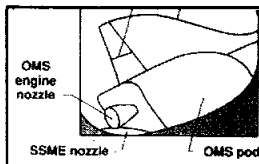


Exploration initiative

The second installment of the lunar and Mars exploration study summary. Story on Page 3.



Shuttle sensing

STS-32 onboard experiments measure re-entry data. Story on Page 4.

Space News Roundup

Vol. 29

January 19, 1990

No. 3

Atlantis set to go to pad

As *Columbia* returns to Earth, the shuttle *Atlantis* is being pointed skyward and put in place for the next scheduled shuttle flight, STS-36, a Department of Defense-dedicated mission slated for a launch no earlier than Feb. 16.

Atlantis was to be rolled over to the Vehicle Assembly Building (VAB) early Thursday to be mated with its accompanying external tank and solid rocket boosters, components that already have been attached to one another and closed out for flight. *Atlantis'* weight and center of gravity were measured Wednesday as the orbiter was bolted onto the transporter for its short journey to the VAB.

Atlantis is scheduled to be hoisted upward today and mating to the other components will begin. Altogether, the spacecraft is scheduled to spend six days in the VAB and begin a move to Launch Pad 39-A on Wednesday.

Meanwhile, workers at Kennedy have been busy readying *Discovery* for its March flight to place the Hubble Space Telescope in what will be the highest orbit yet flown by a space shuttle. This week, *Discovery's* nose gear wheels and tires were installed, along with the Remote Manipulator System arm that will be used to lift Hubble from the payload bay.

Discovery's main engines are scheduled for installation this weekend. In the VAB, stacking of the left-hand solid rocket booster for STS-31 was completed Wednesday. Stacking of the right booster continues, with the aft center segment being moved into place Thursday.



STS-32 SCIENCE—(top) The Long Duration Exposure Facility, LDEF, following grapple by *Columbia's* RMS. (bottom) Mission Specialist G. David Low holds a sample from the experiment "Characterization of *Neurospora* Circadian Rhythms (CNCR)." JSC Photo

Columbia performs well for 10 days, landing set today

After successfully snagging the Long Duration Exposure Facility that had been in orbit since 1984, the crew of *Columbia* spent another six days in space conducting secondary experiments and setting the stage for a new era of long shuttle missions.

Commander Dan Brandenstein expertly maneuvered *Columbia's* robot arm within only feet of LDEF's grapple fixture on the fourth day of the flight before mission specialist

ical objectives, including spending time in the Lower Body Negative Pressure Unit. The LBNP was designed at JSC and is hoped to make it easier for astronauts to adapt to Earth's gravity by counteracting some effects of weightlessness on body fluids. Dunbar, Low and mission specialist Marsha Ivins also took turns conducting daily photo surveys of various areas of *Columbia's* exterior with the Remote Manipulator Sys-



STS-32

Bonnie Dunbar smoothly captured the satellite. All aspects of the rendezvous and subsequent photographic survey and berthing were conducted without a hitch.

By the time the crew went to sleep for their fourth night in space, LDEF was securely tucked away for its trip home. During the remainder of the flight, the crew conducted an inflight press conference and received a congratulatory telephone call from President George Bush.

In the middeck, all planned experiments went well, although a minor problem with the Fluids Experiment Apparatus (FEA) involving a cracked sample ampule slowed the FEA work momentarily. Dunbar and mission specialist G. David Low also conducted several supplementary med-

tem robot arm. The surveys served double duty as hands-on training for the astronauts with the system.

On Wednesday, Brandenstein, now 47, celebrated his birthday in space and the crew was awakened by various birthday greetings, including a chorus of "Happy Birthday" sung by Astronaut Office personnel.

Columbia has performed almost flawlessly, except for minor glitches in an Inertial Measurement Unit and the avionics' bays' smoke detection system, which both set off false alarms aboard the craft and awakened the crew on two nights. A faulty state vector transmitted to *Columbia* from Mission Control also caused the reaction control system to make incorrect firings on the crew's

Please see *Columbia*, Page 4

Astronaut candidates for 1990 are selected

By Jeff Carr

In the first of what will become standard biennial selections, 23 new astronaut candidates have been named for the Space Shuttle program.

The candidates were chosen from among 1,945 qualified applicants, 106 of whom received interviews and medical examinations between September and November, 1989. They will report to JSC in July to begin a year of training and evaluation, after which they will receive technical assignments leading to selection for Shuttle flight crews.

The 1990 group includes seven pilot candidates and 16 mission specialist candidates, including 11 civilians and 12 military officers. Among the five women selected are three military officers, including the first woman to be named as a pilot candidate, and the first Hispanic woman to be chosen. A listing of the candidates and biographical data follows:

Daniel W. Bursch, Lt. Cmdr., USN, was born July 25, 1957, in Bristol, Pennsylvania. He now lives in Pacific Grove, California. Bursch attended Vestal Senior High School in Vestal, New York, and earned his BS in Physics at the US Naval Academy in 1979. Bursch is currently a student at the US Naval Postgraduate School. He is single and has one child.

Leroy Chiao, Ph.D., was born August 28, 1960, in Milwaukee, Wisconsin. He currently resides in Danville, California. Chiao attended Monte Vista High School, in Danville, and earned a BS in Chemical Engineering at the University of California, Berkeley, in 1983, and an MS in Chemical Engineering from the University of California, Santa Barbara, in 1985. Chiao earned his doctorate in Chemical Engineering, University of California, Santa Barbara,

1987. Chiao, who is single, is currently serving as a research engineer, at Lawrence Livermore National Laboratory, in Livermore, California.

Michael R. U. Clifford, Major, USA, Mission Specialist, was born on October 13, 1952, at Norton AFB, in California. He currently resides in Seabrook. Clifford attended Ben Lomond High School, in Ogden, Utah, and earned a BS in Basic Science from the US Military Academy in 1974. Clifford earned an MS in Aerospace Engineering from Georgia Tech. in 1982.

Clifford currently is serving as a Vehicle Integration Test Engineer at JSC. He is married to the former Nancy Elizabeth Brunson.

Kenneth D. Cockrell, Pilot, was born on April, 9, 1950, in Austin, Texas. He currently resides in Houston. Cockrell graduated from Rockdale High School in Rockdale, Texas, and earned a BS in Mechanical Engineering from the University of Texas in 1972. He earned his MS in Aero Systems from the University of Florida in 1974, and attended the U.S. Naval Test Pilot School in Patuxent River, Maryland.

Cockrell currently serves as an Aerospace Engineer & Research Pilot at JSC. He is married to the former Joan Denise Raines.

Eileen M. Collins, Major, USAF, Pilot, was born November 19, 1956, in Elmira, New York. She resides in Edwards, California. Collins attended Elmira Free Academy in Elmira, New York, earned her BA in Math at Syracuse University in 1978; an MS in Operations Research from Stanford University in 1986; and an MA in Space Systems Management, from Webster University in 1989.

Collins is a student at the USAF, Please see **CANDIDATES**, Page 4



STS-36 CREW—The five STS-36 astronauts pose near *Discovery* on Launch Pad 39B. Astronaut John O. Creighton (center) is mission commander. Others pictured are (left to right) Pierre J. Thuot, John H. Casper, Richard M. (Mike) Mullane and David C. Hilmers. Casper is pilot and the other three are mission specialists. JSC Photo

JSC signs support contract with Rockwell

JSC has signed a 5-year extension of an orbiter operations support contract with Rockwell International Corp., Downey, Calif. The extension begins Jan. 1, 1990 and continues through Dec. 31, 1994 and is a continuation of tasks being performed under an existing contract that originally went into effect in 1984.

The value of the cost-plus-award-fee contract is \$605,088,000, which provides a total base effort of 9,320,000 man-hours over a five-year period. Additionally, a firm price option for 1,200,000 man-hours at a cost-plus-award-fee value of \$79,552,000 may be exercised in part or whole at

any time during the period of performance.

Orbiter operations support includes necessary engineering support, such as real-time flight mission support from countdown through landing, ground support for checkout and turnaround of orbiter vehicles, and updating of the Shuttle Avionics Integration Laboratory (SAIL).

Services also provided under the contract are configuration management, which includes the maintenance of existing configuration records for delivered orbiter vehicles and support equipment necessary to Please see **ROCKWELL**, Page 4

STS-32 return ceremony set for JSC today

The welcome home ceremony for the crew of STS-32 is currently scheduled for 2:30 p.m. today on the north side of Bldg. 1. All employees are invited to attend.

Current plans call for the crew to arrive at Ellington Field at 2 p.m., approximately nine and a half hours after the shuttle lands at Edwards Air Force Base in California.

The ceremony location will be changed to Teague auditorium if it rains.

JSC

Ticket Window

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

General Cinema (valid for one year): \$3.75 each.

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

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

JSC

Gilruth Center News

Sign up policy—All classes and athletic activities are first come, first served. To enroll, you must sign up in person at the Gilruth Recreation Center. Everyone will be required to show a badge or EAA membership card. Payment must be made in full at the time of registration. Classes tend to fill up four weeks in advance. For more information, call x35789 or x 30304.

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

Defensive driving—Course is offered from 8 a.m.-5 p.m., Jan. 20 and Feb. 3; cost is \$15.

Ballroom dance—Professional instruction in beginning, intermediate, and advanced ballroom dancing. Classes begin March 1, and meet every Thurs. for 8 weeks. Beginning and advanced classes meet 7-8:15 p.m., intermediate class meets 8:15-9:30 p.m., cost is \$60 per couple.

Weight safety—Required course will be held 8-9:30 p.m., Jan. 17; cost is \$4.

Taekwondo/hapkido—Classes in the Korean art of self-defense, and mental and physical discipline are held Tuesday and Wednesday nights; cost is \$40 monthly.

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

Basketball officiating training—A training class for those interested in becoming basketball officials will be held from 9 a.m. to 4 p.m., Feb. 20. Contact Morris Williams, x33299 or Tim Sartor for information.

Country and Western dance lessons—Dance lessons begin Jan. 22 and are held each Monday night for six weeks. Cost is \$20 per couple.

JSC

JSC

Dates & Data

Today

Space Society presentation—The Houston Space Society will meet at 7:30 p.m. Jan 19 in the Atlantic Room, University of Houston. Barney Roberts, manager of JSC's Exploration Planet Surface and Human Systems Office, will speak on NASA's plans to continue the manned exploration of space. For additional information, contact the Houston Space Society, 639-4221.

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

Monday

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

Tuesday

BAPCO meets—The Bay Area PC organization (BAPCO) will meet at 7:30 p.m. Jan 23 at the League City Bank & Trust. For information, contact Earl Rubenstein at 483-4807 or Ron Waldbillig at 337-5074.

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

Wednesday

Astronomy seminar—A JSC Astronomy seminar will feature Dr. Nadine Barlow reporting on the "Evolution of Magma Bodies on Mars" conference from noon-1 p.m. Jan. 24 in Bldg. 31, conference room 193. For additional information, contact Al Jackson, 483-3709.

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

Thursday

"All-hands" meeting—JSC Center Director Aaron Cohen will hold an hour-long "All-hands" meeting at 2 p.m. on Jan. 25 in Teague Auditorium. Cohen will address the results of his recent Headquarters assignment in leading NASA activities in response to the president's future programs initiative. Employees interested in getting a better sense of the agency's Mars Mission and Lunar Base initiatives are urged to attend. The session will also be televised live on NASA TV. Contact Estella Gillette at x33077 for additional information.

NCMA workshop—The National Contract Management Association (NCMA) will hold a "Developing People Skills Workshop," given by Peggy

Morrow, from 8:30-11:30 a.m. Jan. 25 at the Gilruth Rec Center, Rm. 216. Registration is from 8-8:15 a.m.; contact Tim Boyes, x36864 for information.

AIAA meeting—The American Institute of Aeronautics and Astronautics (AIAA) will feature Dr. James L. Rand, president and chief operating officer of Winzen International, Inc., as speaker at its dinner meeting at 5:30 p.m., Jan. 25 at the Gilruth Rec Center. Tickets are \$8 for members, \$9 for non-members; contact Sarah Leggio at 282-3160 for reservations and information.

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

Jan. 26

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

Jan. 28

Beyond Earth's Boundaries program—The Lunar and Planetary Institute (LPI) and JSC present a free program named "Explore the Solar System" at 3:30-5 p.m. on Sunday, Jan. 28 at the University of Houston-Clear Lake. For information contact Nancy Wood, 480-5939, or the UHCL at 283-2810.

Swap Shop

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

Property

Rent: Dickinson mobile home lot, 5 mi. from NASA Rd. 1, \$70/mo. 332-0365 or 282-2802.
Sale: 60 acres, 3 mi. from Karnes City, TX, on Hwy. 80, 50 mi. from San Antonio; El Campo, TX, 2-story house on 1.5 lots, lots of trees. 783-9164.

Sale: Lg. lots, excl. subdiv. near NASA, mid \$30's, can finance. Don, x38039 or 333-3313.
Rent: Lake Travis cabin, priv. boat dock, CA/CH, fully equipped, accom. 8, wkly./daily rental, \$325/\$75. 326-5652.

Sale: Meadowgreen, immac. 3-2-2 David Weekly home, 2 yrs. old, corner lot, FPL, lg. deck, near pool and tennis courts, 2,000 sq. ft., 8.5 assum., \$119,000. 282-2810 or 480-3909.

Sale: El Lago rental property w/excel. long-term lease, \$79,900. 532-4237.

Lease: El Dorado Trace, lg. 1 BR condo, 2 balconies, appli., W/D, alarm sys., CP, ceiling fan, miniblinds, no pets, \$425 plus dep. Mark, x30131 or 332-2416.

Sale: Ganado, TX, 1.5 acre lot, 5 min. from Lake Texana, 100 mi. SW of Houston. 335-1250.

Sale/Lease: El Dorado Trace condo, 2-2, split plan, FPL, W/D, \$39,000 or \$500/mo. Dan, x33003 or 480-6913.

Rent: CL, 4-2-2, formals, ceiling fans, curtains/blinds, near elem. school. 334-3984.

Sale: Seabrook, 3-2-2, formals, lg. den w/FPL, 1,800 sq. ft., remod. w/new A/CH, roof, int., deck w/spa, trees, never flooded, \$67,500, \$4K total move-in. Richard, x30271 or 474-9334.

Lease: Barringer Way Fourplex, 2-1, W/D conn., ex. cond., \$350/mo. 486-2048.

Lease: Pipers Meadow/CLC, 3-2-2, DR, FPL, gas util., fenced, patio, \$650/mo. 482-6609.

Lease: Pebblebrook condo, El Lago, 1-1, miniblinds/vert., W/D, upst. unit, 650 sq. ft., \$330/mo. Lindemann, 488-3300 or 532-2218.

Sale: '85, 35' Mallard motor home, loaded, low mi., \$32,000. 337-4051.

Rent: Vail spring skiing, lg. condo, furn., sleeps 10, clubhouse, indoor-outdoor pools, hot tubs, sauna, racquetball, March 24-31, 1990. (214) 644-2674.

Sale: Custom built 2-story, 2,400 sq. ft., 4-2-5-2, formals, FPL, study, walk-in closets, near Dobbie H.S., \$79,900. 488-5210.

Rent/Sale: Nassau Bay townhouse, 4-2-2, over 2,000 sq. ft., w/2-story den, deck, atrium, FPL, 625 sq. ft., \$995/mo. or \$109,900. Jerry, x38922 or 488-5307.

Sale: Fairmont Park, 3-2-2, corner lot, patio, storm wdw., new roof, new fence, miniblinds, ceiling fans, \$62,000. Paul, 282-2519 or 470-1466.

Sale/Lease: Shoreacres, 4-2-2, 1,800 sq. ft., new wallpaper, paint and carpet, no pets, ref. req., \$65,000 or \$650/mo. plus dep. Sally, x37485 or 488-5501.

Cars & Trucks

'85 Ford F-150 Lariat, super cab, camper, extras, 48K mi. 473-2505.

'82 Ford Bronco 351, 9' liftkit, 40" mudders, 10" chrome wheels, auto., manual lock 4 WD,

\$6,500. Kim, 333-4743 or (409) 986-7671.

'76 Chevy Caprice Classic 4-dr., 350 V-8, elec. doors and wdws., AC, PS, PB, AM/FM cass., new catalytic conv., starter, fuel filter and plugs, valve cover gaskets, U-joints and rebuilt trans., \$1,000. Hank, 333-3810.

'84 Mercury Colony Park wagon, all options, ex. cond., \$3,250. 473-2709.
'79 Camaro, blk., 8 cyl., radio, tape, auto., T-tops, needs wk., \$495. 482-3754.

'81 AMC Concord, 258 cu. in., 6 cyl., auto., AC, PS, PB, 4-dr., good cond., \$900. Michael, 863-8710 or 282-5443.

'69 Ford PU, sell for parts. Tony, 482-5139.

'87 Honda Accord, misty beige, brn. int., 5-sp., 3-dr. htcbk., 46K mi., ex. cond., \$98,000. Tony or Lori, 482-5139.
'89 Komfort travel trlr., 28', 5th wheel, w/glide out rm.; '85 Ford supercab diesel, top cond., w/all options, both for \$34,175 or trlr. for \$24,175. Hix, x35187 or 333-4396.

'86 Celica GT-S, 5-sp., ex. cond., PS, PB, AC, PW, PL, pwr. moonroof, cruise, stereo/cass., \$8,750. 474-2384.

'84 Bonneville Brougham, ex. cond., recent overhaul, AC, cruise, auto., PL, stereo/cass., wire wheel covers, \$3,950. 474-2384.

'77 L-82 Corvette, 65K mi., all orig., \$5,500. Bruce, 485-0396.

'81 Datsun 280 ZX turbo, T-tops, 2-tone brn., auto., AC, AM/FM/cass., sport tires, ex. cond., runs great, \$3,600. 283-4171 or 486-8574.

'86 Dodge Mini-Ram van, ex. cond., cust., seats 7, auto., AC, tilt, AM/FM/cass., 67K, \$6,400. 480-4589 or 280-4416.

'86 Volvo 240 DL, ex. cond., low mi. 326-4167.

'89 Ford Aerostar, V-6, auto., dual AC, AM/FM cass., 6/60 maint., must sell, \$16K, OBO. 487-0253.

'76 Olds 98 Regency, 455, PS, PB, PS, P/WDW, gas shocks, \$1,200. 482-0927.

'76 Trans Am, 400 c.c. eng., 4 new gas shocks, new brakes, turbo trans., T-tops, P/WDW, \$1,095, OBO. 334-3984.

'81 Ford Bronco, full sz. w/remov. top, 4x4 w/mudders, rebuilt 351, auto., AM/FM, new carpet, seat covers and gas tank, \$2,800, OBO. Richard, x30271 or 474-9334.

'73 Corvette, white/saddle, 350, auto., air, PS, PB, PW, new Eagle GT 255-60R15, new stainless steel exhaust, more, \$7,800, OBO. 488-8927.

'77 Ford T-Bird, white w/red vinyl top, \$1,500. 480-3367.

'84 Nissan del. king cab PU w/Leer macho cover, ex. cond., \$3,800. Al, x34126 or 421-2830.

'82 Mazda RX7 GSL, new tires, batt., 25K mi. on new eng., \$3,100. x33187 or 488-5162.

'80 Dodge window van, 3/4 ton, V-8, seats 8, ex. cond., \$1,950. 280-8796.

'79 Cutlass Supreme Brougham, V-8, 2-dr., AC, PS, auto. trans., tilt, del. uphol., stereo cass., very clean, ex. cond., \$1,895. 280-8796.

'79 Buick S.W., 350 Buick eng., 4 new tires, well taken care of, no major rust, \$850, OBO. 333-6558 or 339-1337.

'87 V-8 blk. Firebird, grey uphol., T-tops, alarm, cruise, elec. wdws., louver, AM/FM cass., tilt wheel, 34K mi., \$8,876. Jackie, x37426.

'85 Honda Civic S, 3-dr., silver, 5-sp., AM/FM stereo cass., AC, perf. cond., \$4,250. 482-8558.

'87 Volvo 245 GL, ex. cond., loaded, pwr., 5 mos. left on fac. warr., AM/P/M/cass., graphite, \$16,800. Scott, x34318 or 482-1809.

'81 Mazda RX 7 GSL, loaded, very clean, new tires, \$3,450. John, x38178 or 482-5837.

'86 Toyota PU, custom paint, clean, \$4,250. John, x38178 or 482-5837.

Cycles

'83 Suzuki GN125cc motorcycle, street legal, low mi. 474-7006.

Women's 24" 10-sp., hardly used. Amy, 283-5742.

'79 Suzuki wetbike, 44.1 cu. in., 50hp, new batt., trlr. incl., ex. cond., \$950. 333-6119 or 326-1254.

850 motorcycle, shaft drive, Suzuki touring bike, windscreens/fairing, foot rests, backrest, very low mi., ex. cond., \$1,300. Patrick, x32635 or 488-1079.

Boats & Planes

23' sailboat, Gulf Coast, sleeps 4, head, main and jib, sail/equip. for Spinnaker, fixed keel, Johnson 15hp motor, ex. cond., \$5,500. 280-2016.

Listen!

Need the latest information on what's happening at JSC?

The JSC Employee Information Service may have just what you're looking for.

Updated every day at 11:30 a.m. the recorded announcement can be reached by calling:

483-6765

Audiovisual & Computers

TI-994A computer w/assorted software cart and access, \$150. Ed, x36969 or 332-0442.

Bearcat/Uniden scanner, 10-chan. programmable base unit, fire/med./police/etc., ex. cond., \$100. 474-7006.

IBM XT clone, 32 Meg hard drive, 640K, dual floppy, color monitor, mouse, 1200 Baud modem, \$850. 480-3717.

Commodore Super Expander 64, cartridge for graphics, game sounds, more, \$20. Hays, 280-2294.

Household

26" Quasar console T.V., \$100. 946-6658.
Sears 19" color T.V. w/remote, \$225. Dave, x32592 or 482-6673.

Zenith 25" rem. cont. console T.V., \$200; clean water filter appli., \$120. 482-4156.

Stereo sys., Sansui rec., Fisher dual cass., JVC spkrs., \$275. Dave, x32592 or 482-6673.

Sony Betamax VCR w/freeze frame, forward/rev. scan, 3-day programmable mem., \$50, OBO. Chris, x32606 or 333-3839.

Rect. coffee table w/matching end table, brass w/glass top, \$20/both. Sharon, 480-2646.

China cab., solid oak, beveled glass sides, front 38"Wx72"Hx18"D, lighted, orig., was \$2,200, now \$800. Fran, 333-6277 or 339-3562.
Sofa pit group, contemp. design, 4 pcs., brn./blk./white and tan, \$300. Fran, 333-6277 or 339-3562.

Contemp. solid oak kingsize waterbed w/6 drwrs. under and mirrored hdbd. w/matching Highboy dresser and nightstand, \$850. 282-3985.

Scan. style entertainment center, \$250; Magnavox 26" color T.V., ex. cond., \$175. 282-3985.

English armoire, needs refin., \$300, off-white crewel sofa, \$100. 333-9883.

Queensize sofa/sleeper, \$75; chair, \$15, do not match. Vicki, 282-4151 or 334-3288.

BR set, full bed w/bkcs. hdbd., 6-drwr. dresser, wall mirror, 5-drwr. desk w/chair, antique white/blue, \$300. x38163 or 486-0830.

1 desk w/hutch top and chair, walnut, \$200; 1 desk legat wood, \$50; moving sale, furn., household and misc. items until Jan. 31. Barbara, 996-8426.

Rust color chair and ottoman, good cond., \$25, OBO. 486-7628.

Musical Instruments

Applause acoustical guitar, ex. cond., \$175. 486-7628.

Fender Concert amp, tube type, like new, \$295; Gibson-Epiphone Emperor jazz guitar, ex. cond., \$795. Ed, 896-1035.

Lost & Found

6-sp. Raleigh bike missing from Mission Control Cen. Jon Axford, 483-7671.

Pets & Livestock

Free, lovable dog, good w/other animals and children, shots, med. sz., mixed breed. Dallas, 488-4194 or 486-9520.

Sm. Pomeranian dog, 9 mos. old male w/papers, brn., \$250. 280-9419.

Purebred Yorkshire terrier pups, 8 wks. old, all male, first shots, wormed, \$350. George, x38959 or 488-8241.

Cocker Spaniel, AKC reg., free, buff-colored fem., 2 yrs. old, loves kids. Vicki, 282-4151 or 334-3288.

Free pups, mother full blk. Lab, father Husky/Shepherd. Bruce, x32030 or 332-2600.

Min. Schnauzer AKC male pups, born 10-18-89, shots, wormed, salt and pepper, \$225. 996-6826.

Seven New Zealand white rabbits, 2 reg. w/papers, good for show, feeders and water bottles, \$75, OBO. Ronnie, x39762 or 996-1737.

Male Bassett Hound w/AKC papers. Donna, 283-5453 or 337-3838.

2 male dogs, 18 mos. old, neutered, shots, sm., playful, loves kids, dog house and feeder incl., free. Lee, 486-4894 or 282-2681.

APHC reg. gelding, champion bloodlines, approx. 60 saddles, \$1,800. William, 992-1225, 8-5.

Wanted

To rent comfortable Class A RV for last week in March, prefer 28' or less, must sleep at least 5. Michele, x35427 or 482-9576.

Baby swing and playpen. Michele, x35427 or 482-9576.

Babysitter to care for 6 mo. old in your nonsmoking home, Seabrook/Nassau Bay, M-F, 7:30-5:30 p.m. x36616 or 474-7496.

Ride home daily, pref. w/Pasadena resident, near A.C. Collins Ford on Richey, 8:00 to 4:30, I work in Bldg. 4. x34386.

Complete eng. or eng. parts for Yamaha and Suzuki A.T.V., 125cc-175cc. x31226 or 534-3710.

17- to 18' V-hull ski boat for an outboard eng., walk thru windshield, open bow w/w/out motor or trlr. Andy, 333-6671 or 332-9105.

Cheap work car or truck. 482-4156.

Bacliff property, 2 or more lots, will pay cash, improvements O.K., but not nec. 333-6558 or 339-1337.

Van pool riders from West Little York and Old Katy Road (NW Mall) Park and Ride to JSC, \$70/mo., hrs. 7:30-4:15 p.m., starts Jan. 29, 1990. Ed, 333-6963 or 998-9168.

Used Ethan Allen furn., all types, all rooms. Gloria, x39802 or 998-9168.

Trade concert/church elec. organ for 30' plus cabin cruiser. 337-4051.

Used baby furn., crib, hi-chair, etc., also used Nintendo and/or Nintendo games. x37815 or 486-6747.

Miscellaneous

Alcon boil 'n soak kit for contacts, never used, \$20; OMC control unit for boat w/16' cables, never used, \$125. 332-0365 or 282-2802.

Series of studies identifies key technology issues

The Human Exploration Initiative



(Editor's note: This is the second installment in a series of articles summarizing the Report of the 90-Day Study on Human Exploration of the Moon and Mars. JSC Director Aaron Cohen directed the study, which was completed in November. Excerpts will continue next week.)

INTRODUCTION

Human exploration of the Moon and Mars has been a sustaining vision of the U.S. civil space program almost since its inception. With the Apollo Program, we took our first small steps on the surface of another world; never again would our vision be restricted to the narrow confines of Earth's boundaries. Throughout the 20 years that have passed since the Apollo 11 astronauts first landed on the Moon, the aspiration to further explore has remained a beacon to the future.

In fact, during the Apollo era, Wernher von Braun led a task force to develop long-range goals for the space program after Apollo: more lunar missions, a space transportation system, a space station, and human journeys to Mars. The Space Shuttle became the space transportation system, *Skylab* was the first and *Freedom* will be the second space station, and several studies throughout the years have examined concepts and identified supporting requirements for human missions to the Moon and Mars.

Events over the past several years have increased awareness of the significant opportunities for human

exploration and have provided a wealth of technical data to support a response to the President's bold new initiative. In 1986, the National Commission on Space published its report, "Pioneering the Space Frontier." The commission was appointed by then-President Ronald Reagan and mandated by Congress to formulate a visionary agenda to lead America's civilian space enterprise into the 21st century. The commission recommended to the nation a bold plan for the next half century in space: "To lead the exploration and development of the space frontier, advancing science, technology, and enterprise, and building institutions and systems that make accessible vast new resources and support human settlements beyond Earth orbit, from the highlands of the Moon to the plains of Mars."

Later that year, then-NASA Administrator James C. Fletcher asked scientist astronaut Sally Ride to lead a NASA-wide task force to define and evaluate potential long-range goals for the U.S. civilian space program, building on earlier technical studies conducted throughout NASA and outside NASA in direct response to the Commission. The task force report, "Leadership and America's Future in Space," was released in August 1987. The report identified and analyzed four potential initiatives that could ensure continued civilian space program leadership: Mission to Planet Earth, Robotic Exploration of the Solar System, Outpost on the Moon, and Humans to Mars.

NASA's Office of Exploration was established in June 1987 in response

to the task force's recommendation that NASA establish a focal point to fund, lead, and coordinate studies examining potential approaches to human exploration of the solar system, based on the Outpost on the Moon and Humans to Mars Initiatives. For the past two years, NASA has examined in detail a number of potential strategies: Apollo-type expeditions to Mars and its moons, evolutionary plans for permanent human presence on the Moon and Mars, and scientific observatories on the Moon. The goal of this effort has been to develop a substantial base of knowledge on technical and programmatic requirements in order to enable the President to define a pathway for the human exploration of the Moon and Mars.

PATHWAY DEFINED

With the President's historic announcement, that pathway has been defined. We are going to build Space Station *Freedom*, and then we are going back to the Moon and on to Mars, to continue the remarkable journey of exploration that began more than 25 years ago when human beings first rocketed into space. Exploration is a human imperative, one deeply rooted in American history and its destiny. Our flag still flies on the Moon, and exploration is an endeavor in which our nation excels. Returning to the Moon and journeying to Mars are goals worthy of our heritage, signalling an America with the vision, courage, and skills essential for leadership among spacefaring

nations in the 21st Century.

In developing a preliminary program plan for human exploration of the Moon and Mars, results of past studies examining a wide variety of fundamental approaches formed the basis for the selection of certain key technical parameters. For the most part, these assumptions were derived from the past two years of intensive trade analyses conducted as part of the human exploration case studies. However, the case studies themselves built upon a rich heritage of earlier studies that established a foundation of technical information from which to draw. Combined with the strategy established by President Bush, this foundation provided a starting point for the development of the Human Exploration Initiative.

Certain technological approaches have been proven to be the most feasible ways of building capability in the development of an outpost either on the Moon or Mars. It is known, for example, that some degree of in-space assembly and maintenance is necessary for the vehicles that transport cargo and crew to their ultimate planetary destinations. Trade studies of the location and function of the transportation node at which these functions are performed have determined that Space Station *Freedom* is both a necessary and feasible approach to meeting this requirement. Power for outpost operations, for another example, is provided in initial stages by photovoltaic systems with regenerative fuel cells, a known and well-developed technology that is entirely adequate for early power

requirements. As the outpost develops, the next level of power generation is provided by space-based nuclear systems.

LAUNCH BALANCE

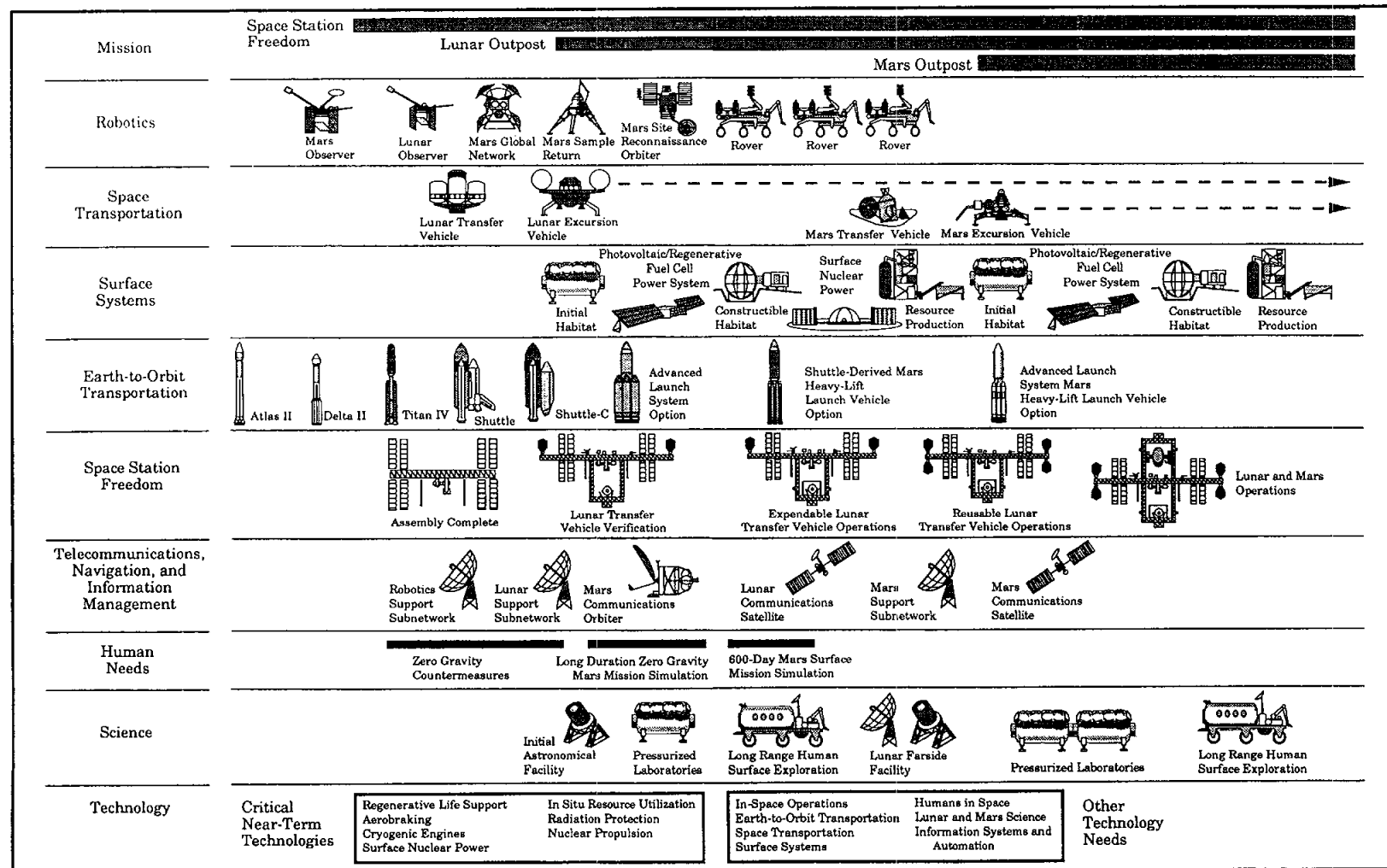
A significant trade study conducted over the past two years addressed the consideration of balancing the need to occasionally deliver relatively large masses, such as living quarters and utilities, to planet surfaces with the need to more regularly deliver the smaller masses associated with logistics resupply and crew transfer. This balance affects the sizing of launch and space transportation vehicles, the need for vehicle reusability, and the buildup sequence of the outpost.

For missions to the Moon, this balance has been found to be best achieved by launch vehicles in the 50 to 80 metric ton payload class, which carry payloads to Space Station *Freedom* for final assembly and checkout before departure for the Moon. Although designed for no human intervention, lunar vehicles and payloads will, realistically, require some hands-on activity in Earth orbit. Separate Earth-orbit-to-lunar-orbit and lunar ascent/descent vehicles are required to satisfy operational and abort considerations. For Mars missions, launch vehicles having a payload capability well in excess of 120 metric tons are required to achieve a balance between larger, fewer launches and less assembly at *Freedom* and smaller, more numerous flights that greatly complicate the assembly tasks.

An area in which a very wide range of system technology options were examined is propulsion systems for space transfer vehicles. Approaches ranged from conventional all-chemical propulsion to a variety of nuclear systems to solar sails and mass drivers. All-chemical propulsion with aerobraking was selected as the baseline for space transfer vehicle propulsion, and this assumption was used in developing mission profiles for the initiative. However, for transportation from Earth orbit to Mars, nuclear propulsion shows a great deal of promise as an option for significantly enhancing mission performance.

As the development of the Human Exploration Initiative unfolds, these and other issues will continue to be examined to identify the most efficient approaches to the various elements of the program.

Above: A recommended precursor to human exploration of Mars is the robotic Mars Rover Sample Return mission. Aerobraking techniques would be used to slow the flight system and place it in a 400-to-500-kilometer-high orbit. The lander, rover and ascent vehicle would then descend to the planet's surface for a year of study. Left: The relative timing of systems needed to support the Human Exploration Initiative is depicted in chart form.



Space Station Freedom design task team set

A task team has been selected for a six-month effort to evaluate Space Station Freedom (SSF) external maintenance requirements. Results of the evaluation are of critical importance to SSF design activities.

The study has been chartered by Bob Moorehead, Deputy Director of Program and Operations for Space Station Freedom. The work of the task team will be technically directed by the JSC Level III Space Station Projects Office. Representatives of Level II, all Level III work packages, and selected center institutional organizations make up the team.

Study results will include design requirements for replacement parts for Freedom's exterior hardware as well as the division of maintenance chores between extravehicular activity and robotics devices. The task team also will recommend assignment of maintenance responsibilities for each work package.

Astronaut William F. Fisher, M.D., and Charles Price, chief, Teleoperator Systems Branch, Engineering Directorate, will co-chair the SSF EVA/Robotics External Maintenance Task Team. Both Fisher and Price will devote full-time to the task team for the duration of the evaluation.

Columbia to land today

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planned next-to-last night. However, the crew quickly straightened out the problem after flight controllers awakened them. The crew was allowed to go to sleep early for a final night in space.

Also, a problem was noted early in the flight with one of two dehumidifiers, or humidity separators on board. The prime unit leaked an estimated two gallons of water into an area below the middeck floor, resulting in several hours of extra housekeeping work by the crew. It was turned off for the remainder of the flight, and the back-up unit was used. However, the back-up dehumidifier also leaked smaller quantities of water in the ensuing days, but the leakage was contained using towels and plastic bags rigged to the

unit by the crew.

Weather at Edwards Air Force Base in California appeared favorable for a scheduled 4:55 a.m. CST landing today. *Columbia's* deorbit burn was scheduled for 3:49 a.m. CST. Landing was planned on Edwards' Runway 22, a concrete landing strip. With LDEF aboard in addition to support equipment for Syncom IV-F5 and the long-duration flight, *Columbia* will be the heaviest-ever space shuttle to land, weighing in about 4.5 tons over the previous heaviest flight, STS-9 and Space lab I.

The crew spent Thursday stowing the cabin before going to sleep shortly before noon. Their final day in space was scheduled to begin at 8:35 p.m. CST Thursday.

Rockwell ops extension set

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document all changes, as well as providing the current status of hardware configuration.

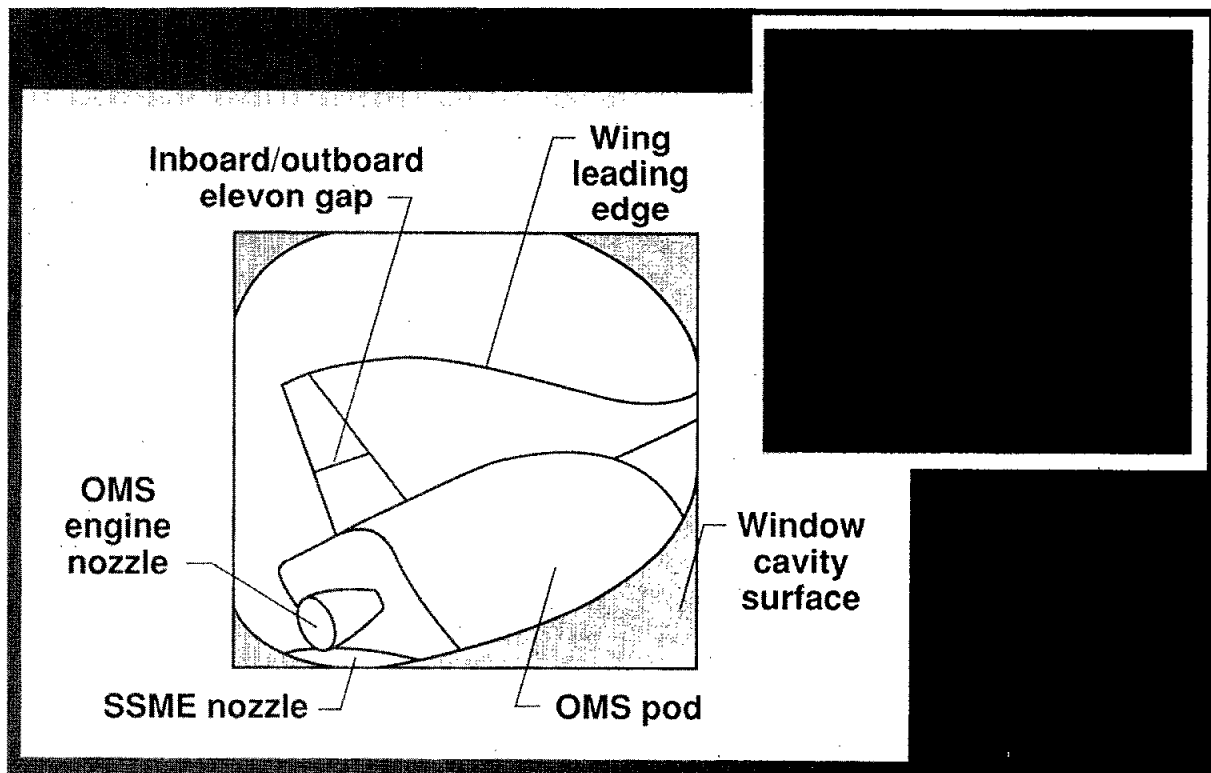
In addition, Rockwell will provide launch support services at Kennedy Space Center (KSC) that assures the orbiter vehicles and subcontractor-furnished ground support equipment configuration documentation is maintained to reflect the effects of work performed on hardware at KSC.

The operations support effort will be completed at Rockwell's Downey facility, as well as onsite at JSC and KSC.

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EXTRA EXPERIMENTS—Program to measure *Columbia's* aerodynamic and thermodynamic characteristics upon re-entry will help predict thermal protection requirements for future missions.

Experiments monitor STS-32 entry, to measure heating, aerodynamics

During *Columbia's* fiery re-entry through Earth's atmosphere, two experiments are planned to measure the orbiter's aerodynamic and thermodynamic characteristics to acquire data for future space transportation systems.

STS-32 is the third flight of the Shuttle Infrared Leaside Temperature Sensing (SILTS) and the Shuttle Entry Air Data System (SEADS) experiments, developed by Langley Research Center, Hampton, Va., in NASA's Orbiter Experiments (OEX) program.

The OEX program conducts atmospheric entry research during the Shuttle orbiter's return from space. OEX experiments are placed within the orbiter structure for data collection, leaving the payload bay free to support the flight's primary payloads. SILTS and SEADS previously flew on STS-61C in January 1986 and on STS-28 in August 1989.

On STS-32, SILTS will gather additional data to predict thermal protection requirements for the upper surfaces of advanced entry vehicles. As *Columbia* slows from orbital

speed down to about Mach 8 (eight times the speed of sound), an infrared camera located in a pod at the tip of the orbiter's vertical tail will gather high-resolution infrared imagery of the upper (leeward) left wing. Researchers will use the data to produce detailed thermal maps showing the magnitude and distribution of aerodynamic heating.

On STS-28, SILTS images revealed increased temperatures just behind the leading edge of the wing and in an area between the inboard and outboard elevons flight control surfaces which reached around 1,100 degrees Fahrenheit.

Prior to the experiment's next flight on the STS-35 mission scheduled for April 1990, the experiment will be reconfigured to monitor *Columbia's* upper fuselage.

The SILTS results are vital to the design of advanced winged spacecraft because each pound of unnecessary thermal protection that can be eliminated allows another pound of payload to be carried for the same launch cost. Moreover, SILTS collects data under flight conditions that

can not be duplicated in ground-based facilities.

SEADS is housed in *Columbia's* nosecone. The experiment incorporates 14 penetration assemblies distributed about the nosecone surface, each containing a small port through which local surface air pressure is measured.

Measurement of air pressure distribution allows precise post-flight determination of "air data" such as angle of attack, angle of sideslip, free stream dynamic pressure and Mach number. Accurate information on these factors, coupled with vehicle motion information measured by a separate experiment, are required to determine the orbiter's aerodynamic flight characteristics. SEADS provides accurate data during ascent from liftoff to about 56 miles and from that altitude through landing during re-entry.

The principal technologists for SILTS are David A. Throckmorton and E. Vincent Zoby of Langley's Space Systems Division. Paul M. Siemers III of the Space Systems Division is the principal technologist for SEADS.

Candidates for 1990 astronaut selection slated for July arrival at JSC

(Continued from Page 1)

Test Pilot School at Edwards AFB, and is married to James P. Youngs.

William G. Gregory, Captain, USAF, Pilot, was born May 14, 1957, in Lockport, New York, and resides at Edwards, California. Gregory attended Lockport Senior High School, Lockport, New York, and earned his BS, Engineering Science, from the USAF Academy in 1979; his MS in Engineering Mechanics, from Columbia University in 1980, and his MS in Management from Troy State in 1984. Gregory currently serves as a test pilot as Edwards AFB, California. He is married to the former Mary Elizabeth Harney.

James D. Halsell, Jr., Major, USAF, Pilot, on September 29, 1956, in - Monroe, Louisiana. He resides at Edwards AFB, in California. Halsell attended West Monroe High School in West Monroe, La.; earned a BS, Engineering, at the USAF Academy in 1978; an MS in Management at Troy State in 1983; and an MS in Space Operations at the AF Institute of Technology in 1985. Halsell is single and serves as an F-16 & SR-71 Test Pilot at Edwards AFB.

Bernard A. Harris, Jr., M.D., was born on June 26, 1956, in Temple, Texas. He attended San Antonio High School, earned a BS in Biology from the University of Houston in 1978, and his MD from Texas Tech in 1982. Harris is a medical officer at JSC, and is married to the former Sandra Lewis.

Susan J. Helms, Captain, USAF, Mission Specialist, was born on February 26, 1958, in Charlotte, North Carolina, and currently resides in

Alberta, Canada. She attended Parkrose Senior High School in Portland, Oregon, earned a BS in Aerospace Engineering, USAF Academy in 1980, and an MS in Aeronautics/Astronautics from Stanford in 1985. Helms is single and serves as flight test engineer, for the Aerospace Engineering Test Establishment in Alberta, Canada.

Thomas D. Jones, Ph.D., was born on January 22, 1955, in Baltimore, Maryland, and resides in Fairfax, Virginia. He attended Kenwood Senior High in Baltimore, earned his BS, Basic Sciences, USAF Academy in 1977 and his doctorate in planetary science from the University of Arizona in 1988.

Jones serves as a scientist for the CIA's Office of Research & Development in Washington, DC. He is married to the former Elizabeth Lynn Fulton.

William S. McArthur, Jr., Major, USA, Mission Specialist, was born on July 26, 1951, in Laurinburg, North Carolina, and resides in Houston. He attended Red Springs High School in North Carolina; earned his BS in Applied Science and Engineering, US Military Academy, in 1973; and his MS in Aerospace Engineering, at Georgia Tech in 1983. McArthur serves as Vehicle Integration Test Engineer at JSC, and is married to the former Cynthia Kathryn Lovin.

James H. Newman, Ph.D., born on Oct. 16, 1956, Trust Territory of the Pacific Islands, resides in Houston. He attended La Jolla High in Calif.; earned a BA, Physics, Dartmouth College, 1978; MA, Physics, Rice, 1982; and a Ph.D., Physics, Rice, 1984. Newman, single, is a simulation supervisor at

JSC.

Ellen Ochoa, Ph.D., Mission Specialist, was born May 10, 1958, in Los Angeles, California, and attended Grossmont High School in La Mesa. She earned her BS in Physics, San Diego State, 1980; her MS, Electrical Engineering, Stanford University, in 1981; and her doctorate in Electrical Engineering from, Stanford in 1985.

Ochoa, who is single, currently serves as an optical physicist at the Ames Research Center.

Charles J. Precourt, Major, USAF, Pilot, was born on June 29, 1955, in Waltham, Massachusetts, and currently resides in Middletown, Rhode Island. He attended Hudson High School in Massachusetts, earned his BS, Aeronautical Engineering, at the USAF Academy in 1977; and his MS in Management from Golden Gate University, in 1988. Precourt is a student at the Naval War College of Command and Staff, Newport, R.I., and is married to the former Lynne Mungle.

Richard A. Searfoss, Major, USAF, Pilot, born June 6, 1956 in Mount Clemens, MI., resides in Lancaster, CA. He attended Portsmouth Senior High, New Hampshire; earned a BS, Aerospace Engineering, USAF Academy in 1987; and an MS, Aerospace Engineering, Caltech in 1979. Searfoss serves as Instructor/Deputy Chief-Flying Qualities, at the USAF Test Pilot School at Edwards AFB. He is married to the former Julie McGuire.

Ronald M. Sega, Ph.D., was born on December 4, 1952, in Cleveland, Ohio, and resides in Seabrook, Texas. He attended Nardonia High School, Mace-

donia, Ohio; earned a BS in Physics/Math from the USAF Academy in 1974; an MS in Physics from Ohio State in 1975; and his doctorate in Electrical Engineering, from the University of Colorado in 1982. He is currently serving as Assistant Director for Flight Programs/Professor, at the University of Houston's-Space Vacuum Epitaxy Center, and is married to Mission Specialist Bonnie J. Dunbar.

Nancy J. Sherlock, Captain, USA, born May 6, 1955, Cleveland Ohio, lives in Seabrook. She attended Troy High in Ohio, earned a BA, Biological Science, Ohio State, 1980; and an MS, Safety Engineering, University of Southern California, 1985. Sherlock is a flight simulation engineer at JSC, and is married to Richard J. Sherlock.

Donald A. Thomas, Ph.D., Mission Specialist, was born on May 6, 1955 in Cleveland, Ohio, and resides in Seabrook. He attended Cleveland Heights High School in Ohio; earned his BS in Physics at Case Western Reserve University in 1977; his MS in Materials Science at Cornell University in 1980; and his doctorate in Materials Science at Cornell University in 1982. Thomas currently serves as a materials engineer at JSC, and is married to the former Kristine R. Castagnola.

Janice E. Voss, Ph.D., Mission Specialist, was born on October 8, 1956, in South Bend, Indiana. She attended Minnechong Regional High, Wilbraham, Mass.; earned a BS, Engineering Science, Purdue, 1975; and an MS, Electrical Engineering, MIT. Her doctorate is in Aero/Astronautics, MIT, 1987. Voss is single and manager,

Integrations and Operations, Orbital Sciences Corp. in Houston.

Carl E. Walz, Captain, USAF, Mission Specialist, was born on September 6, 1955, in Cleveland, Ohio, and resides in Henderson, Nevada. He attended Charles T. Brush High School in Lyndhurst, Ohio; earned a BS in Physics from Kent State in 1977; and an MS in Physics from John Carroll University in 1979. Walz serves as a Flight Test Program Manager, for the Air Force Flight Test Center, at Pittman Station, Nevada, and is married to the former Pamela J. Glady.

Terrence W. Wilcutt, Major, USMC, Pilot, born Oct. 31, 1949, - Russellville, Kentucky, resides in Patuxent River, Maryland. He attended Southern High School, in Louisville, Kentucky and earned his BA in Math at Western Kentucky University in 1974. Wilcutt serves as a Test Pilot/Project Officer at NAS Patuxent River, Maryland, and is married to the former Robin Moyers.

Peter J.K. Wisoff, Ph.D., born Aug. 16, 1958, Norfolk, Va., lives in Houston. He attended Norfolk Academy, earned a BS, Physics, University of Virginia, 1980; an MS, Physics, Stanford, 1982; and his Ph.D., Applied Physics, Stanford, 1986. Wisoff, single, serves as Assistant Professor at Rice in the Dept. of Electrical & Computer Engineering.

David A. Wolf, M.D., was born on August 23, 1956 in Indianapolis, Indiana, and currently resides in Houston. He earned his BS in Electrical Engineering from Purdue University in 1978; and his M.D. from Indiana University in 1982. Wolf, single, serves as Aerospace Medical Officer at JSC.