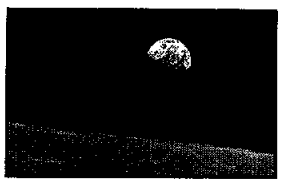
NASA
National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, Texas



Moon memories

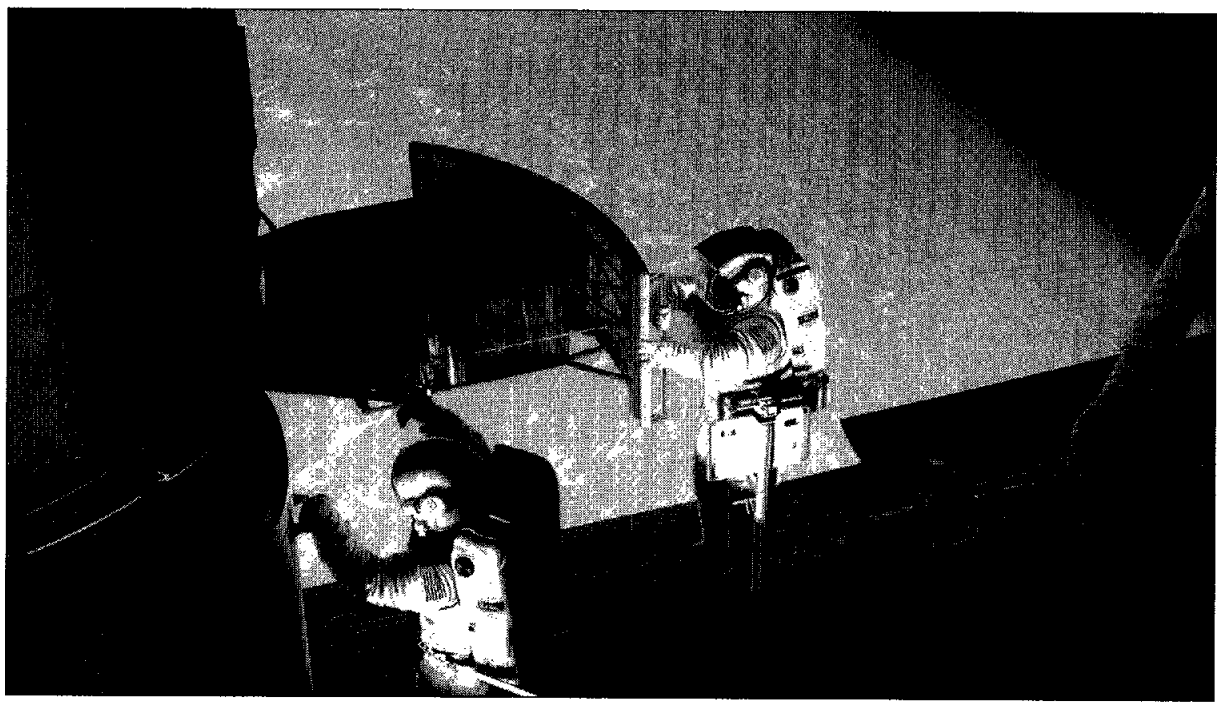
JSC salutes the 25th anniversary of Apollo 8 with speakers and a special gala celebration scheduled for Dec. 17-18. Story on Page 3.

Airlock arrival

The new Space Station Airlock Test Article comes to Bldg. 7 for component development and crew training. Photo on Page 4.

Space News Roundup

Vol. 32 **December 6, 1993** No. 47



NASA Illustration

In this artist's illustration, space walking astronauts install the Wide Field/Planetary Camera II in the Hubble Space Telescope as it rests in *Endeavour*'s cargo bay.

Endeavour crew ready for Hubble servicing tasks

By Audrey Schwartz

After nearly two years of planning and hundreds of hours of simulations for servicing the Hubble Space Telescope, the STS-61 crew may have been delayed, but not daunted, by Mother Nature.

Low clouds and wind gusts scrubbed the planned launch of *Endeavour* on Wednesday, but forecasts called for improving conditions later in the week.

"It's time to go do it," said Story Musgrave, payload commander. The veteran crew members — Commander Dick Covey, Pilot Ken Bowersox, and Mission Specialists Kathy Thornton, Claude Nicollier, Jeff Hoffman, Tom Akers and Musgrave — have logged more than 23 trips in space between them.

The Hubble Space Telescope servicing mission is perhaps the most difficult and challenging satellite servicing mission shuttle astronauts have ever attempted. A record five space walks are planned during the scheduled 11-day flight with many complex tasks to be performed within a limited time frame.

Despite their 400 hours of simulations in the Weightless Environment Training Facility and the neutral buoyancy tank at Marshall Space Flight Center, the crew and flight controllers know to expect the unexpected during a servicing mission, particularly one as ambitious as HST.

"There's opportunities for a lot of things to go wrong—obviously," said Randy Brinkley, HST mission director. "Don't count us out until the gun goes off and the game is over."

JSC mission planners began preparing for a December 1993 Hubble servicing mission to replace failed parts and add updated technology even before HST was launched three years ago and the flawed primary mirror discovered. Other servicing missions are scheduled for 1997, 1999 and 2002.

The STS-61 mission is the first to perform this regularly scheduled "tune-up" and install corrective optics and solar arrays.

As a result of this planning, HST was designed to be astronaut-friendly. Two grapple fixtures allow *Endeavour*'s mechanical arm to retrieve the satellite from its 370-mile-high orbit and secure it in the cargo bay on flight day three. Hubble is studded with handholds to allow easier movement by space walkers and its modular design allows access for servicing.

Hoffman, Musgrave, Akers and Thornton will work in two-member teams to conduct the nearly 30 EVA hours, scheduled for flight days four through eight. EVA crew members can be distinguished by markings on the legs of their space suits: Hoffman, solid red stripe; Thornton, dashed red stripe; Akers, a diagonal broken red stripe; and Musgrave with no stripe. All four crew members have been cross-trained to perform any given task, and extra EVA days can be added if necessary.

STS-61 Mission summary timeline

This timeline summarizes the activities planned for the Hubble Space Telescope servicing mission. All event times are based on mission-elapsed time. EVA times are not given as the durations will be modified as events require.

All on-orbit activities may be impacted by the dynamic nature of this mission.

Flight Day One

Ascent

OMS-2 burn: MET 00/00:45:00 at an orbit of 310 n.m. x 297 n.m.

ICBC activation

NC-1 burn: MET 00/05:33:00 at an orbit of 310 n.m. x 302 n.m.

Flight Day Two

Remote Manipulator System checkout

Cabin depressurization to 10.2 psi

Space Support Equipment checkout/survey

Configure Flight Servicing Structure

NPC burn: MET 00/23:12:00 at an orbit of 310 n.m. x 302 n.m.

NSR burn: MET 01/03:57:00 at an orbit of 310 n.m. x 304 n.m.

Extravehicular Mobility Unit checkout

NC-2 burn: MET 01/04:32:00 at an orbit of 317 n.m x 305 n.m.

Flight Day Three

HST rendezvous operations

NH burn: MET 01/17:22:00 at an orbit of 320 n.m. x 305 n.m. This burn adjusts the altitude of *Endeavour*'s orbital high point and fine-tunes its course to arrive at a point 40 n.m. behind HST at the same altitude.

NC-3 burn: MET 01/18:10:00 at an orbit of 320 n.m x 310 n.m. This burn fires at 40 n.m. behind HST and begins closing in on HST at a rate of about 16 n.m. per orbit aimed at arriving at a point 8 n.m. behind HST at the same altitude, two orbits later.

NCC burn: MET 01/20:23:00 at an orbit of 320 n.m. x 310 n.m. The first burn calculated by onboard computers using onboard navigation derived from orbiter star tracker sightings of HST. It fires while the orbiter is closing on a point about 8 n.m. behind HST to fine-tune its course.

TI burn: MET 01/21:23:00 at an orbit of 320 n.m. x 312 n.m. It fires on arrival at a point 8 n.m. behind HST and begins terminal interception of HST.

HST grapple at an orbit of 320 n.m x 313 n.m.

HST berth

HST survey

Group B powerdown

Please see **TIMELINE**, Page 4

Hubble servicing presents big challenge

By Eileen Hawley

The ambitious goals of the Hubble Space Telescope servicing mission include three primary objectives designed to be accomplished in an unprecedented series of five space walks.

Ultimately, the goal of STS-61 is to restore Hubble's scientific capabilities and the reliability of its operational systems, and to validate the concept of on-orbit servicing for the spacecraft during its anticipated 15-year life.

"Hubble is an amazing instrument even with the problems it's had," said STS-61 Pilot Ken Bowersox. "I think it's a testimony to the flexibility of our agency that we've come up with a way to make it work. People provided for the contingency and now we're going to fix it," he said.

Once on orbit, the challenges will just be beginning for this veteran crew as it capture the telescope and install upgraded equipment. "Surprise was the one thing I wanted to accommodate," said Payload Commander Story Musgrave. "No matter how good your historical process of development is, no matter how many stones you turn over trying to eliminate surprises, trying to build a flight plan that you can live with...it just doesn't turn out that way," he said.

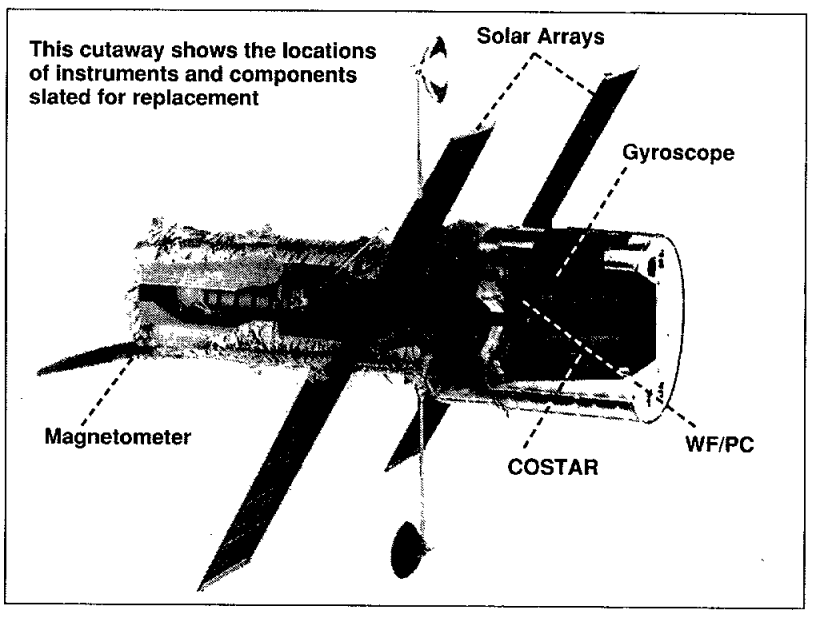
During five scheduled space walks, the astronauts will perform a variety of tasks in their efforts to successfully repair and upgrade the telescope. "Our goal is to accomplish what we set out to do," said Mission Specialist Kathy Thornton.

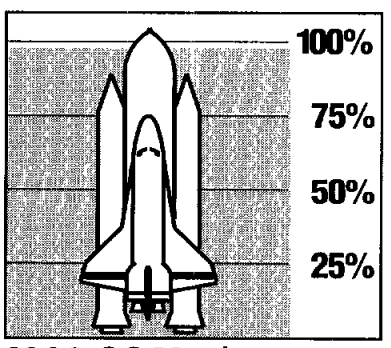
The primary servicing tasks to be performed by the space-walking astronauts include:

• Installing the Solar Array II to eliminate the "jitter" the solar panels currently experience twice each orbit as the telescope passes from dark into light and vice versa. Additionally, drive units for the solar array electronics control assemblies will be replaced to restore redundancy and provide improved heat protection for the transistors;

• Replacing two non-functioning gyroscope pairs to restore redundan-

Please see **ASTRONOMERS**, Page 4





1993 GOAL: $440,000

CFC

Planetary probes continue the exploration of space

NASA's planetary probes are continuing to trek through the galaxy encountering asteroids, planets, and solar winds.

The Galileo spacecraft is almost 415 million miles from Earth on its way to a 1995 rendezvous with Jupiter.

With the high-gain antenna still only partially deployed, the low-gain antenna will be used during the Jupiter mission. Following a September encounter, Galileo transmitted images of the asteroid Ida. Transmissions will resume in Spring.

Another of the successful interplanetary probes, Galileo was launched Oct. 18, 1989.

Galileo flew by Venus and Earth in 1990 and 1992 for gravity assists, and flew by the asteroid Gaspra in October 1991.

The Magellan spacecraft currently is in a gravity-mapping orbit around Venus. The probe has mapped about a third of the planet's gravitational field through precision tracking. Magellan has successfully radar-mapped more than 98 percent of Venus's surface from September 1990 to September 1992

Magellan achieved orbit through an aerobraking maneuver earlier this year. Magellan was launched May 4, 1989.

The Topex/Poseidon satellite is healthy with all scientific instruments performing normally. The satellite is mapping global sea level changes, reflecting seasonal warming and cooling and winds. Topex/Poseidon was launched Aug. 10, 1992.

The Ulysses spacecraft, launched Oct. 6, 1990, is in a highly inclined solar orbit more than 45 degrees south relative to the sun's equator and is 390 million miles from Earth. The probe received a gravity assist following a flyby of Jupiter in February 1992. The spacecraft will make solar polar passages in 1994 and 1995. Ulysses is gathering data on the heliosphere — the realm dominated by the solar wind.

The two Voyager spacecraft are continuing their interstellar mission, currently taking data on magnetic fields and charged particles as well as ultraviolet data.

Voyager 1 was launched Sept. 5, 1977 and is currently 5.11 billion miles from Earth. The spacecraft has had flyby encounters with both Jupiter and Saturn in 1979 and 1980.

Voyager 2 was launched Aug. 20, 1977. The spacecraft has flown by a number of planets in our solar system including Jupiter, Saturn, Uranus, and Neptune. The spacecraft is now 3.94 billion miles from Earth.

JSC

Ticket Window

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

Christmas dinner dance — Tickets for the Dec. 10 and Dec. 11 EAA Christmas dinner dances are on sale through Dec. 8. Cost is $22.50 per person.

Metropolitan Ballet's Nutcracker — Performances will be 8 p.m. Dec. 10 and 12, and 2 p.m. Dec. 11. A limited number of tickets is on sale for $12.50 per person.

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

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

Metro tickets — Passes, books and single tickets available.

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

Upcoming events: Children's Christmas Party, New Year's Eve Dance.

Stamps: Book of 20, $5.80

JSC

Gilruth Center News

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

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

Weight safety — Required course for employees wishing to use the weight room is offered from 8-9:30 p.m. Dec. 16. Pre-registration is required. Cost is $5.

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

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

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

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

Self-defense — Self-defense workshop for women from 5-6 p.m. Dec. 15 at Gilruth Center. Registration is required but there is no cost to attend.

Western dance — Country and western dance classes begin Jan. 3. Beginner class meets from 7-8:30 p.m. Mondays and advanced class meets from 8:30-10 p.m. Mondays. Cost is $20 per couple for six weeks.

Line dance — Classes meet from 7-8 p.m. Tuesday nights beginning Jan. 4. Cost is $10 per person for six weeks.

Flag football registration— Men's "C" teams play Tuesday or Wednesday nights, mixed teams play Thursdays beginning in January. Registration is 7 a.m. Dec. 13. Roster forms and additional information are available at the Gilruth Center.

Soccer registration — Men's and mixed teams play Saturdays beginning January 22. Registration is at 7 a.m. Dec. 13. Roster forms and additional information are available at the Gilruth Center.

Volleyball registration — Mixed "C" league will play Tuesdays and Fridays. Registration is Dec. 14 at 7 a.m. Mixed "B", Women's and Men's teams play Mondays. Registration is Dec. 15 at 7 a.m.

Basketball registration — Registration is at 7 a.m., Dec. 16. Play begins in January.

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

JSC

Dates & Data

Today

Engineering applications — The latest developments in mechanical system simulation software will be demonstrated at 9 a.m. in Bldg. 12, Rm. 112. Dec. 6. Representatives of MDI Adams will discuss space engineering applications. For additional information, call Ken Tanoury, 214-789-5353.

Cafeteria menu — Special: Italian cutlet. Total Health: roast beef au jus. Entrees: chicken a la king, enchiladas with chili, baked lasagna with meat, steamed fish, French dip sandwich. Soup: split pea and ham. Vegetables: Brussels sprouts, oriental vegetables, buttered carrots, lima beans.

Tuesday

Cafeteria menu — Special: stuffed cabbage rolls. Total Health: roasted turkey. Entrees: turkey and dressing, country style steak and hash browns, beef ravioli, baked chicken, French dip sandwich. Soup: tomato Florentine. Vegetables: Italian blend, okra and tomatoes, corn cobbette, navy beans.

Wednesday

Russian speakers — Practice Russian language skills from 11 a.m.-1 p.m. Dec. 8 in the Bldg. 3 cafeteria. For more information, call Jack Bacon, x38725, or Amy Mendez, x38066.

PSI meets — Clear Lake/NASA Area chapter of Professional Secretaries International will meet at 5:30 p.m. Dec. 8 at the Holiday Inn on NASA Road 1. For more information, contact Elaine Kemp, x30556.

Astronomy seminar — The JSC Astronomy Seminar will meet at noon Dec. 8 in Bldg. 31, Rm. 129. For more information, call Al Jackson, 333-7679.

Software seminar — The Institute of Electrical and Electronics Engineers will host a seminar on software reliability from 11 a.m.-1 p.m. Dec. 8 at the Gilruth Center. Ted Keller of IBM will speak. For additional information, contact Frankie Hap, 333-6064.

Cafeteria menu — Special: pepper steak. Total Health: stir fry pork with rice. Entrees: liver and onions, catfish and hush puppies, stir-fry pork with rice, steamed fish, Reuben sandwich. Vegetables: steamed broccoli, yellow squash, macaroni and cheese, vegetable sticks.

Thursday

IEEE meets — The Galveston Bay section of the Institute of Electrical and Electronic Engineers will meet at 11:30 a.m. Dec. 9 at Gilruth Center. Joe Loftus will discuss "Orbital Debris: Issues and Solutions." For additional information, contact Barbara Nepveux, x30194.

AIAA meets — The Houston section of the American Institute of Aeronautics and Astronautics will host the annual JSC director's reception at 5:30 p.m. Dec. 9 at the Gilruth Center. For reservations and additional information, contact Shirley Brandt, 929-7183.

Blood drive — Rockwell will host a blood drive from 8-10:30 a.m. Dec. 9 at the Rockwell LSF Bldg. at Feathercraft and Gemini. For additional information, contact Liz Sanders, 282-3418.

Cafeteria menu — Special: chicken fried steak. Total Health: fat-free vegetable soup. Entrees: beef tacos, scrod with Hollandaise sauce, steamed fish, French dip sandwich. Soup: navy bean. Vegetables: spinach, cut corn, breaded okra, pinto beans.

Friday

Cafeteria menu — Special: tuna noodle casserole. Total Health: steamed salmon steak. Entrees: steamed salmon steak, roast beef, baked chicken, steamed fish, Reuben sandwich. Soup: seafood gumbo. Vegetables: French cut green beans, cauliflower with cheese, green peas, black-eyed peas.

Monday

Cafeteria menu — Special: breaded cutlet. Total Health: crispy baked chicken. Entrees: baked chicken, beef chop suey, smoked sausage and German potato salad, French dip sandwich. Soup: cream of broccoli. Vegetables: okra and tomatoes, peas, navy beans, baby carrots.

Dec. 15

Astronomy seminar — The JSC Astronomy Seminar will meet at noon Dec. 15 in Bldg. 31, Rm. 129. Dr. George Ciangaru of Lockheed with discuss the near-Earth space environment and local space activities. For more information, call Al Jackson, 333-7679.

Blood drive — Lockheed will host a blood drive from 8:30-11:30 a.m. Dec. 15 at Lockheed Plaza 3 and from 1:30-4 p.m. Dec. 15 at Lockheed Plaza 5. For more information, contact Joe Victor, x34791.

JSC

Swap Shop

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

Property

Sale/Lease: Friendswood, Wedgewood Village, 3-2-2, FPL, fans, updated kitchen, new carpet, trees, fenced yard, formal dining, lg living room, 482-0874 after 5 p.m.

Sale: Nassau Bay House, 4-2-2, on quiet street, excellent cond. 333-9291.

Sale: Clear Lake Shores, 3 BR, wood floors, lg kitchen, decks, 538-1849.

Sale: LC/Brittany Bay, lg kitchen, DR, breakfast area, FR, master bath has shower and oval tub, walk in closet in master. $86.5k. David, 544-5514 or 282-3827.

Sale: El Dorado Trace condo, 1-1.5-CP, all appl, patio, balcony, FPL, fans, designer carpet/wallpaper, low equity assum. Jevene, 488-3383 or 764-0185 pager.

Lease: Seabrook, 2-2.5 TH, and 1-1.5 TH, W/D, patio, outside storage, 2 covered parking spaces, $585 and $495, 474-9262.

Sale/Lease: Friendswood, 4-2.5-2, lg lot on Polly Ranch runway, taxi to back yard tie-down, pool w/cabana and 3/4 bath, move-in condition, $160k or $1500/mo w/pool and yard serv, Steve Bailey, x35909 or 482-1963.

Sale: Piper's Meadow, 4-2.5-2, new carpet/ vinyl, low util, fans, miniblinds, auto gar dr opnr, immed occup. Wayne, x36617 or 291-9020.

Lease: Webster condo, 2-2, W/D, FPL, ceiling fans, $550/mo, plus deposit. 485-6021.

Sale: Taylorcrest, 4-3-2.5D, southern colonial, 3200 + sq ft, pool/spa, on cul-de-sac, island kitchen, 3 BR suites, balconies, art studio, $290k, 3% co-op, Richard x30271 or 326-4963.

Lease/Rent: Forest Bend, 4-2-2A, 1 story, FPL, fenced, avail Jan 1, $750/mo. x37328 or 482-3681.

Sale: Rockport Wooded lot, 2.40 ac, can be divided, black top road access, $12k. 996-8194.

Sale: LC, 3-2-2, ceiling fans, recently painted, decorator ceramic tiling, new floor tile, gar dr opnr, landscaped, $66.5k, assumable. John, x33662 or 334-6794.

Sale: LC/Meadowbend, 4-2-2, FPL, ceiling fans, landscaped/painted, $69.9k nego, assum. Peter, 526-1853.

Sale: Friendswood, rustic country home on wooded 3.6 ac, 3-2-2, pond, atrium, separate workshop, solar satellite, never flooded, 2400 sq ft, $158k. Jim, x39229 or 482-7873.

Sale: LC/Waterfront Marina townhome, 2-2, 15 min to NASA/JSC, $99.5k. Steve Brody, 703-487-7138 or 703-532-3415 eve.

Rent/Sale: Baywind One condo, 1-1-1, ceiling fans, appliances, private balcony, $380/mo or $28k. Bill, x39376 or 332-3649.

Rent: Clear Lake Shores Waterfront, apartment/duplex 2-2, 1200 sq ft, W/D hook-ups, boat slip, available Dec. 1, $600/mo. 538-3627.

Rent: Lomax/LaPorte, 3-2-2, fenced, FPL, ceiling fans, $650/mo 474-2660.

Friendswood/Polly Ranch, 4-2.5-3, all formals, family room, FPL, 3000 sq ft, $169k. 996-0788.

Sale: Country place on 3 acres, 3-2, huge family room, on wooded hill north of Nacogdoches, FM225, spring-fed stream, $49k. Ray 996-0788.

Sale; Leaque City, 82' x 130' lot, $9.5k, 333-5493.

Sale: Gulf Meadows, 3-1-1, carport, fenced backyard, corner lot, $37.9k. 476-1797.

Sale: LaMarque, south bound side of I-45, 75' x 213' wooded lot w/pine trees. Dee, x37888 or 409-938-1167.

Rent: Wolf Creek, CO, furn, 2 BR, sleeps 5, no smoking/pets, day/wk/mo or longer, Bob, 30825 or 998-7372.

Lease: Clear Lake/Ellington, lg 2 BR condo, new ceiling fans, paint, nice carpet, W/D connections, pool $460/mo plus dep, 326-1761.

Cars & Trucks

'88 Jeep Cherokee, 4-WD, 5-speed, sunroof, 50k miles, $7k. Jerry Craig, x48116 or 420-2936.

'91 Ford 1/2-ton extended body van camper, 22k miles, off white, 110v-12v refrig, 110v microwave, AC, fully self contained for RV parking facilities, 339-2181.

'91Mazda Miata, wht convertible, 5 spd, 48k alarm, new tires, $10.7k. 333-1335.

'62 Porsche 356 B, 1750cc, 912S cam, counter balanced crank, balanced crank/pistons, Weber 40 carbs, classic condition $15k. x30039 or 3329044

'87 Toyota Supra wht/red, 5 spd, power everything, AM/FM/CD, emaculate and well maint, garaged, 49k mi., $10k. x38543 or 409-942-1903, Chris.

'77 Ford Granada, ex motor, 4 spd, $900. x36600 or 996-0170.

'86 Town car, V-8, loaded, well maintained, new tires, new brakes, runs great, $4.5k. 482-4770.

'84 Mustang GT 350 ragtop 20th anniv, 1323 of 3000 built, 5 sp, PW, PDl, tilt, CC, Glaspak, 93k mi, bra, 302 OH, $3.5k, OBO. 996-8020.

'87 Nissan Pulsar, red/gray w/black interior, new tires, ex cond, well maintained. x36277 or 339-3562.

'91 Chevy Silverado PU ext cab, blue, 3" lift kit, oversize tires, loaded w/extras, 12k mi. Phil, 212-1339 or 337-6614.

'80 Olds Cutlass Supreme, wht, 4 dr, AC, auto trans, PS/PB, 128k mi, $1.1k. Allison, x37752 or 280-9424.

'87 Hyundai Excel, 5 sp, 4 dr, A/C, tinted wind, AM/FM cass, non smoker, garaged, new batt, well maint, ex cond, 59k mi, $2.9. x33662 or 334-6794.

'78 Porsche 928, brown w/leather int, auto, exc cond, 75k mi, $8.5k. Bill, 244-8889.

'86 Audi 5000 CS, loaded, ex cond, 63k mi, Bob, 485-2987.

'92 Chevy Corsica, factory warr, ABS, V-6, loaded, 33k mi., $9.k. 480-6543.

'90 Ford Ranger, tint, cruse, tilt, AC, tool box, bed liner, V-6, 5 spd, 76k mi, $6k OBO. Brian, 474-3553.

'86 Ford Escort, $700. 734-1899.

'91 Mustang LX, V-8, 5.0, sun roof, loaded, 33k mi, $9.5k. Dan Remington, x31004 or 331-0742.

'84 VW Scirocco, 5 spd, new tires, muffler, sunroof, P/O stereo, $1.5k. Jesse, 471-3980.

'73 Grand Torino, A/C, PS/PB, auto, 351 Cleveland, new parts everywhere, runs great, Bill, 331-7964.

'88 Hyundai GLS, ex cond, 52k mi, $2.3k OBO. x33765 or 326-1390.

'81 Corvette, 4 spd, T-tops, new paint job, 75k mi, $12k OBO. x33765 or 326-1390.

Boats & Planes

Pietenpol Air Camper, open ckpt, tandem seating, $9.5k. 214-241-7184.

22.5' Sea Ray Cuddy cruiser, 228 hp Mercruiser I/O, Color Furuno depth finder, VHF, ex cond, $8.5k. Mark, x38013 or 992-4132.

David Clark HIO-30 aviation headsets, 2, both ex cond, under 50 hrs ea, $140 ea, $250 for both. Dennis, x31733 or 486-5546.

24' Seawind catamaran, 9.9 Yamaha w/elec start, VHF, DF, porta pot, stove, compass, 16' beam, 12k mi, OBO. x37124 or 532-2370.

13'-11" laser sailboat, LOA, 76 sq ft sail, centerboard, no trailer BO. Jerry, x35226 or 333-2778.

'89 SeaRay, V-6, 175 hp, 30 hrs, ex cond, trailer and other access incl, $9.8k. Ray, x41063 or 334-4124.

Raytheon color depth sounder, bronze thru-hull transducer, bargain. 333-9291.

Cycles

'82 Yamaha Vision V-twinmotorcycle, model XZ550, 552 cc, 33 cu in, 5 spd constant mesh trans, shaft dr, 12k mi, $900 OBO. 488-1118.

Rokon Trailbreaker, two wheel drive motorcycle, $650. Phil, 212-1339 or 337-6614.

Audiovisual & Computers

Macintosh SE W/40 meg internal HD, 2.5 MB RAM, dual floppy, std kybd, mouse, sys software, manuals and orig pkging, $600. Kevin, x39461 or 729-2006.

Packard Bell PC, NEC 3D monitor, dot matrix printer, $600. 283-6600 or 996-0170.

Macintosh classic 4/40 w/System 7, $750. Peter or Cecilia, 526-1853.

IBM PC, 640k, 2-51/4 FD, 13" color monitor, kybd, S/W, IBM Proprinter, paper $250; Okidata dot matrix printer $100. Michelle, x31109 or 474-7263.

286-10, 287, 1 MB RAM 20 MB HD, EGA color monitor, Epson LX-800 printer, Logitech mouse, 2400 baud modem, DOS 3.3, DOS 6, Turbo C, Turbo Pascal, $400 OBO. Brad, 244-5766 or 532-2117.

RCA Pro 850 camcorder, zoom lens, auto focus, 1 yr, used only in-doors, over $1k. new, $550. 482-6879.

Commandore 64 computer/kybd, printer modem, software, will sell indiv components OBO. Bob, 283-1193 or 326-5616.

Super NES games, ex cond in boxes, super Star Wars, Desert Strike, Batman Returns Starfox, $35 ea. Ron, 30887 or 488-7797.

Onkyo 45 w/channel $75; Pioneer CD $50; Microacoustic speakers 10"/3 way $125; Technics auto turntable $75. Ken, 333-7167 or 785-8359.

IBM PS/2 model 50z, 30 MB HD, 2 Meg RAM, 3 1/2 & 5 1/4" FDs, VGA color monitor, mouse, $650 OBO. 483-6814.

Personal computer, 286, 1 MB RAM, 40 MB, DOS 5.0, Windows, color matrix printer, VGA color monitor, mouse, joystick, all for $500. 286-5971.

SCO UNIX 386 3.2 v4 unlimited users, open desktop 2.0.0 X-windows, $1.4k; UNIX 386 3.2 v4 Dev. Sys. w/Microsoft C cross-compiler, $400; MaxSpeed 8-port serial board, $200; various MayneStream ext Tape B/U, 60-525, $100-$500; Core ext. 310MB ESDI HD, $300. Chuck, 713-481-4822.

AT&T 6300 IBM compatible, color monitor, 640K RAM w/coprocessor, 30 MB HD, 5 1/4 FD, modem, mouse, 101 key kybd, Gemini printer, software, $400. Rob, 31477.

Hewlett Packard peripheral for HP-41, cassette drive HP82161A and HP-IL module 82160A, ex cond, in orig boxes, any reasonable offer, Carlos, x38879 or 554-7726.

Photographic

Olympus 35 mm, 38-105 mm lens, Infinity Super Zoom 300, leather cse $130 OBO. 996-9646 or 282-4271.

Cannon EF 70-210 mm zoom lens, fits any EOS, Cannon Camera mint cond, distance scale window, infrared index, macro and more, $145. 335-1480.

Craftsman transit level telescope w/folding tripod and 10' sliding type bldg rod, was $850; now $500. Jim, x39229 or 482-7873.

Vivitar VI Color enlager, color meter, lots of color process equipment, ex price. 333-3876.

Pets & Livestock

Pair 4 yr old Emu proven breeders, laid 29 eggs last year, 482-0874.

Pot bellied pigs, $75; horse stalls for rent, $35/mo, full board, $160/mo. 713-452-6078.

Free 4 yr female Siamese, spayed. Linda, 337-5921.

Cocker Spainel pups born 10-27-93, 3 females, 2 males, buff and buff/wht, $200, available Dec. 15. Roger, 332-2709.

Rabbit hutches, $40 to $80 OBO. 34218 or 331-2289.

Keeshond puppies, 1 male, 2 females; 1 3 yr old female w/papers, 1 5yr old male no papers, free. Wes, 474-7712.

Fuzzy Lop rabbit, handling and grooming instructions included, $25. 713-554-6200.

7 yellow labrador puppys, will be avail Xmas eve, mother is champion line retreiver, free. Lisa, x41101 or 337-3689.

Musical Instruments

Gulbranson spinet piano, ex cond. $1k. Marjy, 488-3389.

Spindle Baldwin piano, must sell, ex cond $600. 554-2337.

Ibanez RG550 solid body electric guitar and Peavy "Classic" amp, cost new for both $2.1k, now $795. 280-9621.

Lost & Found

Found strip of photographic negatives between Bldg 1 & Bldg 3. x45050.

Household

Small wood & glass table w/four wood. cane & cloth chairs, brass legs, $150. 996-9646 or 282-4271.

Couch, lt blue w/tiny mauve diamonds set 1" apart, good cond, $200. Lisa, 922-4627.

Hamilton Beach malt milk machine, commerical, stainless, new $75. 333-2335.

Sears portable electric oil filled heater, 3 settings, 1500, 1000, 500 watts, thermostat controlled. x34204 or 480-2954.

Two piece lighted china cabinet, ex cond, $700 OBO. 554-7669.

Lg screen Mitsubishi, 45", cach cabinet, like new, $1.8k or trade for a truck; king size motionless waterbed, mirror head board, good cond, $300. 488-0345.

Kg sz oak waterbed, lighted cabinets, padded sides, exc. cond, $300. Kirby, 554-6741.

DR suit, bleached oak table & six chairs, lighted china cabinet, like new, $1,750. 554-5261 or 554-6717.

Small dormitory refrigerator, $63. 482-8827.

Brown sugar color sectional sleeper sofa $150 OBO; mauve/blk top dinette set, 4 chairs, new, $250 OBO; 4 dining room chairs, newly upholstered, $15 ea. Jean, 922-6674.

19 cu ft Kenmore refrig w/top freezer, icemaker, rever drs, almond color, $220 OBO. x36814 or 554-2955.

Stove-oven & dishwasher, $250; side by side refridgerator $250. Ted, 483-6894.

Ethan Allan Grandfather clock, cherrywood, 3 diff chimes, ex cond, $750; oak 2 drawer file, $50; green arm chair, $80; white wicker rocking chair, $90; art, green Xmas tree, $45. 532-3242 or 483-9268.

Kg waterbed frame, head & footboards w/drawers underneath, no bladder, $50. Carol, $88-4493.

Maytag washer & gas dryer, $125 ea; dual 1019 truntable $50.; microwave table, casters, $30; telephone answering machine, needs work, $10 ea; elec organ, $150. Don, x33926 or 326-1817.

Solid wood microwave stand, $40; coffee table, $30; twin bed w/frame, $20; butcher block, $20. 333-6573 or 488-4813.

Simmons white baby crib, $250; master bedroom suite, kg sz bed w/matt & box springs, triple dresser w/mirrors, 2 night stands, armoire, solid wood, will deliver, $750. Jan, 480-7266.

Twin bed frame, $15; twin head/foot board, $35; white brass kg sz head board, $15; dining room table wood, $50; kitchen butcher block table, $50 OBO. x34218 or 331-2289.

Crib w/mattress, $50; infant carseat, $10; boys clothing sz 12 mos – 2T; assorted toys. x38518 or 332-4366.

Kitchen table, wood, w/4 swivel chairs, brown leather cover, two of the chairs need slight repair, entire set $50. 244-8985.

Solid Oak dining room table & chairs, solid butcher block table and eight chairs, modern styling, med stain, chairs w/solid dk blue upholstery, $550; solid oak TV stand/entertainment center, custom made, holds lg TV, three feet high stack of components, side-by-side, two lg solid oak drawers for CD's & tapes, light stain/oil finish, $250 OBO. Allyson, 483-9318.

Antique oak round table, 5 chairs, 1 buffett, $750; 2 drop leaf antique tables, $125; 2 sets pitcher/bowls antique, $25 set. Jim, x38624 or 475-9671.

Single twin bed, boxspring/mattress/ frame/headboard, Simmons Beautyrest "Backcare", $100. 486-6794.

Rattan qn sz headboard, open, scallop design, light color, $50. 480-2444.

Antique bedroom chest and dresser w/triple mirror, marbleized top/mahogany wood, pair, will not split up, $500. 333-1297.

Blue sofa, plush, full-sz, ex cond, 2 yrs old, Scotchguard, $275. 486-6794.

Sofa & loveseat, tan/lt brown tones, w/pillows, good cond, $150 OBO; kitchen table, $25; 4 chairs, $10. ea. 244-9832.

Kenmore Electric stove, $250; mares lg BCD, $250. 480-7927.

Refrigerator, 20.6 cu ft, 3 door w/ice maker, almond color, $175. 532-1673.

Wanted

Want donated furniture, mattress, household goods, cookware, toys, etc, for Vietnamese refugees, can pickup, receipts given. Mai Pham, x31786 or 484-5414.

Want stereo LPs of Classical, Rock, or Jazz in good cond, x34698 or 474-3685.

Want '70/'72, Pontiac 455 CIO engine. Tom, 333-6592.

Want considerate, responsible, nonsmoking housemate to share 3-2-2 in Bay Glen/CLC, $300/mo + $200 dep + 1/2 util. Larry, x33168 or 488-7460.

Want SLR camera or VCR camera, w/accessories, in good cond. x35913 or 280-0065.

Riders needed for vanpool, West Loop park & ride to NASA & contractors, Richard, x37557.

Want Nintendo Tapes, $5 to $10. x34218 or 331-2289.

Want neat, honest, nonsmoker to rent furnished room in Seabrook, 20 min from JSC, w/d and kitchen usage allowed, avail Dec 1. 474-3581.

Babysitter needed to care for seven month old, in our LC home on a part time/occasional basis weekends/nights and some days. References req. 538-4416.

Van pool riders needed, from Sugarland, Westwood park & ride, to JSC area. Alice, 483-5234.

Want to buy Macintosh computer, also want to buy a used car. 867-8820.

Want elec chess set, elec dictionary, Franklin Mint books, leather bound, china, complete set and serving pieces, Barbie van in ex cond. 280-8746.

Want one or two roomates to share large 4-2-2 in South Shore Harbor, furn, x31456 or 538-1596.

Want 286 or 386 CPU with hard drive. Stacey, 332-1585.

Miscellaneous

Desk, $30; round dinette table, $20; end table, $15; printer table, $12; elec talking Battleship game, $20; remote control boat and army tank, $20. 488-6521.

VHS-C format video camera, w/20 tapes, $190; Vector Research matrix surround sound amp/receiver, 35 W per channel, needs output transistors, $120; mini-car alarm, never used, $20; food processor, $20; 2 air filters, $40 ea. 992-7120.

Dodge Dakota bench seat, gray/wht cloth w/seat belts, good cond, $60. x49744.

Craftsman riding lawn mower, 11Hp, 30" deck, 8 spd, ex cond, $575. Mark, x38013 or 992-4132.

Metronome, $10; music stand, $5; French horn mouth pieces; Sega-CD w/variety discs, $200. 409-938-4793.

Gargoyles sunglasses, men's mirrored, wrap around Terminator cool, were $85, BO, Bob, x33149.

2 solar panels, 4' x 8'. 482-0874.

19" color TV, remote, $75; AM/FM stereo rcvr w/bookshelf speakers, $100; men's clothing, slacks, jeans 33x3, shirts med/lg, blazers, all weather coat 38 reg, $5 – $50. 332-8017.

Golf clubs, Tour Model III 1-SW, $15.95/club and metal woods, 1, 3, or 5 wood, $35/club. David, 554-5514.

Schwinn World Sport 12 spd road bike w/new tires, $149. Peter or Cecilia, 526-1853.

Stairclimber, like new, $50. Jeevan, 483-5814.

Ladies mid-length coat, maroon, $50. OBO; lavendar women's winter coat, $35, both in good cond, sz 12. Laurie, 474-9262.

110-lb free weight set, $50. OBO. Jim, x30411 or 480-2646.

Two living room chairs, $60; Tom Clancy's "Without Remorse" book on cassette, $19. 483-2137.

Mink stroller/Autum Haze, leather trim, sz lg, $900; Curtis Mathis console stereo/radio, $75. 488-3588.

C-128, 5 1/4 drive, 3 1/2 drive, 2 printers, modem, mouse, printshop software, $300; 10 spd bike, $30; 10 spd bike, $60; indoor bike trainer, $60. 488-3527.

Stair stepper with upper body workout, $175. 992-3876.

Baby crib w/mattress, sheets, & bumper guard, $150; 3-stage walker, $25; infant carseat/carrier, $35. Joe, x35896 or Laura, 488-7982.

16 HP Briggs garden tractor, 44" mower, trailer, plow, disk, two other blades, shop manual, good cond, low usage, $1.6k. 326-4316.

Man's bicycle, $60. x36442.

Drafting table, $95; 1917 Boston upright piano needs tuning, $650. Ray, 244-1063 or 334-4124.

Gym Pac 2500 all access, bench, press, lats, etc, $100, will assist in trans and set up. Chuck, x36340 or 286-1470.

Little Tykes, kitchen, $35; slide, $15; desk, $30; turtle sand box, $20; 10" pink bike, $15, all in ex cond. x34218 or 331-2289.

One .7 carat pear shaped diamond ring, sz 6, $1k, have appraisal papers, was $2k. Heather, 482-4879.

Craftsman transit level telescope with folding tripod and 10' sliding type building rod, like new $850; now $500. Jim, x39229 or 482-7873.

Transcription machine, $35; exercise bike, wht glass hurricane lamp, pink base lamp, off wht lovesat sofa, $35; regular large beige/grey sofa, sofa table, coffee table, and glass top w/bottom dark wood shelf end tables, La Machine II food processor. Rose, 791-6239 or 486-0145.

Electric dryer, 2 gold glass based lamps, telephone-clock radio, stereo speakers, truck speakers, boy's bike, wood frame earth-tone cushion couch, loveseat, rocker, foot stool w/coffee table, lamps and end tables. John, 338-1752 or 480-5079.

Nintendo games, Dragon Warrior I, Major League Baseball, Punchout, Dash Galaxy, $10; Dragon Warrior II, $30. 532-1673.

Fly to London & return from Paris next summer, D-Day 50th anniversary, 4 extra group tickets/American, $975 per ticket, depart Dallas for London May 29, return from Paris June 11. Larry Griffin, 283-6000.

'92 Coleman Pop-up camper, refrig, stove, A/C, etc, sleeps 6, ex cond. 337-3410 or 409-986-5989.

Rockford Fosgate Power 650, Mosfet 650 watt 4 channel amp, 12 volt, $600. Phil, 212-1339 or 337-6614.

Womens lg leather bomber jacket, $100; woman's lg dk green leather crop jacket, $100; ski-machine/rope pulley and timer, $80; playpen, $25; walker, $25; 2 decorated bears, peach and blue, $20 ea. 280-9612.

Neon "Miller Lite" sign with flasher box, orig owner, very light usage, $75. OBO. Karren, x37389 or 992-3783.

Pres & First Lady Executive gold membership, was $1080 + $7.50/mo; now $640 + $7.50/mo, negotiable. Trudy, x35106 or 333-6688.

Vacuum cleaner, self propelled, $50; pink umbrella strolier, rarely used, $25; small set of stereo speakers $20; baby's changing accessory table w/baskets $15. Ed, 481-4889.

Interior doors, 5, some hardware, $3 per door. Ken, x35999 or 486-5432,

One to two Pres & First Lady Charter gold memberships, free babysitting, free raquetball for guest, $650/ea, dues $6.50/mo never increase. Rich, x38519.

Stepper exercise machine, Sears Lifestyler, $100. 992-0454.

Jr sz red elec jeep, used approx 3 times, ages 3 & up, was $199, now $100. Karen, x37389 or 992-3783.

Baseball cards & memorabilia collector sets, singles, boxes, starting line ups, and Astros. Ron, 554-6207.

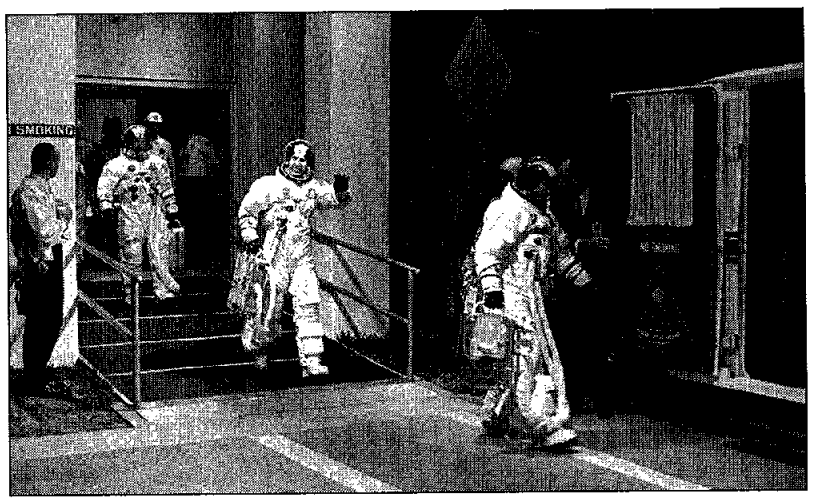
Bicycle kiddie kart, 2-seater w/safety straps, $85 OBO; desk walnut, $100; wht 5-drawer dresser, $20; upright piano $700. OBO. Desiree, 332-7023 or Jason 334-1058,

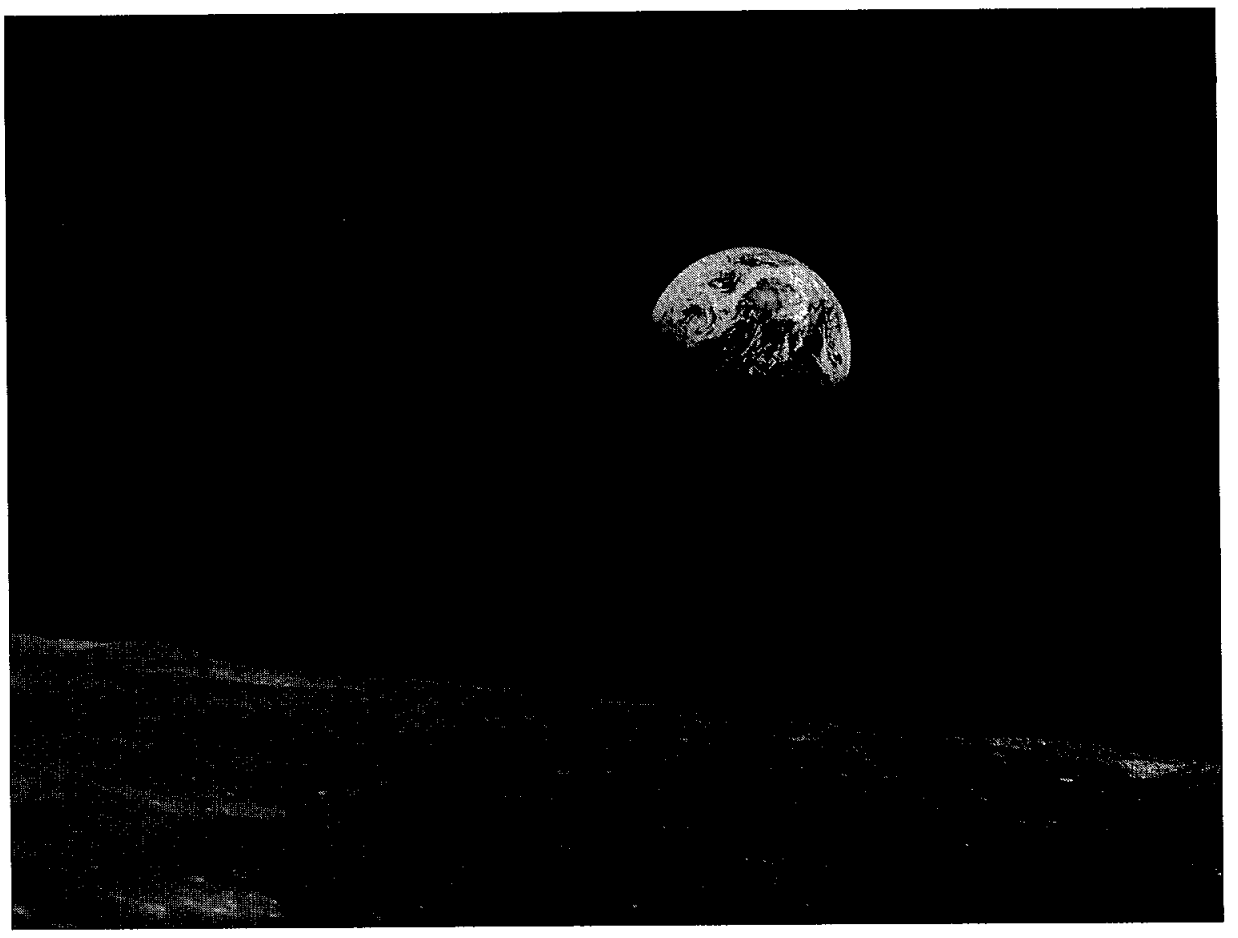
Blue Fox jacket, ex cond, $225. Deborah, 333-7504.

2 Oiler tickets Sun. Dec 5, noon, vs Atlanta; Sears riding mower, 10 Hp, 36" cut, $375; rattan swivel rocker grey cloth, $50; 15' boat trailer w/15' fiberglass v-hull boat, 55 Hp eng, $300. 334-2335.

Aquarium 55 gal with custom built cabinet/stand, fully functional, everything included, $325. Ron, 554-6207.

Vertical blinds, new Wards 3 1/2 fabric w/valences, 78" w x 84" l, peach/teal/white, were $125+ ea, now $60 ea. Ed, 481-4889.





To boldly go...

Apollo 8 celebration relives first human space flight to moon

[Editor's Note: This article is the first in a two-part series commemorating the 25th anniversary of the Apollo 8, America's first mission to the Moon.]

By Audrey Schwartz

Twenty-five Decembers ago, Apollo 8 realized a timeless dream. Astronauts Frank Borman, Jim Lovell and Bill Anders literally ventured where no one had gone before—to the moon, a quarter-million miles beyond the boundaries of Earth.

While Apollo 11 culminated our national challenge to land humans on the moon, with Apollo 8 we became an interplanetary society.

Apollo 8 was a Christmas gift from the United States to the world. War, conflict and daily worries were put aside for a few moments as people of all faiths, all nationalities and all politics looked up to the heavens and "saw" their home planet, and themselves, for truly the first time.

JSC employees, contractors and the public are invited to relive the inspiring adventure of Apollo 8 at a special silver anniversary celebration to be held Dec. 17 and 18 at JSC and Space Center Houston.

Events include panel discussions about the mission Dec. 17 in Teague Auditorium and a gala reception with Apollo crew members at Space Center Houston Dec. 18.

"The decision to go to the Moon for the first time was one of profound significance," said Joe Loftus, JSC assistant director for plans, and chairman of the Apollo 8 silver anniversary celebration. "On the 10th and 20th anniversary we made much of Apollo 11, but it seemed we never before have given Apollo 8 the proper attention it deserved."

In a way, the Apollo 8 mission was a fluke. Apollo 7 tested the command and service module in Earth orbit and the next scheduled mission would try out the lunar module, but the LM development was behind schedule.

"We didn't want to stand down, so George Low (manager of the Apollo Program) put forward a daring proposal to change the sequence and go to the Moon before testing the lunar module in low-Earth orbit," Loftus explained.

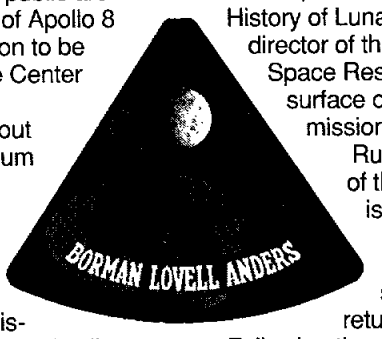
However, a more fateful question loomed—would Apollo 8 fly by or orbit the Moon? A decision to orbit the moon required the service module to work perfectly, and that was far from a given, said Loftus. The mission had other problems to resolve as well. The Saturn rocket was vexed by pogo vibrations and the Spacecraft Lunar Module Adapter atop the third stage suffered from delamination.

"What we really had was a bunch a failures with a random success or two. So here we were with all that history, yet we decided to go to the Moon. This really was our first bold mission. That's the reason we put together this celebration so we could talk about it," Loftus said.

As part of the Apollo 8 anniversary celebration, two panel discussions will be held Dec. 17 in Teague Auditorium. The sessions are open to the public.

Pre-Apollo lunar science will be the topic of the first seminar beginning at 1 p.m. Mike Duke, a space scientist in the Space and Life Sciences Directorate, will moderate a panel discussion concerning the unmanned scientific missions that blazed the trail for Apollo. Among the missions to be reviewed include Ranger, the first unmanned spacecraft to the Moon of which four were complete failures; the Surveyor missions and the successful soft landing on the lunar surface; the Lunar Orbiter Moon mapping satellites as well as landing site assessment research by the Apollo 8 astronauts.

The science panelists include Eugene Shoemaker, one of the leaders in lunar science, astronaut training and site selection for Apollo, now with the U.S. Geological Survey in Arizona; Oran Nicks, professor of aerospace engineering at Texas A&M University, and former director of the Lunar and Planetary Programs Office at NASA Headquarters in the 1960s; Don Wilhems, author of "A Rocky Moon: A Geologist's History of Lunar Exploration"; and Jack Sevier, director of the education division at Universities Space Research Association, who selected lunar surface objectives for the Apollo landing missions.



Russian geologist Alexander Basilevski of the Vernadsky Institute of Geochemistry at the Russian Academy of Science has been invited to discuss Russian robotic flights to the Moon, such as Lunakhod and Luna sample return missions.

Following the science panel, key members of the Apollo 8 team will discuss the decision to go to the Moon and mission execution at a seminar beginning at 3 p.m. in Teague Auditorium.

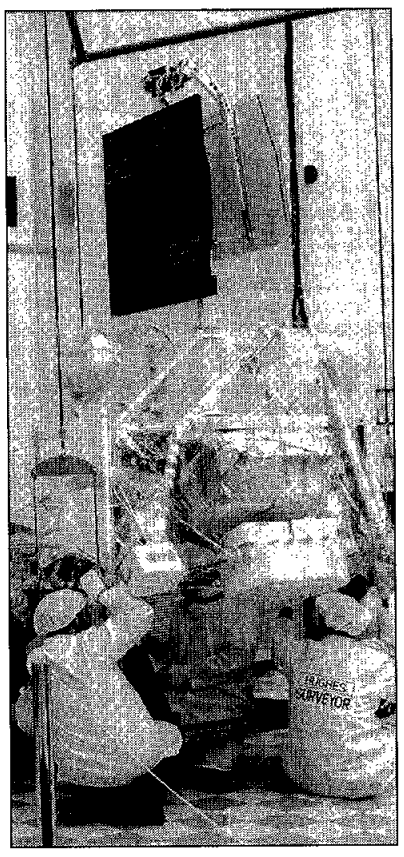
Apollo 8 astronauts Borman, Lovell and Anders will reminisce with former center directors Aaron Cohen and Chris Kraft. Cohen was the Apollo 8 command-service module project manager, and Kraft served as director of flight operations during the mission.

Also participating in the discussion are Glynn Lunney, an Apollo 8 flight director, and Bill Tindall, former chief of the Mission Planning and Analysis Division. Moderator Joe Loftus plans to discuss such topics as space sickness, the crew's reaction to its sudden mission re-assignment and other behind-the-scenes experiences.

The Apollo 8 crew will be guests of honor at the Silver Anniversary Gala beginning at 8 p.m., Saturday, Dec. 18, at Space Center Houston. Apollo 8 Flight Director and former JSC Director Gerry Griffin will emcee the program beginning at 8:30 p.m. featuring remarks by the astronauts and other special guests. Desserts and refreshments will be served and a cash bar will be available. Holiday attire is recommended

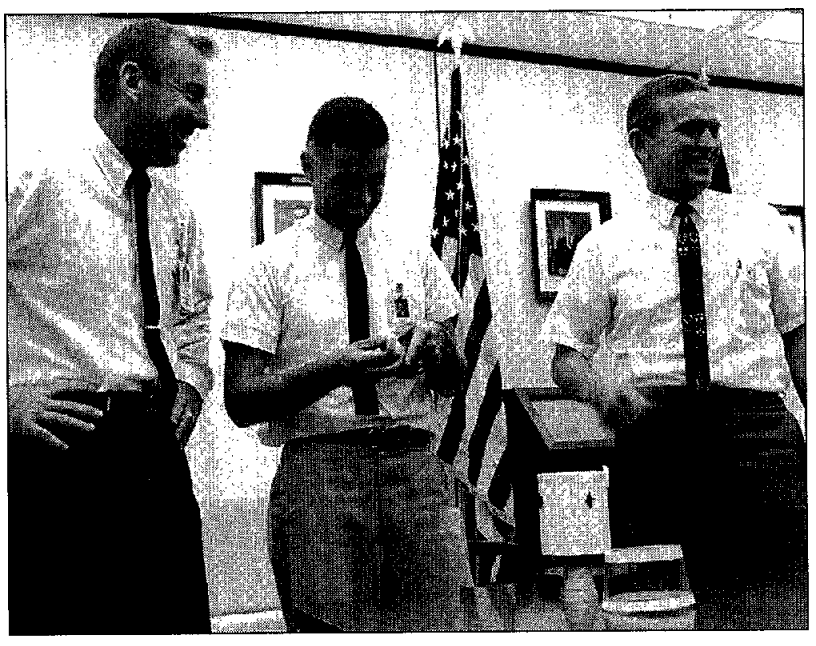
Tickets to the Apollo 8 gala are $10 per person and are on sale through Dec. 14 at Space Center Houston, the JSC Exchange Store, the Clear Lake Chamber of Commerce, Spaceweek Headquarters and at many JSC contractor offices.

For additional information, contact Community Affairs at x33276. ❑



Top right: The rising Earth as seen from Apollo 8 in lunar orbit. Top left: Command Module Pilot Jim Lovell waves to well-wishers in a pre-dawn departure for the pad with Commander Frank Borman, leading, and Bill Anders. The astronauts were launched on the first manned lunar flight Dec. 21, 1968 at 6:51 a.m. CST. Above: Dr. Robert Gilruth, director of the Manned Spacecraft Center, left, and Apollo Spacecraft Manager George Low check on Apollo 8 status from a Mission Control console. Right: The Surveyor C lunar surface sample was one of several unmanned pre-cursors for the Apollo lunar missions. Below: Lovell, left, Anders and Borman review for their historic flight.

NASA Photos



Satellites aid in war on famine in Africa

Scientists from Goddard Space Flight Center are helping detect early warning signs of potential famine and desert locust swarms in Africa using information from NASA satellite data.

Using daily data from the National Oceanic and Atmospheric Administration meteorological satellites, scientists measure the density of green vegetation in a specific region every 10 days. By comparing satellite data to ground data dating back to 1981, scientists have gained a better understanding of vegetation and rainfall patterns throughout Africa.

The effort attempts to understand the natural variations of climate as they relate to desert boundaries and adjacent semi-arid areas and to determine any changes in climate between 1980 and 2000.

In addition to the climatic studies and early famine warnings, the same satellite data are being used to identify areas where desert locust swarms are developing in Africa.

Locust eggs can remain dormant in the soil for 10 to 30 years, hatching when rainfall which enables the growth of green vegetation, provides the soil moisture needed for the eggs to hatch. The newly hatched desert locusts then feed on the green vegetation. Another benefit of the technology is the reduced use of powerful insecticides since they can be restricted to localized areas before the swarms become mobile and disperse.

The work is being conducted through a cooperative agreement between GSFC and the U.S. Agency for International Development. "The agency contacted us after seeing publications on remote sensing of the Sahel of Africa" conducted by NASA. Goddard scientist Compton Tucker said. "Since we use satellites to look at vegetation in these regions, we can obtain data on countries that historically have been affected by famine and do so very close to real time."

According to Compton, by assessing current and future vegetation growth, the AID is able to "determine where droughts are occurring, their severity and how widespread" the drought is.

The satellite information helps AID maximize the efficiency of supplying food aid to needy countries, saving lives and reducing waste. The use of the satellites has been particularly valuable in gathering data in those countries where political instability makes it difficult to obtain information in any other way.

Toys for Tots annual campaign under way

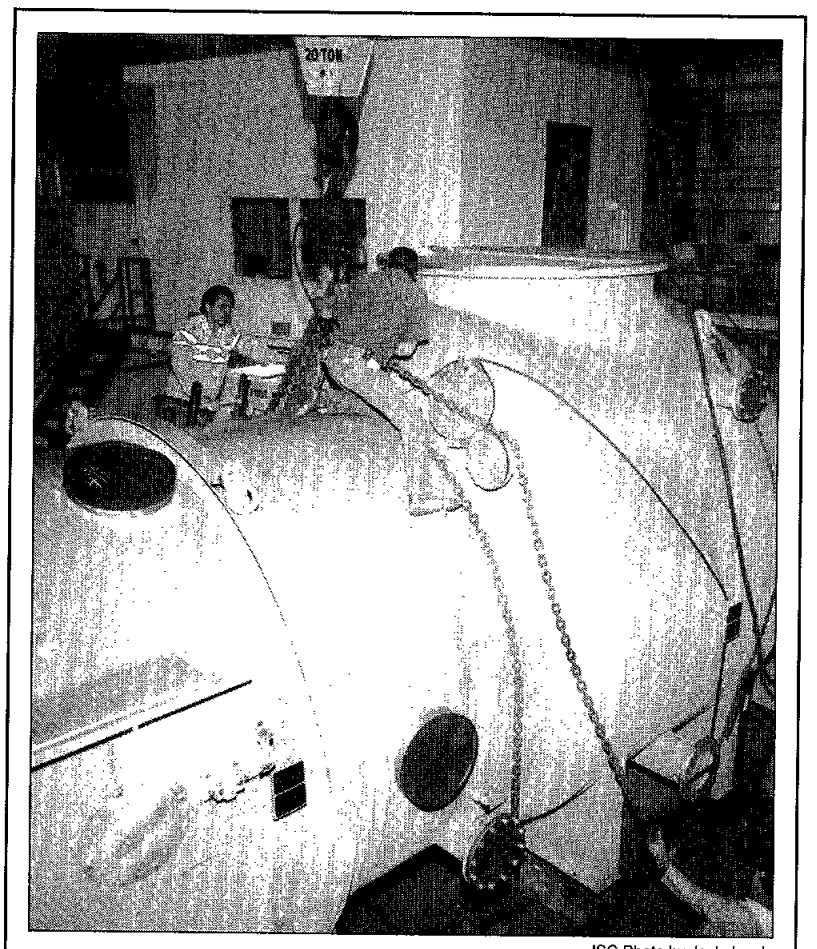
JSC employees and contractors are invited to spread the holiday spirit by joining Space Center Houston in supporting the U. S. Marine Corps Reserves' Toys for Tots Program.

Space Center Houston will be collecting toys for needy children Dec. 18-19.

Every guest bringing a new toy to the center on these two days will receive a $2 discount off the regular admission price. To receive the discount, tickets must be purchased at the Space Center Houston ticket window.

Uniformed Marines will be at the center from 9 a.m.-7 p.m. to accept donations. The Marine Reserve collects and distributes new toys every holiday season and has become an integral part of the Christmas spirit for many under-privileged children. Their activities allow some three million children to experience the delight of finding a new, shiny toy waiting for them on Christmas morning.

Help make Christmas special for the less fortunate by supporting the Toys for Tots Program. The program also accepts monetary donations. For additional information, contact Space Center Houston at 244-2130.



JSC Photo by Jack Jacob

VESSEL WRESTLE—Workers from C.L. Vick Construction and McRay Crane and Rigging Co. deliver the new Space Station Airlock Test Article to Bldg. 7. It will be used to develop space station airlock components and train crew members. Once fully outfitted it will be used to verify the interface with shuttle space suits, develop space walk procedures and investigate malfunctions.

Mission Control viewing room open for STS-61

The Mission Control Center viewing room will be open to JSC and contractor-badged employees and their families during portions of the STS-61 mission.

Based on a Thursday launch, employees will be allowed to visit the MCC Tuesday from 11:30 a.m.-2:30 p.m. and 5-7 p.m.; Wednesday from 11:30 a.m.-2:30 p.m.; Thursday, from 11 a.m.-2:30 p.m. and 5-7 p.m.; and Saturday, from 1-5 p.m.

Employees must wear their badges and escort family members through the regular public entrance on the northeast side of Bldg. 30. Children under 5 years will not be permitted.

No flash photography or loud talking will be permitted at any time.

Because of the dynamic nature of shuttle missions, or changes in launch time, viewing hours may be rescheduled or canceled without notice.

For the latest information on the schedule, call the Employee Information Service at x36765.

Timeline lists mission plans

(Continued from Page 1)

Flight Day Four

HST Extravehicular Activity No. 1 — Hoffman and Musgrave: Two Rate Sensor Units/Secondaries

Flight Day Five

HST Extravehicular Activity No. 2 — Thornton and Akers: Solar Arrays

Flight Day Six

HST Extravehicular Activity No. 3 — Hoffman and Musgrave: Wide Field/Planetary Camera; Two Magnetic Sensing Systems

Flight Day Seven

HST Extravehicular Activity No. 4 — Thornton and Akers: Corrective Optics Space Telescope Axial Replacement/Secondaries

Flight Day Eight

HST reboost burn at an orbit of 320 n.m. x 313 n.m.

HST Extravehicular Activity No. 5 — Hoffman and Musgrave: Solar Array Drive Electronics/ Secondaries

Flight Day Nine

Group B power up
HST grapple
HST unberth
HST release: MET 08/00:43:00 at an orbit of 320 n.m. x 313 n.m.

Separation burn 1: MET 08/00/44:00 at an orbit of 320 n.m. x 313 n.m. This burn begins a slow separation of *Endeavour* from the vicinity of HST.

Separation burn 2: MET 08/01: 08:00 at an orbit of 320 n.m. x 313 n.m. Increases the rate at which *Endeavour* departs from the HST.

Separation burn 3: MET 08/01: 32:00 at an orbit of 320 n.m. x 311 n.m. Puts *Endeavour* on its final course departing the vicinity of HST.

Group B power down

Flight Day Ten

Cabin repressurization to 14.7 psi
Off-duty half day for STS-61 crew

Flight Day Eleven

Group B power up
Flight Control Systems checkout
Reaction Control System hot fire
Cabin stow

Flight Day Twelve

Space Support Equipment power down
Deorbit preparations
Deorbit burn: MET 10/20:31:00
Entry
Landing: MET 10/21/:45:00

New Year's Eve gala slated for Gilruth

Ring in 1994 at the New Year's Eve dinner dance beginning at 7 p.m. Dec. 31 at the Gilruth Center.

The evening begins with the 7 p.m. social hour followed by dinner at 8 p.m. Dinner includes a buffet of hot and cold hors d'oeuvres, cold cuts and salads, a complimentary midnight champagne toast and a helping of traditional black-eyed peas. In addition, party goers may partake of a continental buffet breakfast as they head home.

Entertainment for the event will be provided by the Phil Gray Orchestra and the Boot Leg Band. The orchestra will play in the ballroom and country and western music can be heard in the gym.

Tickets for the dinner dance are on sale beginning Wednesday through Dec. 29. Cost is $25 per person and the tickets are nonrefundable. JSC employees, retirees and NASA-badged contractors may purchase tickets individually or in tables of 6, 8 or 12 seats.

For additional information, call Mike Gaudiano at x38318.

Astronomers look forward to refurbished observatory

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cy. The telescope has six pairs of gyroscopes on board and requires three for proper operation;

• Replacing the Wide Field/Planetary Camera, which has studied bright, high-contrast objects such as planets, nearby star clusters and galaxies. WF/PC II has been modified to compensate for the spherical aberration of the main mirror. Small actuators will fine-tune the positioning of the mirrors on orbit ensuring the precise alignment required;

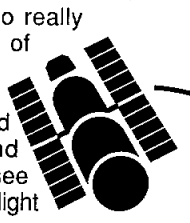
• Installing the Corrective Optics Space Telescope Axial Replacement to restore the optical performance of other instruments on the telescope; and

• Improving magnetic sensing systems that measure the spacecraft's relative orientation with respect to the Earth's magnetic field will be installed over the existing magnetometers. All of these tasks are scheduled to be completed by the end of EVA 4.

With these activities successfully accomplished, what lies ahead for the Hubble Space Telescope? It has gathered vast amounts of scientific data since its deployment in April 1990 despite the spherical aberration in the main mirror. Hubble has conducted long-term observations of global weather changes on Mars, documented the development of a rare, planet-wide storm on Saturn, and uncovered the strongest evidence yet that many stars form new planetary systems.

Astronomers are looking forward to the recommissioning of this orbiting observatory. Ed Weiler, Hubble chief scientist, said the first thing astronomers hope to look at with the refurbished telescope is the expansion rate of the universe. This will be accomplished by using Hubble's unique capabilities to precisely measure the light curve of Cepheid Variable stars in galaxies out to the distance of at least 50 million light-years.

"Think of them as a cosmic mile marker in astronomy," Weiler said. "To really establish the distance scale of the universe, upon which so much depends in measuring the age of the universe and determining its nature and eventual fate, you need to see farther out than a few million light years.



HUBBLE SPACE TELESCOPE

HST already has been able to detect Cepheid Variables out to 10 or 15 million light years but with its improved sensitivity, astronomers should be able to see the three or four times farther. The age of the universe is currently estimated to be between 10 and 20 billion years, but with the precise measurements expected from the serviced telescope, this prediction can be narrowed to an accuracy range of 10 percent.

Installing COSTAR and WF/PC II will allow Hubble to further the study of the evolution of galaxies. "We'll be able to see objects which are 10 to 15 times fainter than those we can see now," Weiler said. "We've started this process of seeing how galaxies form and with COSTAR and WF/PC II we hope to look back right to the very beginning when galaxies began to form."

The telescope also will look for gravitational signatures of massive black holes in the cores of normal and active galaxies. HST has already produced "very strong circumstantial evidence for a black hole," Weiler said. Hubble's spectrograph will measure the velocities of gas and stars orbiting the center of a galaxy, and if these velocities increase toward the galaxy center it would signal the existence of a massive, compact central object. "We hope to do that observation very early in the era of the repaired Hubble which hopefully will come about in February," said Weiler.

Hubble also will be able to determine the shapes of very distant galaxies and measure the ages of globular clusters by observing the faintest stars in the clusters. Globular clusters are thought to be the oldest objects in the universe and their ages provide insights into how stars evolve. These measurements also will provide independent corroboration on the age of the universe.

Will accomplishing all of the objectives of the servicing mission allow us to attain all the promise and potential of the telescope? "Absolutely not," Weiler said. "Hubble was always dreamed of as a long-lived observatory. To justify the huge investment in it we have to keep it running as long as possible doing world class science, and that will take routine maintenance."

"Gratification in science and astronomy does not always come quickly," Weiler added.

Following the visit of the *Endeavour* crew, the telescope faces a long recommissioning period. It will be 12-14 weeks before the telescope begins to gather new scientific data.

Dr. David Leckrone, senior scientist at Goddard Space Flight Center, said that period will be spent calibrating gyros, testing pointing systems, and locating apertures and focal points on the instruments.

This relatively protracted period of focusing and aligning optics within the instruments is critical. "It is important for us to have internal control within COSTAR and WF/PC II on our optics, so it will take quite a long period of time in a trial and error process to bring the optical systems into operation," Leckrone said.

Success can be measured at several levels during the mission. The basic success criteria requires installing the new design gyroscope systems and either an operational WF/PC II or COSTAR. These activities restore the most critical vehicle redundancy, correct a portion of the science instrument problem and validate the concept of on-orbit servicing.

Full success may be determined by completion of the primary servicing tasks which includes installing the gyroscope pairs, WF/PC II, COSTAR, the magnetometer system, and the solar array drive electronics unit. If these primary servicing tasks are not completed, program managers will request a back-up mission to be flown within one year.

In judging the success of this mission Weiler stressed that "this is the most aggressive mission ever attempted. This is not like going to Grandma's to fix a leaky faucet."

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