Henricks, making his first flight, will assist Gregory during launch and landing and work with

Please see **STS-44**, Page 4



1991 GOAL: $385,000

CFC

Next week, JSC hosts eighth NASA/Contractors Conference

The winners of the 1991 George M. Low Trophy for quality and excellence will be announced next week in Houston at the eighth annual NASA/Contractors Conference and National Symposium on Quality and Productivity.

The conference, hosted by JSC, convenes Wednesday and Thursday at the George R. Brown Convention Center. Some sessions will be broadcast live on NASA Select Television.

Wednesday's featured speakers will include NASA Administrator Richard Truly, at 8 a.m., and Dr. Renso L. Caporali, chairman of Grumman Corp., at noon.

Truly and Robert Caine, president of the American Society for Quality Control, will present the Low Trophy at the NASA Quality and Excellence Award Banquet at 7:30 p.m. Wednesday.

Five of the finalists for the 1991 Low Trophy hold JSC contracts: Computer Sciences Corp.'s Applied Technology Division and Unisys Space Systems Division, both of Houston; Honeywell's Space and Strategic Systems Operation, Clearwater, Fla.; TRW's Space & Technology Group, Redondo Beach, Calif.; and Cray Research Inc., Chippeway Falls, Wis.

Thursday's featured speakers will include Dr. Tor Dahl, president of Tor Dahl and Associates, at 7:15 a.m.; and Jim "Mac" McIngvale, president of Houston's Gallery Furniture Co., at 11:30 p.m.

JSC Photo by Jack Jacob

BACK TO WORK — Back from this year's International Space University in France, three students from JSC present Director Aaron Cohen with their group's study of an international Mars mission. From left are Rick Davis, Andy Petro, Cohen, and Steve Elsner.

JSC

Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Gift Store from 10 a.m.-2 p.m. weekdays.

General Cinema (valid for one year): $4.

AMC Theater (valid until May 1992): $3.75.

Loews Theater (valid for one year): $4.

Texas Renaissance Festival (9 a.m.-6 p.m. weekends Oct. 5-Nov. 17, Plantersville): child (5-12), $5.55; adult, $9.25.

NASA Night at Delta Downs (Nov. 16-17). Day trip (3:30 p.m.-2:30 a.m., includes transportation and admission to clubhouse): $15. Overnight trip (12:30 p.m.-12:30 p.m., includes transportation, reception at Beaumont Hilton, accommodations, admission, brunch): $50.

Entertainment '92 (coupon book): $26 for FBA members' first book; $27 for all others.

JSC

Gilruth Center News

Defensive driving — Course is offered from 8 a.m.-5 p.m. Dec. 14. Cost is $19.

Aerobic dance — High/low-impact classes meet from 5:15-6:15 p.m. Tuesdays and Thursdays. Cost is $32.

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

Weight safety — Required course for employees wishing to use the Gilruth weight room. The next class will be from 8-9:30 p.m. Nov. 7 and Nov. 21. Cost is $5; preregistration required.

Aikido — Martial arts class meets Tuesdays 6:30-7:30 p.m and Fridays 5:15-6:15 p.m. Cost is $35 per month.

Country and western dance — Six-week course meets Mondays 7-10 p.m. beginning Nov. 4. Cost is $20.

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

JSC

Technical Library News

The following selections are now available in JSC's Technical Library, Bldg. 45, Rm. 100

Workshop on Cosmogenic Nuclide Production Rates. The Institute, 1990. WC793.5.N862 W67 1989.

Limb Darkening Functions as Derived from Along-Track Operation of the ERBE Scanning Radiometers for August 1985. Louis G. Smith, 1990. QC809.T4 S64 1990.

JSC

Dates & Data

Today

Cafeteria menu — Special: tuna and noodle casserole. Entrees: liver and onions, deviled crabs, roast beef with dressing. Soup: seafood gumbo. Vegetables: whipped potatoes, peas, cauliflower.

Monday

Cafeteria menu — Special: breaded cutlet. Entrees: beef chop suey, Polish sausage with potato salad. Soup: French onion. Vegetables: okra and tomatoes, green peas.

Tuesday

Free enterprise lecture — A brown-bag luncheon will discuss "Investment Problems Under Present Economic Conditions" at 11:30 a.m. Nov. 5 in the Lockheed Plaza eighth floor Training Rm. Call Charles Campbell at 333-6107 for more information.

Cafeteria menu — Special: fried chicken. Entrees: Salisbury steak, shrimp Creole. Soup: split pea. Vegetables: mixed vegetables, beets, whipped potatoes.

Wednesday

AIAA meets — The AIAA's Engineering and Management Technical Committee will sponsor a lunch and learn meeting at 11:30 a.m. Nov. 6 in the partitioned area of Bldg. 3 cafeteria's south side. The topic will be the Deming-Taguchi approach to total quality management. Dr. M.S. Rajaram of the University of Houston's Cullen College of Engineering will be the speaker. For more information call Dr. John Hunsucker at 749-2545 or Suzan Voss 483-4841.

Quality, productivity conference — The eighth annual NASA/-Contractors Conference and National Symposium on Quality and Productivity will convene Nov. 6-7 at the George R. Brown Convention Center. The event will address the current strategies in Total Quality Management. Code QB (FTS 453-8415) will act as a point of contact and handle the invitations.

Security technology conference — The first AIS Technology for Space Operations Conference will be co-sponsored by JSC's Mission Operations Directorate, the Information Systems Security Association and the University of Houston-Clear Lake Nov. 6-8 at the Holiday Inn-Hobby. Registration, due by Nov. 1, is $195 for NASA employees. For more information, call Jane Kremer, x32601, or the Software Engineering Professional Education Center, 282-2223.

Cafeteria menu — Special: stuffed bell pepper. Entrees: fried catfish with hush puppies, braised beef rib, barbecue plate, wieners and beans, shrimp salad. Soup: seafood gumbo. Vegetables: corn O'Brian, rice, Italian green beans.

Thursday

IEEE meets — The Galveston Bay Section of the Institute of Electrical and Electronics Engineers will meet at 11:30 a.m. Nov. 7 at the Gilruth Center. Col. Will Stackhouse of NASA's Jet Propulsion Laboratory will discuss technological and industrial erosion in the United States. Lunch reservations, which are $7 for members, $8 for nonmembers and $6 for young members, are due Nov. 4; call Marcia Taylor, x30195.

Cafeteria menu — Special: barbecue smoked link. Entrees: beef Stroganoff, turkey and dressing. Soup: chicken noodle. Vegetables: lima beans, buttered squash, Spanish rice.

Nov. 8

JAS meets — The JSC Astronomical Society will meet at 7:30 p.m. Nov. 8 at the Lunar and Planetary Institute to hear trip reports and see a video of the July solar eclipse viewing in Mexico. An observing session will follow the meeting. For more information, call Eleta Malewitz, 488-1959.

RMS anniversary — A party to celebrate the 10th anniversary of remote manipulator system operations will be held at 5 p.m. Nov. 8 at the Gilruth Center. Tickets are $6. For more information, call Don Pallesen, x30634, or Liz Bains, x31551.

Call for papers — The Canaveral Council of Technical Societies is seeking papers for the 29th Space Congress, scheduled for April 21-24 in Cocoa Beach, Fla. Abstracts of 200 words are being sought by Nov. 8; send abstracts of Astrid Heard, NASA, PT-AST, Kennedy Space Center, Fla., 32899. For more information, call Heard at 407-867-2780.

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

Nov. 12

Free enterprise lecture — A brown-bag luncheon will discuss "Economic Problems" at 11:30 a.m. Nov. 12 in the Lockheed Plaza eighth floor Training Rm. Call Charles Campbell at 333-6107 for more information.

Swap Shop

Swap Shop ads are accepted from current and retired NASA civil service employees and on-site contractor employees. Each ad must be submitted on a separate full-sized, revised JSC Form 1452. Deadline is 5 p.m. every Friday, two weeks before the desired date of publication. 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: Oakbrook on the golf course, 4-2.5-2, 2400 sq ft, both formals, den, $99.9K. 488-1374.

Rent: Heritage Park, 3-2-2, 1700 sq ft, new paint/carpet, $700/mo. Sonny, x38533 or 474-4198.

Rent: Galveston condo, furnished, sleeps six, cable TV, pools, wknd/wkly/dly rates. Magdi Yassa, 333-4760 or 486-0788.

Sale: Pearland, lot in Dixie Hollow Subd, all util. x39530 or 482-5003.

Rent: Baywind II condo, 1-1, W/D, refrig w/ice maker, microwave, new paint/carpet, dishwasher, near pool, $440/mo. Steve, 244-7474 or 486-8047.

Lease: Friendswood, Wedgewood Village, 3-2.5-2, FPL, lg fenced yard, carpet, wet bar, formals, 1800 sq ft, $850/mo, avail 1-1-92; Friendswood, Wedgewood Village, 3-2-2, FPL, lg fenced yard, carpet, formals, 1700 sq ft, $750/mo, avail 12-1-91. 482-6744.

Lease: CL condo, 1-1, corner unit w/balcony, storage rm, near pool, lighted tennis courts/club house, refrig, microwave, dishwasher, W/D, fans, miniblinds, no pets preferred, avail 1-1-92, $375/mo plus dep. 333-6458.

Lease: CLC 3-2.5-2CP, 2 story townhouse, W/D, cable hookups, sm fenced yard, avail 11-4, no pets, $725/mo. 946-7793.

Sale: 55' x 90' canal lot on Tiki Island, $17K. x30220.

Lease: 3-2-2, remodeled, near 45, Fuqua exit, $595/mo. Minh, 333-6806 or Oanh, 484-2456.

Rent: Nassau Bay townhouse, 4-3.5-2, 3200 sq ft, 38 ft boat slip, $1.5K/mo, plus $750 dep. x30852 or 996-0981.

Sale: La Porte, 2 story 3-2.5-1, lg corner lot, assume $506/mo, $10K equity. 474-2660.

Lease: Barringer Knoll, 2-1, new paint, W/D conn, ex cond, no pets, $410/mo. 486-2048.

Rent: Cancun, Mexico, beach front condo, sleeps 4, avail February 1-29, 1992, $650/wk. x37990 or x33185.

Lease: Pipers Meadow, 3-2-2, FPL, wet bar, appli, deck, 1540 sq ft, $795/mo. x31826 or 480-9436.

Sale/Lease: Sun Valley, near Almeda Mall, 3-1.5-2 wht brick, gas built/ins, tile bath/kitchen floors, wood parquet LR/BR, C/A, avail Dec, 1, 1991, $55K or $500/mo. Jim McCoy, x35068.

Sale: LC, Countryside, 2 story, 3-2.5-2A, lg fenced lot, 2 parks, no approval assume, $15K down, $692/mo. 554-7623.

Sale: Property near Livingston, 48 plus acres, 2 houses, stocked fish pond, spring fed creek. (409) 563-4079.

Cars and Trucks

'59 Chevy PU for restoration or parts, good eng, $950; '76 Datsun B210, 2 dr, 4 spd, new eng/trans, $650 OBO. 334-2335.

'90 Chevy Cheyenne ext cab, loaded, 18.9K mi, $11.1K. 282-3215 or 480-9448.

'89 Chevy Cavalier, 4 dr, 4 cyl, auto, AM/FM, A/C, cruise, tilt, wht w/blue int, ex cond, $5K. Bob, x39378 or 332-4756.

'89 Cutlass Sierra, 4 dr, 6 cyl, pwr access, cass, blk w/gray int, ex cond, $7990. 497-6401.

'80 Toyota SR5, AM/FM, A/C, good cond, $1450. x30354 or 480-4160.

'74 VW Super Beetle, fully restored, 28 MPG. $2995. 333-6963.

'89 Ford Probe GT, ex cond, low mi, 6yr/100K mi warranty, $9450. Dan, 280-2780 or 457-2850.

'78 Olds 98, V8, 77K mi, good cond, $750 OBO. x35529 or 484-6056.

'78 Pontiac Grand LeMans, 98K mi, A/C, 4 dr, AM/FM, new tires. Rich, x38519 or 996-7630.

'74 Chrysler Newport, ex cond, 117K mi, $950. Ray, 333-7519 or 554-6252.

'85 Chevy Cavalier, 4 dr, 4 cyl/2.0L, auto, 72K mi, new tires/brakes, ex cond, $2.7K. 488-5522.

'76 Jeep Wagoneer 4x4, new tires, needs work, $650. x32207 or 470-8416.

'87 Chevy Suburban 3/4 ton, 454, white w/blue int, 68K mi, $9.5K. Mike, 333-6821.

'85 Chevy Celebrity wagon, loaded, new A/C, alternator, alignment, tune up. Mike, 664-2433.

'84 Jeep CJ-7, 78K mi, 5 spd, 6 cyl, AM/FM/cass, A/C, hard drs, soft top, maroon, ex cond, $6K. x38170 or 554-2029.

'84 Ford EXP, 5 spd, P/S, P/B, ex cond, $1.6K. 282-2614 or 334-6208.

'82 Ford Granada, 45K mi, new paint, ex cond, $3.2K. 482-1369.

Boats and Planes

Windsurfing equipment. Mark Fraizer, 332-3466.

'86 Southern Skier, 351 PCM I/B, low hrs, new int, stereo, Magnum trlr, $8950. Ralph, x34736 or 772-6506.

18' Prindle, ex cond, $2.5K; 22' 4 Gulf Coast sailboat, ex cond, $2.5K. Greg, x32259 or 474-7634.

Audiovisual & Computers

Audio Sansui AM/FM tuner, $20. 332-2453.

Tandy 1000 TL, 80286 based computer, IBM compatible, 32 MB HD, 3.5 and 5.25 FD, 768KB RAM, CGA moni, joystick, DOS, and Deskmate SW, $500; mouse, $20. Gregg, 338-2379.

Sony portable radio/cass w/detached speakers, AC/DC/batt, was $600, now $100. Chuck, 283-5600 or 538-3273.

Technics 100w rack stereo system, ex cond, $350 OBO; misc stereo equip, Sony, JVC, Yamaha, BO. 280-9461.

Stereo cabinet 24" x 42", dbl glass drs, $60. Mark, x30131 or 488-0056.

Infinity Quantum Jr speakers, 12", 3 way, $200 OBO; Recoton MTS TV stereo decoder, $25; DBX 3BXIII dynamic range expander, $100; Nikko EQ1 12 band equalizer, $50. Jim, 286-1766.

Mac Apple LISA 2/10, 10MB HD, RAM, Imagewriter II printer, SW, complete system, $750. x35384.

286 12 MHz AT Clone, 3.5, 5.25 HD, math coprocessor, EGA moni, 2 parallel and serial ports, Epson RX-80 printer, $750. George, 749-4677 or 484-6295.

Compaq portable, dual 5.25 FD, 20 MEG hard card, Hayes int. modem w/SW, external color moni, $550 OBO. Russ, 282-4283 or 554-4942.

Pioneer stereo, 6 CD changer, turntable, dual cass, equalizer, 4 Pioneer speakers, 120W per channel, Dolby, $600. x31120.

Realistic 5 band, 40W car equalizer, $30. 482-3428.

Four industry std Shure SM58 dynamic microphones with case, ex cond, $90/ea; 2 JVC MD-580A dynamic microphones, ex cond, w/case, $50/ea. Sy, x30504 or 776-9754.

Musical Instruments

Peavey 100W classic guitar amp, two 12" speakers, ex cond, $350. 333-6963.

Korg DS 8 keyboard w/memory card, Korg portable 8 track sequencer, both ex cond in boxes, $750 for both. 333-6458.

Bach 42B Trigger Trombone, school approved, $900. 488-5288.

Pets & Livestock

Rabbits, $7/up. Gailo, 554-6200.

Miniature male dachshund. 486-7111.

Black chow puppies, 1 female, 3 males, no papers, $40. x36608 or (409) 925-4922.

Free puppy, 3 mos old, brn/blk lab mix. 559-2764.

Free female Keeshond, gray w/blk streaks. x31120.

Household

Metal bed frame for king/queen, ex cond, $25. 991-6503.

Sofa, ottoman, 2 end tables, coffee table, rocking chair, chair, country style, tan/blue/mauve, $360 OBO. Kim, (409) 938-7655.

Queen sz mattress/box springs, good cond, $40. 486-9605.

Queen sz oak waterbed w/mirrored hdbd/shelves, storage underneath, $175 OBO. Kathie, 333-6145 or 480-8684.

Black leather sofa/matching arm chair, ex cond, was $1.5K, now $750. Katie, x33185.

Black Italian design sofa, interior speakers, $400. Johnny, x36778 or 922-1811.

Entertainment center, was $80 now $25. x37906 or 326-5805.

Photographic

Canon AE-1 35mm camera w/50mm 1.8 lens, Vivitar 285 strobe and carrying case, BO. Ron, x30887 or 334-7530.

Wanted

Want female roommate to share 2 BR Nassau Bay apt, near water, $300/mo bills paid. Julia, 335-1063.

Want to buy or trade NASA/space related patches, pins, decals, etc, looking for old patches. 280-0647.

Want housemate, 3-2-2, LC, $300/mo plus 1/3 util. 334-3985.

Want female roommate to share house in CL, util incl, $250/mo. 333-7772 or 480-6980.

Want intermediate sailboard, 10.5', lt wt, stable w/dagger bd; underwater metal detector; Nordic Trac; stainless pressure cooker; oak BR set w/out bed. 486-9605.

Want Barbie dream house w/elevator, in good cond. 280-8746.

Want Brio or TC timber train sets, interested in all offers. 486-4701.

Want air compressor hd/motor, will pay reasonable cost or trade labor. 482-3428.

Want autographed Apollo crew photos. 480-9131.

Want roommate to share 3-2-2 house in Bay Glen, avail immed, nonsmoker, no pets, $360/mo plus 1/2/util, $175 dep. x30147 or 286-2011.

Miscellaneous

King sz waterbed mattress, full motion; 6hp O/B motor, good cond, BO. 480-3260.

Complete box set of space shot trading cards series #1, sell/trade. 280-0647.

Air compressor, paint guns, hoses, body work tools, BO; acetylene welding equip, includes everything, BO. 334-2335.

GE toaster oven, $10; Hoover 12" elec frying pan, $10; Kenmore microwave, $50; extendible card/dinette table w/4 chairs, $25; lg table lamp, $15; sm table lamp, $5. 335-8549 or 280-0754.

Barbie items, Ice Cream Shoppe, dolls, clothes, furniture, etc., $50. 286-0022.

Miniature bottled water machine, $100 OBO; Everex 80286 machine, $1K; preschooler child learning system, $350 OBO; baseball card factory sets, $30/ea. Tony, 335-4299 or 482-4156.

Rolex watch, presidents diamond bezel face, ex cond, papers; 2 leather sided glass top coffee tbls, $50/ea; 2 15" wire wheel covers, $25/ea. James, 335-6710 or 482-6744.

"Hornet" R/C car, assembled, 30 mph, 7.2 V battery, AC/DC recharger, transmitter, ex cond, spare parts, maintenance manual, ex cond, $175 OBO. 488-5522.

Werner 16' articulating ladder w/stabilizer, use as scaffolding, A frame, or standoff ladder, $120; Craftsman 12" wood lathe on cabinet base w/drwrs, incl 4",8",12", face plates, 4", 12", tool rests, bowl turning tool rest, 6" 4 jaw chuck, 2 work arbors, 3 live centers, 2 sets English style tools, was $850, now $500; Craftsman 12" bandsaw on cabinet base w/wheels, incl fence, mitre gauge w/hold down, extra blades, $250. Chuck, 283-5600 or 538-3273.

10 gal acquarium, screen lid, light fixture w/Vita lite bulb for reptiles, foliage backing, thermometer, $55 or $70 w/rod iron stand. 991-6503.

IBM Selectric II correcting typewriter, blk, ex cond, $300. Marcia, x30195 or 486-1844.

Norwegian Cruise Line discount coupon, $1K off cruise for two, selling for 1/2 coupon value. Tony, x35966.

Old Coke box, 10¢ type, working cond, $100. 482-1582 or 482-6181.

Golf clubs, Hogan irons, 3I PW, good cond, was $420/set, now $280/set; Doug Sanders metal driver, graphic shaft, was $75, now $60; Dunlop putter, was $20, now $15. x37137 or 482-8966.

Jeep CJ backseat, brown, ex cond, $95; above ground pool ladder, $20; Deluxe DP weight bench, was $85, now $35. 280-7461 or 333-8130.

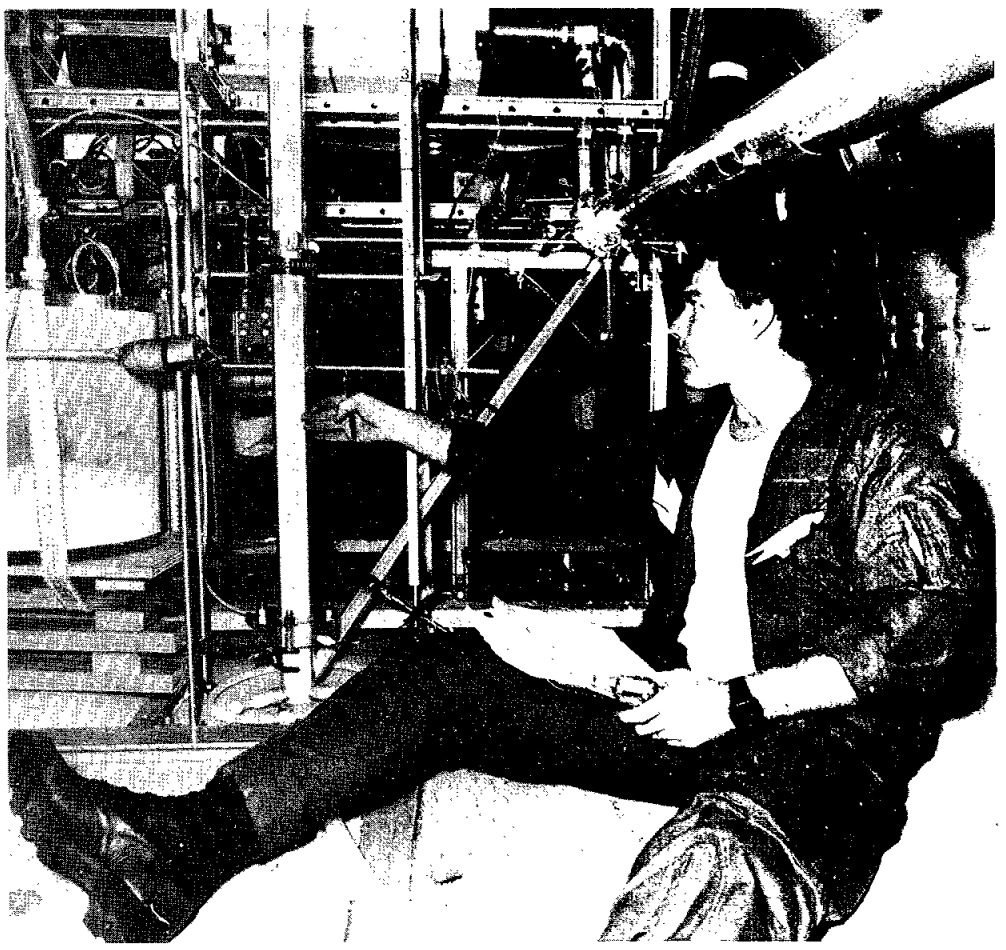
3x9 Redfield wide view Accu-Trak scope, $100; firewood, 1/4 cord $35, delivered $40, 1/2 cord $70, delivered $80. Tom, x32294.

Utility trlr, enclosed, waterproofed, $300. x37906 or 326-5805.

DP power track mod 2000 w/adjust spd and elevation control, spd, distance, calorie counter, ex cond, $150. John Hendrickson, x33660 or 489-0472.

Sears exercise bike, ex cond, $75. 282-6432 or 796-1833.

Tubular Technology



JSC engineers test the stuff drive-up banking is made of for moving lunar outpost soil

By Billie Deason

One of the largest hardware setups ever flown on JSC's KC-135 zero-gravity airplane recently proved that pneumatic conveying — using compressed gas to move solid materials — can stream large quantities of lunar soil for mining and other uses at a Moon outpost.

"Pneumatic conveying has been around for decades," said Tom Sullivan, space scientist in the Solar System Exploration Division's Mission Science and Technology Office.

"Instead of NASA developing new technology, we're taking a technology that exists in industry and applying it to some of the needs we might have," Sullivan said. "Because of the situation where we'll be using it, fighting the lunar vacuum and low gravity, some improvements to the existing technology would be needed."

More than 80 companies manufacture pneumatic systems to handle everything from fine powders to large chunks of coal.

"In our everyday lives, we don't see these devices operating, but if we went to the Houston ship channel, we could find a hundred different examples of pneumatic conveying at work," Sullivan said. "For example, dry cement powder is blown through pipelines today and has been for many years."

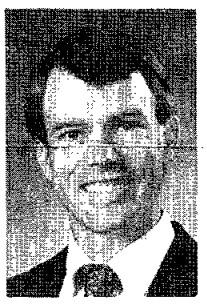
Coal, ground glass and all kinds of chemicals are moved by pneumatic conveyance. Even the food processing industry uses pneumatic pipelines to move products such as flour and cake mixes.

For the lunar soil experiment, Sullivan and his Indigenous Space Materials Utilization team designed and built an apparatus to transport tiny glass beads, a substitute for lunar soil, through two-inch diameter clear acrylic pipe. The experiment hardware measured more than 30 feet and occupied half the cargo space on the KC-135.

"We want to take proven systems that work and see how we can use them in the Space Exploration Initiative," Sullivan said. "We're fighting a vacuum on the Moon, so we have to totally enclose the hardware and the transport pipes and we need to recycle, to the extent we can, all of the air.

"At a lunar outpost, we would need to move large amounts of lunar soil from some location where we dig it up, which could be a mine, to the place where we need it, which could be a chemical plant where oxygen is produced," Sullivan said.

Raw, bulk lunar soil also could be used for radiation protection around the living quarters. One concept being considered would use an inflatable bladder filled with lunar regolith moved directly into it through a pneumatic system. This method could be quickly set up for initial radiation protection, then augmented with basalt bricks for a lunar crew's longer stay time.



'In our everyday lives, we don't see these devices operating, but if we went to the Houston ship channel, we could find a hundred different examples of pneumatic conveying at work.'

— Tom Sullivan, Mission Science and Technology Office

Sullivan's team included researchers from industry, the Lunar and Planetary Institute, JSC's New Initiatives Office and JSC contractors. Three separate experiments were carried out on the KC-135 flights.

"We looked at pneumatic transport of solids in a vertical pipe and in a horizontal pipe," Sullivan said. "In the vertical pipe, we tried two modes of transport. The first was a dilute phase where there were just a few solids and a lot of air flowing. The second, denser phase, had big slugs of solids. It actually looked like a roiling liquid," Sullivan said.

Two of the KC-135 flights simulated lunar gravity, which is about one-sixth the gravity force of Earth. The other flight replicated Mars' gravity, about one-third of Earth's. The investigators gathered baseline data during experiment runs in the ground-based laboratory.

"Designing an experiment to operate at all three of those gravity levels was difficult because we had to satisfy a different set of parameters for each gravity level," Sullivan said.

As planners now visualize a Moon outpost, the two biggest uses for lunar soil will be as radiation protection for the crew's living quarters and for production of oxygen.

"You have to ask yourself how are you going to do that. We'll have to move literally tons of lunar soil. Here on Earth we move soil in dump trucks."

Lunar dump trucks would have to be mobile and would likely use batteries or fuel cells. Recharging time needed for either one would mean the trucks could not operate 100 percent of the time unless multiple batteries were available. Someone would have to manage a spare parts inventory and a maintenance schedule. The trucks would need automatic navigation and telerobotic operating capability, all of which are expensive.

"We asked ourselves how easy it would be to develop the equivalent of a high-tech dump truck that could last 10 years, would have minimal maintenance requirements and be capable of handling tons of material.

"It could be done, but it would not be cheap or easy. So our pneumatic conveying concept is an alternative to a complex soil-hauling vehicle.

"A pneumatic system is a fairly dumb, low-technology operation, which is not to say anything bad about it — simplicity is good in mechanical devices operating at remote locations. We believe the pneumatic system would be a lot less cumbersome in an operational sense," Sullivan said.

Some engineers have expressed concern about leaks of the air or other gas in a lunar pneumatic transfer system.

"Well, it probably will leak some, but a little air goes a long way. Our calculations show you can have nearly a mile-long run of two-inch interior diameter pipe and the air inside the pipe weighs only about seven pounds. That's a whole lot less than some of the spare parts you would need if something equivalent on a dump truck breaks, like a wheel or a fuel cell.

"If you think of a worst-case scenario, yes, it leaked, let's get another seven pounds of air. And, if you're producing oxygen on the lunar surface, we could use oxygen as the conveying gas and you wouldn't have to bring it from Earth," Sullivan said.

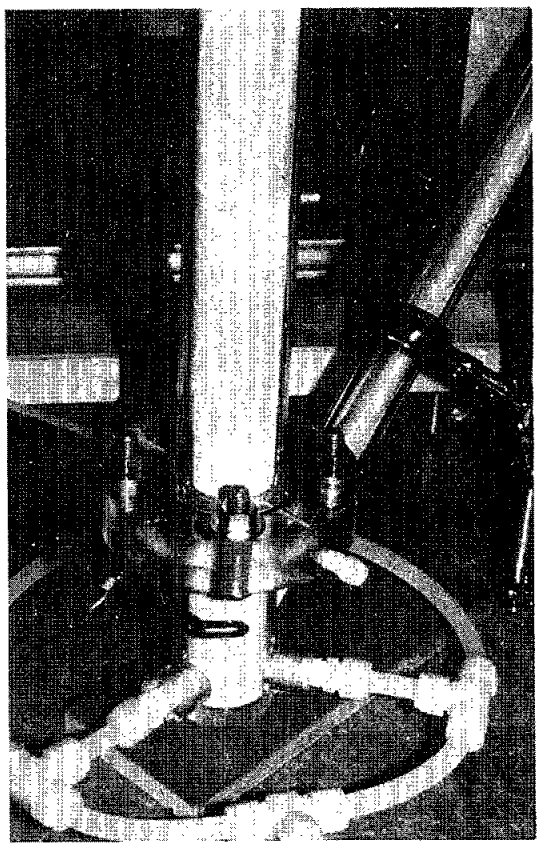
The movement of materials by compressed gas could work with some candidate designs for producing oxygen on the lunar surface, such as the hydrogen reactor that chemically releases oxygen from lunar soil that has been heated to moderately high temperatures.

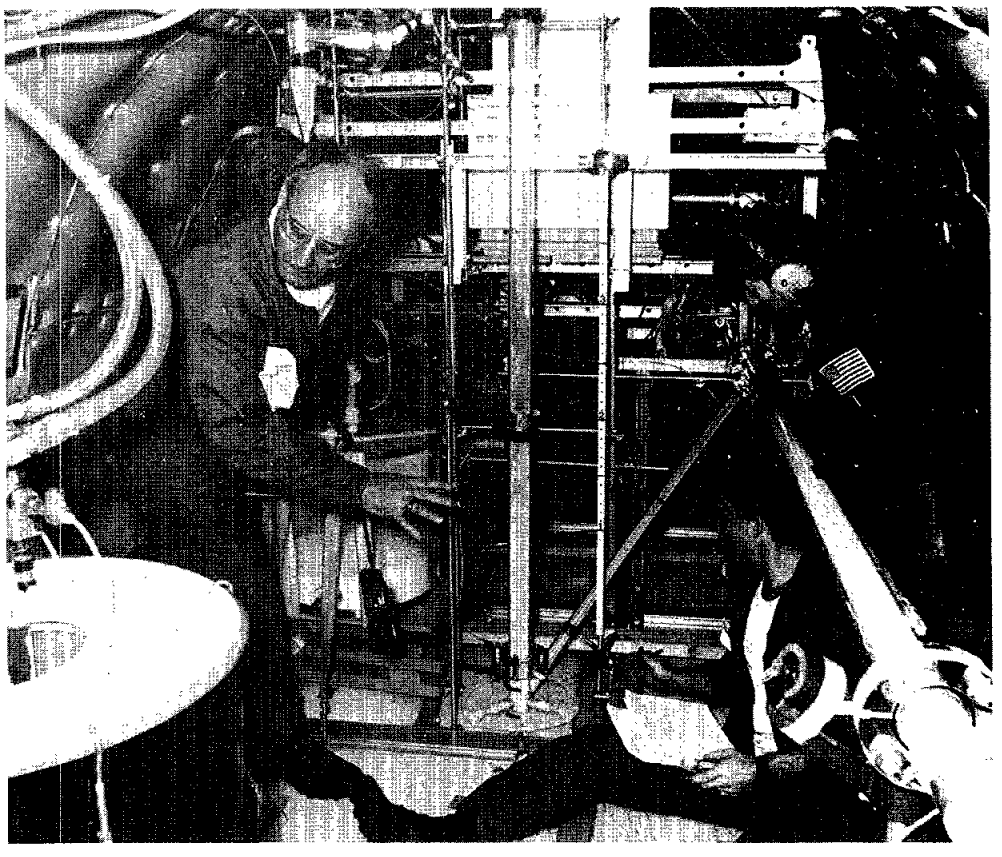
"If we were to use a pneumatic process to feed the solids (lunar soil) into that reactor, it would be a very nice meshing of the two technologies. It might also blend well with digging up the soil if we can come up with ways of using air in an enclosed area to actually start the soil on its way, to initially deconsolidate it and move it into a pipeline.

"Soil comes in a range of different sizes that may need to be separated before processing. We could do that work with air, too, instead of mechanical vibrating screens like we use on Earth. The feedstock would come into a large tray, the fine particles would overflow to a secondary tray and the bigger material stay in the first tray."

The only limitation to pneumatically moving lunar soil will be how quickly it can be dug out of the ground. Thousands of pounds per hour can be moved through a two-inch pipe, but soil likely cannot be excavated at that rate.

"We have several ideas for future experiments. Once you fly an experiment on the KC-135, you think of all kinds of other things you'd like to do to improve and expand the design," Sullivan said.





Top: Tom Sullivan, principal investigator for the pneumatic conveying experiment, monitors upward movement of glass beads in a vertical pipe during KC-135 flight. The large bin at left holds a supply of glass bead material used in the experiment as a substitute for lunar soil. Far left: Tiny glass beads carried by compressed air feed into the vertical pipe during a ground-based lab test. Left: Chris Knudsen, of Carbotech, and Sullivan monitor movement of glass beads through the vertical pipe during KC-135 flight while Linda White, of Aircraft Operations' Zero Gravity Test group, looks on.

JSC Photos by Jack Jacob and Tom Sullivan

Magellan shows Venus 'stunningly different place'

Magellan scientists Tuesday released large-scale hemispheric maps made from radar data acquired by the spacecraft that show Venus to be a "stunningly different place."

The processing of the first mapping cycle data sets, for both imagery and altimetry, was completed recently and encompasses 92 percent of the planet's surface, said Dr. Wes Huntress, director of NASA's Solar System Exploration Division. Launched in May 1989 from the Space Shuttle *Atlantis*, Magellan spent eight months completing its first mapping cycle of the cloud-enshrouded planet.

"The results have permitted a new view of the planet that is most like the Earth in the Solar System," Huntress said. "Magellan has really revealed a new Venus globe just as its namesake, Magellan the explorer, revealed a new Earth when he circumnavigated the planet."

Scientists hope to compare what they have learned about Venus and the processes at work there with those on Earth in an effort to verify theories about processes on our planet and make predictions about Earth's future, he said.

Magellan is now in its second mapping cycle, filling in gaps from the first cycle and looking at the surface from different angles.

Magellan Project Scientist Dr. Steve Saunders of NASA's Jet Propulsion Laboratory, also showed a three-dimensional perspective video illustrating the fractured and rifted terrain of Venus.

"The Magellan test stereo data appear to be the best radar stereo data ever obtained by any program," Saunders said.

The tests have been so successful that the scientists plan to attempt 3-D imagery of 70 percent of Venus' surface in mapping cycle three, which begins Jan. 15.

Dr. John Wood of the Smithsonian Astrophysical Observatory, who has studied rock weathering on Venus, said the giant volcano Maat Mons may be active.

All of the other peaks on Venus show very high radar reflectivity, but Maat Mons does not. Wood theorizes that weathering of other peaks in the harsh Venusian atmosphere produces minerals that are highly reflective, and therefore that the volcanic eruptions of Maat Mons must be recent, or continuing.

Saunders said radio occultation data collected about the planet's atmosphere looks very "clean" and will provide information about the distribution of sulfuric acid vapor down to about 20.5 miles above the surface, much lower than previous spacecraft experiments have been able to measure.

Dr. Gordon Pettengill, Massachusetts Institute of Technology Principal Investigator for the radar experiment, produced a Mercator projection of the global Venus altimetry and radiometry data showing the heights of its mountains and depths of its trenches, showing very strong tectonic forces are at work on the planet.

Chinese quality expert to speak at AIAA meeting

Zhang ZengMao, a top quality assurance official in the People's Republic of China, will discuss recent advances in quality management and standards in China's aerospace industry next week.

Zhang deputy director of the Quality Assurance Bureau in the Ministry of Aerospace Industry, will speak at 11 a.m. Nov. 8 in the Lockheed Plaza 4 fourth floor conference room.

The presentation is sponsored by the American Institute of Aeronautics and Astronautics International Activities Committee.

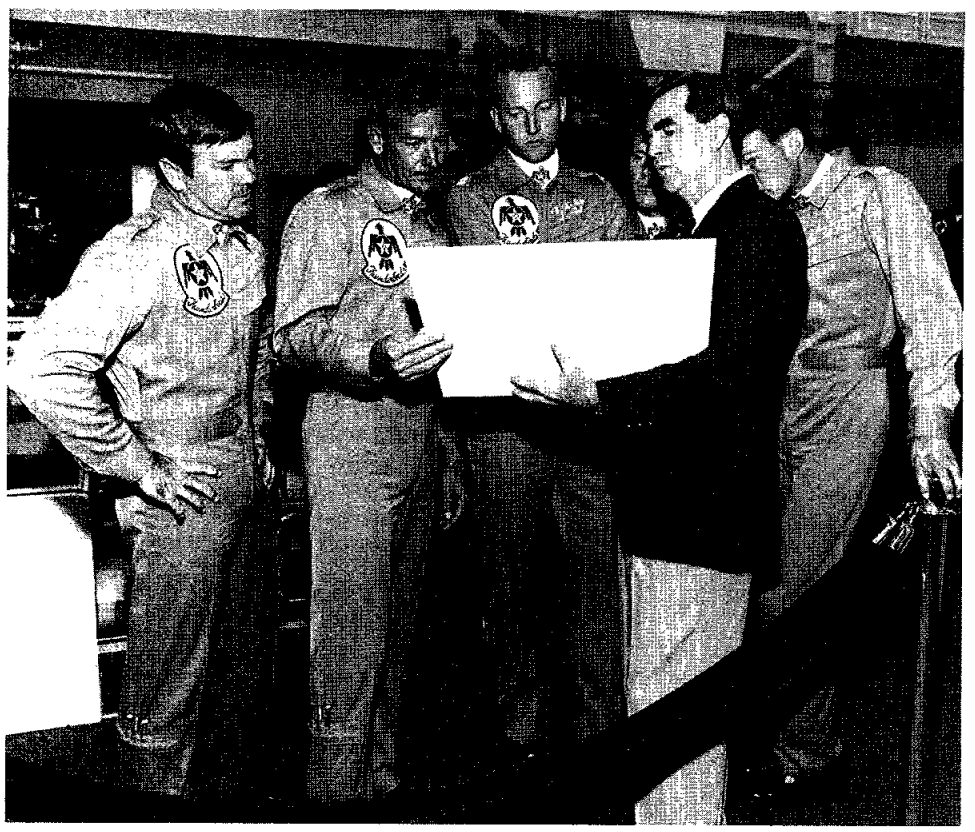
For more information, call Jim Mclane at 488-0312, or Dr. Zafar Taqvi, 333-6544.

Computer help desk telephone number changes

Help for computer users will continue to be only a phone call away, but after Nov. 12 the phone number of the Information Systems Directorate's Help Desk will change.

The Help Desk will move onsite into the ISD Services and Operations Center in Bldg. 12, Room 258A. The new phone number for onsite and Ellington users will be x34800. Offsite users should dial 483-4800.

As an added convenience, the Rolm System Speed 1 setting will automatically continue to call the Help Desk. To use the feature, press the System Speed button followed by 1. For telephones without the button, press #-6-1.



JSC Photo by Mark Sowa

PILOT TO PILOT — Members of the U.S. Air Force's Thunderbird air demonstration squadron talk to Astronaut Lacy Veach in JSC's Bldg. 9 during a tour of the mockups and trainers. After presenting the squadron leader with an STS-39 photo montage, Veach explained where each of the photographs had been taken. The Thunderbirds visited JSC during a break from their performances at the Wings Over Houston air show.

Health Fair to kick off open season

JSC's Human Resources Office will host a one-day Health Fair Nov. 15 to kick off the 1991 Federal Health Benefits Open Season.

Open season will continue through Dec. 9, giving employees the annual opportunity to make changes in their current health care plans.

Health care representatives will present their 1992 benefit packages during the Health Fair set for 9 a.m. to 4 p.m. in the Gilruth Center ballroom.

Employees may change from one health plan to another, move from self only to family enrollment, or make a combination of changes. In addition, eligible employees who previously declined health benefits coverage may enroll.

Those who do not wish to make changes do not need to take any action during open season.

Open season changes will be effective Jan. 12, 1992.

Health insurance benefits in 1992 have been expanded to include mammography screening, smoking cessation programs and a minimum lifetime benefit of $50,000 for mental conditions. Cost containment initiatives instituted last year will be continued.

While premiums for some plans have increased, other have decreased resulting in an overall average increase of 8 percent.

For more information, call x45194.

Airborne study of Arctic ozone depletion begins

NASA and other institutions have begun a six-month airborne study to determine the probability of an ozone "hole" forming in the Northern Hemisphere.

An ozone hole has become an annual phenomenon over the Antarctic continent in the Southern Hemisphere.

"We want to know, based on the increasing levels of chlorine in the Northern Hemisphere's stratosphere, if there will be an ozone hole over the North Pole in the next 10 or 20 years," said Jim Anderson, a professor at Harvard University and the project scientist for the Airborne Arctic Stratospheric Expedition II. "We also want to understand the cause of lower levels of ozone observed by satellites as far south as the southern United States."

AASE II involves two NASA aircraft and 120 scientists from NASA, the National Center for Atmospheric Research in Boulder, Colo., the National Oceanic and Atmospheric Administration and six universities.

The first Arctic stratospheric study results were fundamental to the most recent United Nations International Scientific Ozone Trends Assessment that found depletion of ozone over the Northern Hemisphere's mid-latitudes in the spring and summer.

AASE II Project Manager Estelle Condon of Ames Research Center said two aircraft from Ames an ER-2 high altitude research aircraft and a DC-8 flying laboratory, will fly more than 50 missions to support AASE II.

The first results from AASE II will be available next spring.

STS-44 crew prepared to spend Thanksgiving in orbit

(Continued from Page 1)

the Cosmic Radiation and Effects and Activation Monitor, Shuttle Activation Monitor and Radiation Monitoring Experiment-III. He'll also be participating in several detailed supplementary objectives, and backing up the two crewmen selected to make any contingency space walk.

Voss, also making his first flight, said he will make any unplanned space walk that becomes necessary, perform any needed in-flight maintenance and serve as backup to Henricks on the secondary payloads.

Mission Specialist Story Musgrave, making his fourth flight, will be the systems engineer assisting the commander and pilot on ascent and entry. He'll also specialize in photography and television documentations, Earth observations and use of the bioreactor and LBNP.

"I'm the chief cook and bottle washer on this flight," Musgrave said.

Mission Specialist Marion Runco will have prime responsibility for the M881 experiments and a contingency space walker. He'll assist Voss with any maintenance and be a control subject for the LBNP.

"What we're going to be doing with M881, essentially, is looking at the ground and trying to assess just what you can resolve from space," Runco said. "We have never really quantified the amount of detail we can see from 160 miles, 195 miles, 300 miles, wherever the shuttle might be. If we are able to indeed make out things on the ground with any kind of detail or resolution, that would be something of significance should that information be needed in a time of crisis."

Payload Specialist Tom Hennen, making his first flight, said he will be in charge of Terra Scout, making a variety of observations for remote sensing research and development, and will participate in several medical experiments. He'll have only 45 to 60 seconds to acquire Terra Scout targets.

STS-44 is scheduled to land at Kennedy Space Center the day after Thanksgiving, and Gregory said he and Musgrave are "thoroughly prepared" for a holiday in orbit.

"We'll give loads of thanks for being up there again," Musgrave added.

Expo examines changing globe

(Continued from Page 1)

have the right teams with the right people working within the right structure to keep this agency viable, creative and moving ahead despite the current difficult environment."

He said he is working with the administration for a replacement for Deputy Administrator J.R. Thompson, but that another Thompson project will be unveiled soon. A review of the roles and responsibilities of the NASA centers that emphasizes the concept of "centers of excellence" will be the foundation for the new effort.

"As we go through this period, we should never forget that the greatest mission in NASA's history is just around the corner, and should be a vital topic of your discussions at your conference here," he added. "It is nothing less than the sustained human exploration of the Solar System."

JSC Director Aaron Cohen spoke at the conference Thursday, concentrating on the challenges and opportunities ahead for international spacefarers. He said those challenges encompass not just science or engineering risks, but broader historical, political and economic challenges that make space programs possible.

"I think there is little question that the currents of history are taking us in a new direction, that the political conditions which gave rise to space exploration are changing dramatically, and that economic considerations will become — if they are not already — the primary focus of space policy planners around the planet," Cohen said.

The challenge, he said, is to keep exploring the possibilities of space and to ensure that political development and economic constraints don't stand in the way.

"Space is unchanging in that sense: the vast array of resources and possibilities which await us there do not change along with the political seasons here on Earth," he said. "The debate is really about our future, not about the hardware we build to get us there. The issue is foresight, not cost."

He said he doesn't think world leaders are that shortsighted and that Congress' willingness to invest inthe space station is an example.

Houston Mayor Kathy Whitmire addressed the conferees Wednesday afternoon, and former Sen. Harrison "Jack" Schmitt, Apollo 17 lunar module pilot, was the featured speaker at the conference banquet Wednesday evening.

Space News Roundup

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Editor.....Kelly Humphries
Associate Editors .....Pam Alloway
Kari Fluegel

Atlantis

(Continued from Page 1)

three generators that provide power for its hydraulic systems, which move the main engine nozzles, brakes, rudder, ailerons, elevons and body flap.

A standard leak test of the main engine plumbing, using helium, was successful Monday.

In the No. 3 processing hangar at KSC, preparations also have been moving along on *Discovery* for its next flight, STS-42, to be launched in January 1992. This week, technicians finished reinstalling the heat protection panels on the wing leading edges. Wheels and tires for the landing gear were installed, and the tunnel that will connect the International Microgravity Laboratory-1 to the crew cabin, was attached.