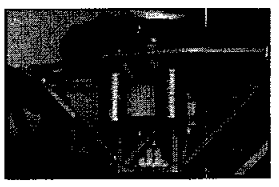
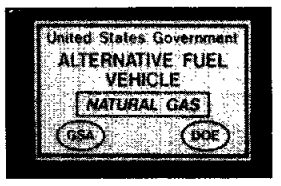
NASA
National Aeronautics and Space Administration
Lyndon B. Johnson Space Center
Houston, Texas



Leaving a Wake

Flight of the Wake Shield Facility will take advantage of the vacuum of space for advanced materials processing. Story on Page 3.



Take the Alternative

JSC inducts three new Compressed Natural Gas vehicles to the center's transportation fleet. Story on Page 4.

Space News Roundup

Vol. 31 | May 8, 1992 | No. 19

Endeavour ready for maiden voyage

Smooth countdown initiates new shuttle into NASA's fleet

By James Hartsfield

An extremely smooth countdown to *Endeavour*'s first launch continued Thursday, with the only threat to a 6:06 p.m. CDT liftoff a poor weather forecast.

At presstime, the filling of *Endeavour*'s external tank was complete but possible thunderstorms and thick clouds were forecast to lower the chances of a Thursday launch.

Shuttle managers laid in place plans for three consecutive launch attempts so, if Thursday proved unsuccessful due to the weather, another attempt could be made today and a third try to launch STS-49 could be made Saturday. A fourth launch attempt would require a 48-hour postponement to allow time for hydrogen and oxygen tanks at the launch pad to be replenished.

Once on orbit, the STS-49 crew — Commander Dan Brandenstein, Pilot Kevin Chilton and Mission Specialists Bruce Melnick, Pierre Thuot, Rick Hieb, Kathy Thornton and Tom Akers — will begin maneuvering to a rendezvous with the stranded INTELSAT-IV satellite.

The communications satellite has been in low Earth orbit since March 1990 when its booster stage separation system failed and the satellite could not reach geosynchronous orbit.

During the STS-49, INTELSAT controllers will maneuver the satellite to the rendezvous point while Brandenstein guides *Endeavour* to meet it. Once the rendezvous is complete, Thuot and Hieb will venture outside the crew cabin to capture and repair the satellite.

With an on-time launch Thursday, the first STS-49 spacewalk would begin at about 3:50 p.m. CDT Sunday or Flight Day Four.

A second spacewalk — by Thornton and Akers to evaluate space station assembly techniques is set for Flight Day Five, and the third spacewalk — by Thuot and Hieb for space station assembly evaluations — is scehduled for Flight Day Six. The three spacewalks are planned to last about six hours each.

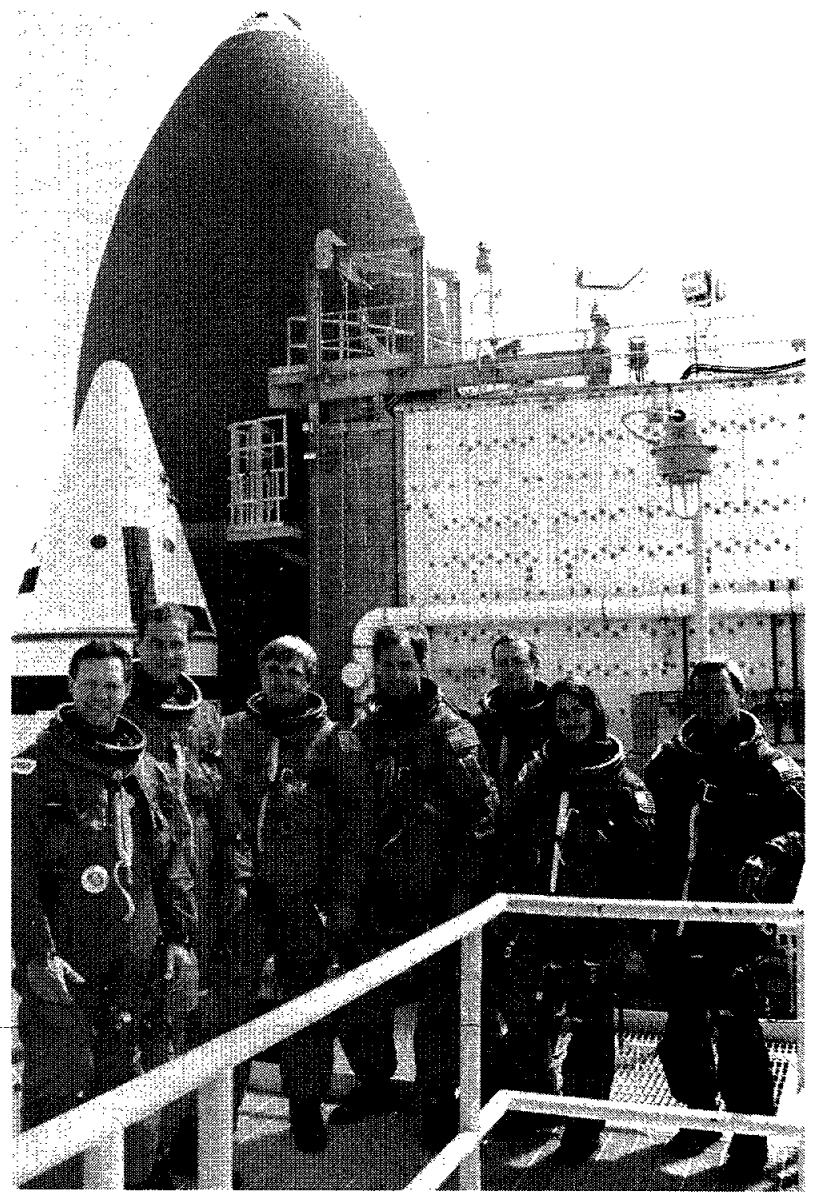
As of presstime Thursday, however, crew members were donning their launch and entry suits and preparing for their trip to the launch pad.

Elsewhere, work continued to prepare *Columbia* for the next shuttle mission, STS-50, a 13-day flight — the longest shuttle flight ever — planned for a mid-June launch.

This week, *Columbia* remained in bay 3 of KSC's processing facilities where workers installed the toilet and prepared for an inspection of the orbiter's cargo bay by the STS-50 crew next week.

Atlantis, in Bay 1 of the process-

Please see **SPACEWALK**, Page 4



READY TO FLY — Crew members for *Endeavour*'s maiden flight are, from left to right, Mission Specialists Pierre Thuot, Rick Hieb, Commander Dan Brandenstein, Pilot Kevin Chilton and Mission Specialists Tom Akers, Kathy Thornton and Bruce Melnick.

Part of Cook's Endeavour *goes on flight*

Capt. James Cook would be proud.

As the British captain sailed across the South Pacific in 1768, he may have wondered about sailing among the stars with which he marked his journey, but he probably never dreamed a spacecraft that would streak through the heavens above would be christened after the ship on which decks he stood.

The spirit of Cook will travel with the Space Shuttle *Endeavour* on its maiden voyage symbolically represented in by a small piece of stern post from Cook's *Endeavour*, on loan to NASA from the Graduate School of Oceanography at the University of Rhode Island.

On wooden sailing vessels, the stern post was the vertical piece at the aft end of the ship, usually supporting the rudder. The particular piece of wood going with the STS-49 crew was presented to the university in 1976 at the christening ceremony for its research vessel *Endeavor*.

The stern post section will fly as part of the Official Flight Kit in a middeck locker.

Cook commanded the maiden voyage of *Endeavour* on a mission to observe and record the planet Venus passing between the Earth and Sun. Determining the transit of Venus allowed early astronomers to determine the distance between the Sun and Earth.

Undersea mission gives JSC look at team performance

By Kari Fluegel

The Florida Keys may not seem as distant as the Moon, but for four men during the next 30 days, it might as well be.

During "La Chalupa 30," sponsored by Marine Resources Development Foundation of Key Largo, Florida, four men will conduct investigations in an underwater habitat without any direct outside human contact for 30 days, giving JSC's Behavior and Performance Laboratory the opportunity to study team performance as part of its continuing investigation to identify pertinent psychological issues for long duration space flight.

At present, NASA employs passive studies to develop its knowledge base on long-term team performance and human behavior. Those studies have progressed to the point at which researchers are ready to test improved behavioral collection methods, said Dr. Al Holland, head of the Behavior and Performance Laboratory.

"The mission will serve as an environment which is analogous to future extended space missions on the shuttle or space station," Holland said. "This project is primarily a testbed for field data collection methods and procedures. Information collected here also will assist investigators in conducting further studies in field environments which are of longer duration and possibly in more remote areas."

The four aquanauts, all volunteers recruited by MRDF, will live and work in the undersea laboratory with regular excursions into the lagoon to perform the in-the-water portion of their marine research projects — an analog to extravehicular activity during space flight. They will be in contact with surface crews via voice and video links, but no direct contact will occur for the duration of the test.

The behavioral investigations address four primary areas pertinent to extended missions in confined environments: individual health and well-being, work, team maintenance and data collection methods.

The aquanauts, all recruited by MRDF, are Chris Olstad, 37, mission commander and an MRDF biologist; Richard A. Presley, 33, deputy crew commander and a hydroponics developer with BioLabs in Key Largo; Bill Soeffing, 35, a cell biologist at Sioux Falls College, Sioux Falls, South Dakota; and John Conant, 34, a hyperbaric emergency medical technician from Fort Meyers, Florida.

"By the end of this 30 days, we will have a better understanding of the viability of certain field methods, hardware and software," Holland said. "We will also be in a better position to establish guidelines and for 30-day space missions."

Agency mourns loss of former administrator

Dr. Thomas O. Paine, 70, who led NASA during the first Apollo moon landings, died Monday of cancer in California.

"The agency mourns the death of Tom Paine, an outstanding American," said current NASA Administrator Daniel S. Goldin. "Over the years, I had the privilege of working with Tom personally. I found him to be man of vision and integrity. Tom's leadership of NASA through the first several moon landings was nothing short of exemplary and later as chairman of the National Commission on Space in the mid-1980s, his direction of this presidentially-appointed group formulated a bold agenda to carry America's civilian space enterprise into the 21st century."

Paine became NASA's third administrator in March 1969, following the retirement of James E. Webb. During his term, NASA launched the first seven Apollo missions in which 20 astronauts orbited the Earth with 14 traveling to the moon and four walking upon its surface. He resigned from NASA in September 1970 to return to General Electric in New York City as vice president and group executive of the Power Generation Group.

In 1976, Paine joined the Northrop Corp. and remained there until retiring in 1982. Paine was appointed chairman of the National Commission on Space by President Reagan in 1985 and served on the Advisory Commission on the Future

Please see **PAINE**, Page 4

Thomas O. Paine

JSC contractors named Low finalists

Three JSC contractors are among the eight finalists chosen to compete for the 1992 George M. Low Trophy — NASA's quality and excellence award.

The JSC finalists are IBM Federal Sector Division, Houston; Paramax Systems Corp., Space Systems Operation, Houston; and Technical Analysis Inc., Houston, (small business).

The other finalists are Cray Research Inc., Customer Service, Engineering, and Manufacturing Divisions, Chippewa Falls, Wis.; Honeywell Inc., Space and Strategic Systems Operation, Clearwater, Fla.; McDonnell Douglas Space Systems Co., Kennedy Space Center, Fla.; Rocket Research Co., Redmond, Wash.; and Stanford Telecommunications Inc., Reston, Va., (small business).

JSC also has significant dealings with Cray, Honeywell and Rocket Research.

Created in 1984, NASA's quality and excellence award was the first national program to recognize the quality of an organization's services and products. The Low Trophy recognizes both NASA's large and small prime contractors, subcontractors and suppliers for outstanding achievement in quality and productivity improvement and Total Quality Management. Key goals of the award are to internalize quality and productivity practices and TQM processes throughout NASA and the agency's contractors and to transfer

Please see **QUALITY**, Page 4

JSC

Ticket Window

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

EAA Galveston Historical Home Tour (May 9 and 10): $11.

Sea World, $18.90 (child free with paying adult); Astroworld, $16.95 and $44.95 (season pass); Waterworld, $9.50; and Six Flags, $16.95 (one-day) and $22.95 (two-day).

Movie discounts:
- General Cinema, $4;
- AMC Theater, $3.75;
- Loews Theater, $4.

Upcoming EAA Events:
- River Raft Trip (June).

JSC

Gilruth Center News

Sign up policy — All classes and athletic activities are first come, first served. Sign up in person at the Gilruth Center and show a badge or EAA membership card. Classes tend to fill up four weeks in advance. For more information, call x30304.

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

Weight Safety — Required course for employees wishing to use the Gilruth weight room is offered from 8-9:30 p.m. May 12 and 27. Cost is $5.

Defensive driving — Course is offered from 8 a.m.-5 p.m. June 6. Cost is $19.

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

Exercise - Low-impact classes meet from 5:15-6:15 p.m. Mondays and Wednesdays. Cost is $24.

Aikido — Martial arts class meets Tuesdays and Fridays. Cost is $35 per month.

Tennis lessons — Beginner lessons will be held Mondays beginning June 1. Cost is $32.

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

Softball tournament — A Men's Spring Fling Open "C" Softball Tournament will be played at the Gilruth May 16-17. Entry fee is $95; deadline is 7 p.m. May 14.

JSC

Dates & Data

Today

AAS symposium — The American Astronautical Society's Southwest Section will present an AAS Spring Symposium from 8 a.m.-4 p.m. May 8 to review the progress and benefits of Space Station *Freedom* in the University of Houston-Clear Lake Bayou Bldg. Registration is free; box lunches are $7 at the symposium. For more information, contact James Vanderploeg, 488-8503.

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.

Saturday

MOD Chili Cook-off — The Mission Operations Directorate will host its annual MOD Chili Cook-off from 8 a.m.-4 p.m. May 9 at the former Lunar and Planetary Institute grounds on NASA Road 1. Tasting kits will be $2; all JSC employees are invited to attend.

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

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

Wednesday

AFCEA meeting — The Armed Forces Communications and Electronics Association will conduct its monthly meeting May 13 at the Nassau Bay Hilton Ballroom. Guest speaker will be Lt. Gen. Edward P. Barry, commander of the Space Systems Division, Air Force Systems Command, at the Los Angeles Air Force Base. The social will begin at 11:30 a.m. with lunch following at noon. Cost is $12 for members and $14 for non-members. For more information, contact Veronica Mullins, 283-7342, or Luz Wood, 283-7308. Reservation deadline in May 11.

Astronomy Seminar — Dr. Larry Friesen will report on the Joint Workshop on New Technologies for Lunar Resource Assessment at the weekly JSC Astronomy Seminar from noon to 1 p.m. May 13 in Bldg. 31, Room 129. For more information, contact Al Jackson at 333-7679.

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

SSQ meets — The Society for Software Quality's Houston Chapter will meet at 5:30 p.m. May 14 at the Nassau Bay American Host Hotel. George Laggis, the AT&T Federal Systems Advanced Technologies System Integration Manager, will speak on "Prototyping in a Structured Environment." Reservations deadline is May 8; call Karl Wiesner at x33807.

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

May 15

AIAA meets — The American Institute of Aeronautics and Astronautics will present a special International Space Year luncheon at 11 a.m May 15 in the Gilruth Center. Aerospace author James Oberg will discuss the use of active technological intervention to help repair human damage to the environment. Registration deadline is noon May 12; cost is $7 for members, $8 for non-members and $6 for students and young members. Call 333-6064, 283-4214, 283-6000 or 282-3160.

UNIX meeting — The JSC UNIX Systems Administration Group will meet at 2 p.m. May 15 in Bldg. 12, Rm. 256. Dan Benbenek will discuss "Connecting to JESNET." For more information, call Mark Hutchison, x31141.

SimTec '92 — The 1992 International Simulation Technology Conference co-sponsored by JSC will be Nov. 4-6 at South Shore Harbour Convention Center. The deadline for papers on aerospace, life and physical sciences, and intelligent systems is May 15. Full papers should be sent to Technical Editor and SCS Representative Mary Lou Padgett, Auburn University, 1165 Owens Road, Auburn, Ala., 36830. For more information, call Padgett at 205-821-2472.

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

JSC

Swap Shop

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

Property

Rent: Timeshare Condo, avail many locations, $400/wk. x33185 or x37990.

Sale: Sageglen, 4-2-2, new carpet, cathedral ceiling, track lights, fans, security sys, CCISD/Pasadena schools, owner, $85.9K. x37760 or 481-4190.

Lease: Egret Bay condo, full sz W/D, custom blinds, ceramic tile, ex cond, $595/mo. 335-6755 or 333-1038.

Sale: Friendswood lot, 1/3 acre, owner financing w/10% dn, $16K. 482-5226.

Sale: Jamaica Beach lot on canal. 286-8558 or 280-2554.

Sale: Seabrook, 3-2-2, single story, vaulted ceilings, FPL, blinds, grape arbor, 1 yr old, $87.9K. Beth, x30528 or 474-9353.

Sale: Countryside, 3-2.5-2A, two story, corner lot, covered deck, all bdrms up, int util rm, CCISD, $66.9K. 554-7623.

Rent: Timeshare condo anywhere in the world, $600/wk. 286-8417.

Lease: Shoreacres, 4-2-2, fenced, approx. 2000 sq ft, no pets, $650/mo. Sally, x37485 or 488-5501.

Sale: Orlando timeshare at Vistana Resort, 2 bdrm, sleeps 8, 1300 sq ft, 2nd floor, screened porch, located at entrance to Disney World, $9.9K. Phil, 283-5648.

Cars & Trucks

'80 Chevette, good body, no rust, engine runs, needs clutch, $300 OBO. 481-2535.

'90 Convertible Dodge Dakota PU, 13K mi, like new, P/S, P/W, P/L, AC, alarm service contract, $11.9K OBO. x49744 or 333-9742.

'85 Cadillac DeVille, rebuilt eng, clean, new AC, no dents, ex cond, maroon int & ext, velour upholstry, $8K OBO. x37771 or 561-9930.

'81 Plymouth Horizon, needs motor work, $200. 992-5353 or 282-6481.

'87 Camry LE, 4-dr, loaded, ext warr, 51K mi, ex cond, $7.2K. x36149.

'84 Audi 5000 Sedan, 4-dr, 45K mi, ex cond, $5.5K OBO. 480-8721.

'88 Chevy IROC-Z, loaded, red, t-tops, 5.7L V-8, $8K OBO. Greg, 286-0356.

'84 Pace Arrow Motorhome, 34', sleeps 8, new tires/batt, ex cond. 409-925-7375.

'87 BMW 325 es, all options, leather int, ex cond, new eng, 16K mi, new brakes/tires. 524-8908.

'77 Ford F100 PU, 6 cyl, short bed, 3 spd, manual, AM/FM, runs well. 326-2307.

'88 Ford Tempo GL, auto, AC, heat, cruise, AM/FM, PS, PB, 4 DR, exc. cond, 74K mi. x37990 or 996-1046.

'80 Pontiac Firebird, V6, auto, AC, Kenwood stereo, new tires, very clean, good cond, $2.5K. 328-4914.

'75 Jeep CJ5, new x-heavy duty suspension w/ 2.5" lift, new tires/drive train, $4K. 554-4315.

'77 Lincoln Mark IV, sell or trade for Van, $2K OBO. 796-0231.

'85 Chevy Cavalier, 4-dr, 4 cyl/2.0L, auto, new tires, brakes, 75K mi, ex cond, $2.4K. 488-5522.

'89 Chevy IROC Camaro, white, red int, t-tops, pull-out stereo/cass deck, V8, AC, loaded, new tires/brakes, $9750 or $500 down and take over payments $314 for 34 mo. Ray, 992-4064.

'88 Corvette, red coupe, tan cloth, 2 alarms, Delco Bose, 31K mi, tint window, auto O/D, ex cond, $16.8K. Ed, x34411 or 482-7461.

'80 Mercury Capri, P/S, P/B, 4 spd, AC, new tires/brakes, clutch well maintained, $600. 482-3428.

'84 Volvo GL Turbo, ex cond, brwn w/tan leather int, auto w/overdrive, sunroof, 96K mi, $4.6K. Cyndi, 482-8224 or 333-7761.

'91 Chevy Storm, 3-dr, colbalt blue, tint windows, AM/FM/cass, AC, low mil, $8K. 286-1754.

'68 Classic Dodge Dart, 90K orig mi, runs well, slant 6, 225 w/Holley carb, $800. George, x36391 or 326-2395.

'89 Plymouth Acclaim, burgundy, 4-dr, AC, P/S, P/B, AM/FM/cass, good cond, 50.5K mi. Sherri, x36529 or 481-0809.

'80 Toyota Corolla, eng needs work, 2 new tires, $475 OBO. Al, x31293 or 996-0054.

Boats & Planes

'90 Liberator jet boat, ex cond, 21' w/trlr, $14K. 426-5866.

17' Trihull, 120 hp OMC stearn drive, fish/ski ready, bimini top, walkthrough open bow, limited saltwater time, $3.1K. Mike, 286-3101.

'84 Bayliner Bowrider, 16 ft, rebuilt motor, 85 hp force, '89 trlr, extras. 538-1357.

Cycles

'73 Honda CB500 four, header, new batt, red, helmet to match, 12K orig. mi, $375 OBO. x34754 or 554-7116.

Kawasaki EX500 Sportbike, mint cond., 3K mi, alarm and lower fairing, $2.7K OBO. x38841 or 326-5446.

'78 Classic Wing GL1000, full dress, sparis, ex cond, $2350. Dave, 486-0808.

Audiovisual & Computers

GEM Desktop Publisher, GEM Draw+, GEM Graph, GEM Wordchart, $300; Wordstar 5.5, $100; Reflex 2.0, $75. Pedro, x38354.

Akai turntable, never used, was $125, now $40. 331-0164.

GE stereo/turntable, encased in sold wood, ex spkr sys, storage area incl, $150. 482-8921 or 482-5704.

Zenith Supersport 286 laptop, IBM compatible, 1MB RAM/20MB HD, 1.4MB FD, backlit supertwist LCD screen, incl modem, batt, custom case, software, never used, in orig packing, was$3K, now $2.3K. Sheila, x32564 or Bob, 486-4711.

NEC P3200, 24-pin dot matrix printer and 2500 sheets paper, $200 OBO. 282-4303 or 998-8821.

Ext 5-1/4" disk drive, IBM, fits PS2/30 system, $125 OBO. 280-2492.

Photographic

Mamiya C-330 Professional-f, med format camera, 80mm and 135mm lens, prism finder, magnifier, flash bracket, metal case, $750. Ignacio, 486-1078 or 282-4818.

Nikonos II w/35 mm lens, $250; Ikelite substrobe 150A, $395; Konica FT-1 motor w/50mm lens, 28 mm lens, 70-210 mm lens, 2x multiplier, UV filter, cross screen filter, polarizer, release cable and case, $500. Dennis, x31966.

Pets & Livestock

AKC lab pubs, born 3-13-92, blacks and yellows, shots/declaws, strong FTC bloodline, ready 4-24, $200. 244-9682.

AKC reg, 2.5 yr old, red male dachshund, $75. 337-1896 or 337-2682.

Himalayan/Persian kittens, seal pt, blue pt, black, blue, white, cream, adult breeders, red, tortoiseshell, pet, breeder, show quality, $250-$750, stud serv avail. Kristy, x31468 or 286-0146.

Lab pups, AKC, born 3-23-92, blk, yellow, choc, mother/father on premises, $250. Karen, x31385 or 947-2025.

Musical Instruments

Story and Clarke spinet piano, ex cond, $700. 946-7587.

Yamaha, kybd PSS-170, 3 yr old, good cond, porto sound/voice bank. (409) 267-3750.

Household

Full sz bet sed, brass headboard, $75. Bruce, 485-5970.

Matching sofa and chair, lt. blue floral pattern, ex cond, $200. Ignacio, 282-4818 or 486-1078.

Camel colored 6 section couch and 100% wool oriental rug, $300; 4 chair kitchen dinette, $65. 337-2461 or 996-8149.

Maytag elect dryer, $80. 283-5595 or 554-7377.

Solid oak trestle table, 4 antique oak bentwood chairs, $300. 280-8746.

Antique style overstuffed chair, gray velvet, chaise lounge, dusty rose velvet, ex cond, $75/ea OBO. 538-3320.

GE washer, ex cond, $150. x31158 or 486-0677.

Complete king sz waterbed; baffled matt, linen, heater, dark finish, frame/headboard w/mirror and shelves, padded siderails, six drawer pedestal, $175 OBO. 334-2612.

Two couch set, one 7', one 5', dark brwn pattern, solid, both $200. George, x36391 or 326-2395.

Wanted

Want rider for carpool starting from SW Alief to CL/JSC. James, 333-6458.

Want to contact good samaritan who loaned me jumper cables at JSC Xmas Tree Sale. Dennis, x32418.

Want software w/documentation for PC/XT. x30133 or 488-7938.

Want little tikes cozy coupe. Greg, 333-7160.

Want to rent popup camper for Memorial weekend. Susan, x33799 or 474-5824.

Want used Hammer Dulcimer in good cond. Jeanne, x38641.

Want Franklin mint books, English riding boots and saddle, wicker picnic basket w/leather straps. 280-8746.

Want working and nonworking appli, refrig, W/D, lawnmowers, air cond. 479-1608 or 476-0612.

Miscellaneous

'76 Starcraft Starmaster popup camper, sleeps 6, inside & canvas good, needs new tires, floor needs work, rust on frame, $350. 481-2535.

Nokia mobile phone, ex cond, portable, 2 yrs old, $100. x38193 or 409-267-3750.

Presidents/First Lady Charter Gold Membership, dues $65/yr paid through Jan '93, 2 day racquetball reser, $550. Roger, x31928 or 996-7674.

.75 carat round diamond solitaire, JSI quality, orig $4k, now $2K OBO. Peter, 244-5578 or 286-8346.

Blk satin coctail dress, ruffled peplum waist, open back w/drap pearl strands, white sequins, beaded flowers attached to shoulders, never worn, was $150, now $90. Connie, 644-5307 or 484-2192.

New front chrome bumper for Ford PU, $200; rear hitch for Chevy PU, $30; electric squirrel cage blowers, $35/ea; new elec htr, $35; tow-bar, $40. 484-8241.

Lawnmower, self-propelled, w/catcher, $125. Kathy, x39190 or 332-6305.

Lawnmower, 3.5 hp, Murrah rearbagger, $75. 280-0850.

RCA console color stereo tv, 27" screen, best offer over $400; attic colling fan, never used, $100; blk velvet and hot pink after 5 dress, sz 5, $75; pink after 5 dress, floor length, sz 5-7, $75; Kenmore floor cleaner/polisher, $125. Diane, 283-5618.

Forty pre-1964 quarters, $40; fifty 1964 VG/BU dimes, $25. Ted, 482-8827.

Smith & Wesson model 686, 357 Magnum, 4" barrel, stainless revolver, extra Hogue grip, $320. Randy, 326-1775.

Weight bench, w/weights, $50; Jasmine acoustic 6-string guitar, $100. 282-5191 or 337-2461.

Lifestyler ski exerciser, $200; bike rack for car roof, holds 4 bikes, $125, both ex cond. 334-4894.

Saab 900 manufacturer's shop manuals, for all models through 1985, 9 vols in 4 binders, $60. 283-5595 or 554-7377.

Fuel injection control unit for '78 Datsun 280Z, known good and fits '77 model also. John, x31114 or 486-0898.

Ladies 1.25 ct oval shape solitaire ring, G-H, color, SI, clarity, appriased $4.5K, asking $2.1K OBO; ladies dinner ring, 1.22K total diamond wt, appriased $2.5K, sell $1.8K.x39341 or 480-9201.

Small round endtable, $15; remote control XCELL-60 helicopter w/Enya eng, assembled, never flown, $600. 480-3424.

Mazda RX7 seats, fits 79-85 models, red vinyl/velour, ex cond, $150/pair. Brian, 480-5430 or 333-7315.

'91 concert shirt of Stevie Nicks and Amy Grant, $75/ea, free copies of VHS tape of 40 min prayers, tape of the Rosary, you supply tape. 286-7192.

Eelskin bags, $80; mens and ladies wallets, $30; ladies Donney & Burke mini pouch, approx 7x5x3", Fischer turntable, cass tape deck, CD, amplifier, $300. x30003 or 644-3137.

Solid oak DR table, $150; CB radio, 1 yr old, $55; Soma matt, $300; lg dog kennel, $60; corner unit bunk beds, $250; 2 infant car seats, $25/ea, baby clothes to 2T. 244-5161 or 480-8721.

Roll top unfinished desk, $150; exercise bike, $100, corner twin bed set with 2 beds, $125. x38243.

Weight bench, Weider design, incline/flat, fly, legs, lats, $100 OBO. 282-3242 or 286-3631.

Drafting set, Radio Shack microcassette recorder, tapes, US divers fins, sz 5-7, mask and snorkel, Sony portable minispeakers, car cover for Honda Accord hatchback, Chilton and Clymer repair guides, best offer. Ron, x30887.

Following in the Shuttle's Wake

Wake Shield Facility finds commercial use for space vacuum

By Brian Welch

The spacecraft is small and intentionally simple, and the theory behind it has grown out of research first conducted in the 1960s. The Class-1,000 clean room where many of the components are being integrated is located in an unassuming building behind a motorcycle dealership on Highway 3, and the total investment to date has been minimal — even cheap — by traditional aerospace standards.

But if theory and hardware come together in low-Earth orbit late next year as planned, the little spacecraft called the Wake Shield could herald the beginning of what is envisioned as one of the most important new industries of the 21st century.

Development of the Wake Shield Facility, a 4,000-pound testbed to be deployed and retrieved by the *Discovery* in December 1993, is the work of a consortium led by the Space Vacuum Epitaxy Center at the University of Houston, one of NASA's Centers for the Commercial Development of Space.

The potential of the project lies in one of the most boundless attributes of space — its vacuum.

The Wake Shield will produce and harness its own ultra-vacuum, and then, in what amounts to a vacuum chamber without walls, it will produce extremely pure materials, atom by atom, using a process known as epitaxial growth.

Epitaxy is the science of growing thin film crystals on an atomic template, with atom-by-atom deposition in a vacuum. There are a host of industrial uses for ultra-pure thin film products, ranging from microelectronics to lasers and superconductivity.

"Purity is the key," said SVEC Director Dr. Alex Ignatiev, who sees many potential applications for the technology but has his eye firmly fixed on the worldwide semiconductor market, now valued at $50 billion annually and growing.

"The best semiconductor material now available in terrestrial labs," he said, "is simply not good enough. There are too many defects at the atomic scale."

But by working at that same scale, Ignatiev and a team of more than 60 research scientists, post doctoral researchers and graduate and undergraduate students at UH have identified a relatively low cost, low mass but high value-added industrial process seemingly made for the wide open spaces of low-Earth orbit.

Using a process known as Molecular Beam Epitaxy, the UH team could build gallium arsenide computer chips from the substrate up, by laying in only atoms of gallium and arsenic with extremely high precision in the near perfect vacuum of space. Molecular Beam Epitaxy, or MBE, was developed at the Bell Labs in the 1970s but has not been a fast growing technology for industrial applications here on Earth because the process is difficult, expensive and sometimes prohibitively time-consuming.

The potential of MBE was recognized by the Japanese microelectronics industry, however, and used to generate the light emitting diode technology that ultimately was applied to lasers and eventually the compact disc, Ignatiev notes. For many other terrestrial processes, however, MBE has its drawbacks.

The epitaxial process takes place within containment chambers, where a vacuum with a rating from 10^{-10} to 10^{-11} torr can be achieved on Earth (one torr is equal to 1/760th of a standard atmosphere). This vacuum level results in residual contamination in epitaxial films. The process also deposits a residue of whatever substance is being processed within those chambers, and the contaminants have to be removed before other materials can be processed. The steps involved in removing the residue of arsenic atoms, for example, can take months.

"That is not something you can really tolerate in an industrial setting," Ignatiev said. "Even here at the research level we wouldn't be real thrilled to have that time constraint. Seven or eight months of down time between operations would kill us."

The solution, he believes, is to work in a vacuum chamber without walls, and that means space.

During the late 1960s, even before MBE was developed at the Bell Labs, work at NASA's Langley and Lewis Research Centers theorized that an ultra-vacuum will form in the wake of an orbiting spacecraft. Plowing through the particles at the whispy fringes of Earth's atmosphere, the 12-foot-diameter Wake Shield Facility will sweep out a cone-shaped wake, extending about 100 feet downstream, creating a vacuum rated at 10^{-14} torr — several orders of magnitude greater than can be done on Earth — and is therefore expected to significantly improve the quality of the epitaxial films grown there.

After five years of research, Ignatiev believes the economics of space processing of materials using this technology are now highly promising. One of the products the team intends to manufacture by remote techniques aboard the Wake Shield is a gallium arsenide wafer that will weigh only 10 or 11 grams and could yield up to 500 computer chips.

"This is not an engine block for a John Deere," Ignatiev said, "and it has the virtue of being a very high value-added product. On Earth, an unprocessed gallium arsenide wafer is worth from $100 to $200. Once terrestrially processed by MBE, however, you can get from $1,500 to $3,000 for the wafer, which can in turn yield many chips. But if you can somehow increase the performance of that chip by a factor of two — and we think we can do much better than that with our space-grown materials — then you can increase the value of the wafer by four to 10 times. So this is when the economics begin to make sense. This is low mass, you can get a lot of devices out of it, and it has a large value-added component. Transport to and from space become an acceptable fraction of the total cost."

The value of a gallium arsenide chip begins at the atomic level. The velocity of electrons in gallium arsenide is about eight times faster than in a standard silicon chip, Ignatiev said. And with zero defects at the atomic level, chip designers could reduce the space between electrical circuit paths, pack more capability into the device, and achieve a performance that is a factor of eight times faster.

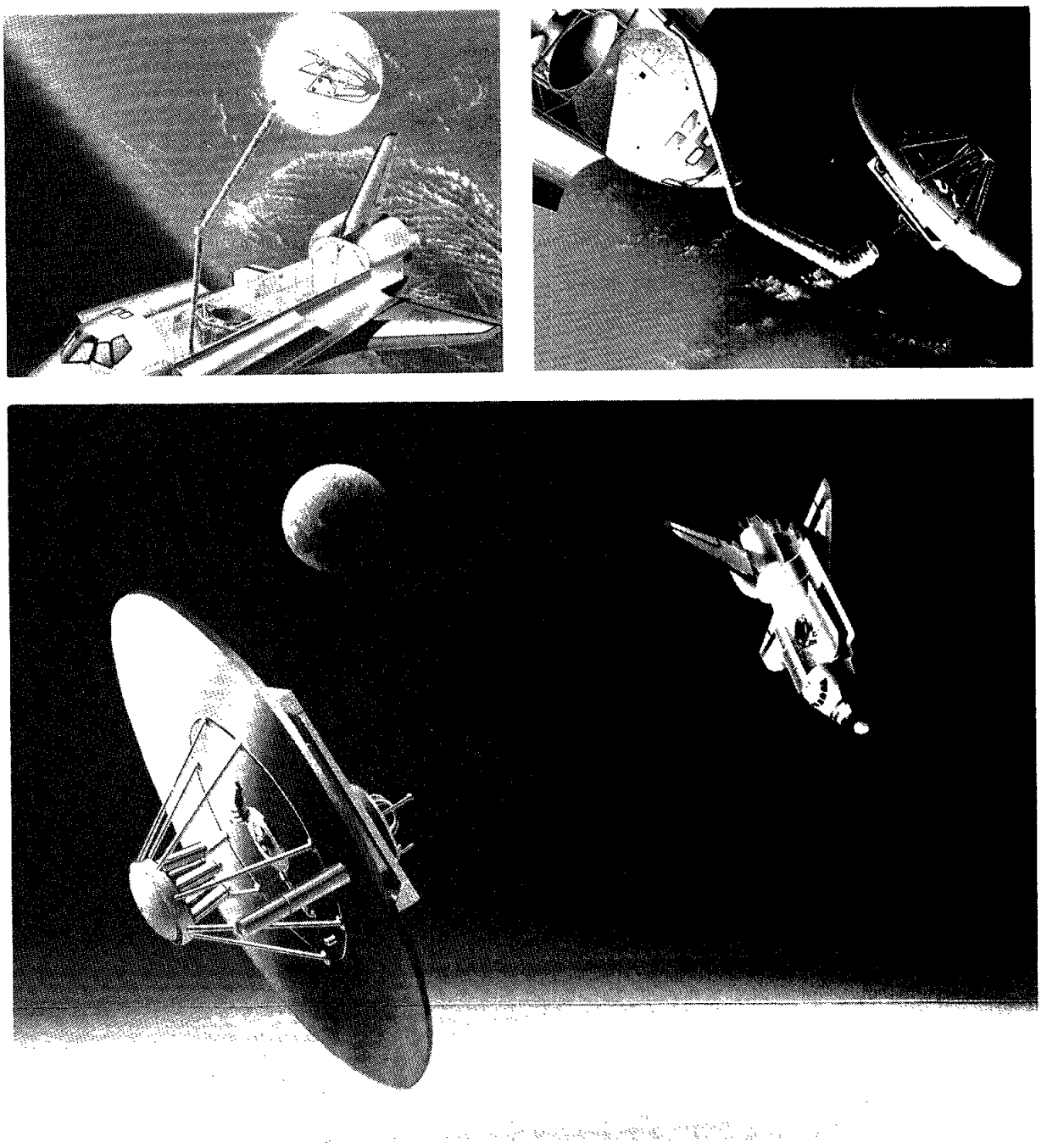
By the fourth flight of the Wake Shield in the mid-1990s, the spacecraft will have already demonstrated chip and solar cell production. Ignatiev's team then plans to process 200 wafers which could yield 50,000 gallium arsenide chips.

The next step, envisioned late in this decade, is a design known as Wake Shield Mark II.

"The Mark II is a four- to five-year orbiting platform," Ignatiev said. "It will include improvements in robotics that will allow for greater ease in servicing and harvesting of materials."

The Mark II would have a greater processing potential and would be able to run 300 samples each month, which in the case of computer chips, would translate to an estimated yield of 1 to 2 million devices each year.

Fabrication and integration of the spacecraft has been done by Space Industries Inc. The spacecraft is mounted on a cross-bay support structure, also designed by Space Industries, and is equipped with an internal power supply, a cold-gas propulsion system and telemetry. ❑



Illustrations by John R. Lowery

As depicted in the artist renditions above, the Wake Shield Facility, once on orbit, will be grappled by the shuttle's remote manipulator arm and deployed. It will then orbit at distances ranging up to 40 miles from *Discovery* for about 50 hours of materials processing prior to retrieval and return to Earth. Dr. Alex Ignatiev, below right, director of the Space Vacuum Epitaxy Center at the University of Houston, and Astronaut Ron Sega, below left, who worked with the SVEC prior to joining the astronaut corps, take a close up look at the Wake Shield Facility.

JSC Photo

Goldin appoints three to key Headquarters positions

NASA Administrator Daniel S. Goldin announced Wednesday the selection of three individuals to fill posts at NASA Headquarters including the newly created position of chief of staff.

The new chief of staff will be Darleen A. Druyun, current assistant administrator for procurement.

"NASA intends to be world class in everything we do, and I view this appointment as being truly world class," Goldin said.

Goldin also announced the appointment of Don G. Bush to replace Druyun as assistant administrator for procurement and Dr. Charles J. Pellerin, Jr. as deputy associate administrator for safety and mission quality.

In her new post, Druyun will conduct strategic planning for the administrator, provide continuity in the administrator's office and facilitate communications between the administrator's office and senior staff members, private sector executives and international visitors. The chief of staff also will focus on internal NASA Headquarters management and operations, aiming to increase the efficiency of the organization. The appointment is effective immediately.

"Mrs. Druyun will focus on improving overall efficiency at NASA Headquarters," Goldin said. "I believe we cannot ask the NASA field centers and contractor teams to undertake efficiency improvements without the active participation and leadership of NASA Headquarters. Mrs. Druyun will spearhead these activities."

Bush has served as Druyun's deputy since her arrival at NASA last year.

"Don and I developed the NASA procurement initiatives as a team, and he has been their most aggressive and forward-thinking supporter," Druyun said. "I leave our efforts in good hands."

Pellerin, who has served as director of astrophysics in NASA's Office of Space Science and Applications since 1983, also will serve as special assistant to the administrator for long-range planning, working with newly appointed Assistant Deputy Administrator Charles F. Bolden.

In his previous position, Pellerin oversaw the development and launch of satellites including Cosmic Background Explorer, Hubble Space Telescope and Compton Gamma Ray Observer.

Open season declared on Thrift Savings Plan

Employees wishing to join or change their participation in the Thrift Savings Plan have the opportunity to do so beginning next week.

Open season begins May 15 and continues through July 31, giving eligible employees the chance to join the plan, change the amount of their contributions, allocate their contributions among the three investment funds or terminate current contributions.

Several briefings on the Thrift Savings Plan are scheduled during open season on June 2, 15 and 23 and July 8 and 23. All briefings will be from 1:30 to 2:30 p.m. in Bldg. 45, Room 304, except June 23 which is set for 9:30 to 10:30 a.m. Contact Employee Services at x32681 to reserve a place.

The effective date for plan changes is dependent on when the election form is received by benefits specialists. If the form is received before July 11, changes are effective on July 12; from July 13 - 25, on July 26; and from July 27 - 31, on Aug. 9.

Federal Employees Retirement System employees who are not making employee contributions may elect to invest all or any portion of their automatic agency contribution (1 percent) to any of the three funds.

For more information, contact Employee Services.

Jerry Johnson, GSA fleet manager at JSC, and John Chesler, head of JSC's Center Transporation Section, show off one of the new alternative fuel vehicles. The white tank seen below the van is carrying compressed natural gas.

Two briefings to focus on reporting system

JSC will kick off its Safety Reporting System Awareness Campaign next week with two special briefings about the system.

The half-hour briefings, at 2:30 p.m. Wednesday and 1 p.m. Thursday in the Bldg. 30 auditorium, will cover how the Headquarters level reporting system works, how to use it and how to use other reporting channels at JSC.

Dan Clem of JSC's Test Operations and Institutional Safety Branch said safety problems at JSC first should be reported through supervisors or organizational safety representatives. Supervisors at all levels are responsible for providing a safe workplace, and safety representatives receive special training in recognizing and dealing with such problems.

The next step, if necessary, would be contacting the Test Operations and Institutional Safety Branch directly at x34290, or use one of several anonymous reporting systems, he said. Those include the JSC Safety Hot Line, x37500, and the Occupational Safety and Health Administration hot line, 1-800-321-OSHA. NSRS reporting forms are available in the lobbies of most JSC buildings.

Spacewalks highlight *Endeavour*'s first flight

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ing facilities, was to have the three main engines used during its last flight removed in preparation for its next launch, STS-46 planned for mid-July.

The solid rockets for STS-46 are being stacked in the Vehicle Assembly Building as well.

Discovery remained in Bay 2 of the processing facilities where it is undergoing a six-month period of upgrades and structural inspections. Technicians this week checked the freon cooling loops for leaks, installed several new windows and new hydrogen and oxygen tanks for the electricity-generating system.

Former administrator dies

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of the Space Program and the Space Policy Advisory Board under President Bush.

Paine began his career as a research associate at Stanford University from 1947 to 1949 where he made basic studies of high-temperature alloys and liquid metals in support of naval nuclear reactor programs. He joined the General Electric Research Laboratory in Schenectady, N.Y., in 1949 as a research associate where he initiated research programs on magnetic and composite materials. In 1951, he transferred to the Meter and Instrument Department, Lynn, Mass., as manager of materials development and later as laboratory manager. Under Paine's management the laboratory received the 1956 Award for Outstanding Contribution to Industrial Science from the American Association for Advancement of Science for its work in fine-particle magnet management.

From 1958 to 1962, Paine was research associate and manager of engineering Applications at G.E.'s Research and Development Center in Schenectady. From 1963 to 1968 he was manager of TEMPO, G.E.'s Center for Advanced Studies in Santa Barbara, Calif.

Born in Berkeley Calif., Paine received a bachelor's degree in engineering from Brown University, and his master's and doctorate from Stanford. He also received honorary degrees from Brown University, Clarkson College of Technology, Nebraska Wesleyan University, the University of New Brunswick (Canada), Oklahoma City University and Worcester Polytechnic Institute.

"Within the past six months," Goldin said, "the nation has been saddened by the passing of three former NASA administrators - Jim Fletcher in December, Jim Webb in February and Tom Paine. Their accomplishments and legacies will long endure."

Alternative fuel vans put to work

By Kari Fluegel

Three new vans joined the JSC fleet last week and, at first glance, they look like typical vans. But crawl underneath one and the difference becomes apparent.

In place of gasoline tanks, each van carries bottles for its alternative fuel — compressed natural gas.

As part of a government-wide effort to encourage the development of alternative fuel vehicles and support service, JSC became the first government entity in a five state area to receive the CNG vehicles.

"This is an excellent use of an abundant natural resource," said Acting Director Paul J. Weitz. "At JSC, we've been very much involved from the employee level right up through the management chain in making our contributions to improving the environment. We also think its important for the federal government to take the lead in this field and they have."

Weitz officially accepted the keys for the vans from Sen. Phil Gramm, R-Texas, during a special dedication ceremony Saturday.

Gramm, who has been a leading figure in the alternative fuel vehicle program said, "We're trying to provide the technology, not in a scientific sense, because the technology has been proven scientifically, but by getting now several thousands of these vehicles out in actual use day after day building up experience with what they will do. We think that's going to be important in building up consumer confidence."

Gramm said he could foresee the day when people would be able to fuel vehicles in their own driveways simply by tapping into the natural gas which is now piped into most American homes.

The Alternative Motor Fuels Act of 1988 was designed to encourage the development and production by original equipment manufacturers of alternative fuel vehicles, said Hollis Rutledge, administrator of the Government Services Administration, Region 7.

The act also encourages the introduction of advanced vehicle technology and development of commercial maintenance and fueling infrastructures that are needed for the specialized vehicles, he said.

The new CNG vans are not vehicles that have been retrofitted with equipment for operating on alternative fuels. They only run on CNG, the cleanest burning of the existing fuel options with the exception of solar and electricity.

Performance of the CNG vans is no different from that of gasoline-powered vans. Each van carries the range equivalent of 11 gallons of gasoline or about 200 miles. JSC is an optimum location for such a vehicle because of the heavy use, but low monthly miles the fleet accumulates.

The vans are not additional vehicles, but replacements for gasoline-powered vehicles. They will be immediately integrated into the JSC fleet, said Joel Walker, chief of the center's transportation branch.

"This is not a test program for us," he said. "These are working vehicles in a working program."

Quality award nominees announced

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performance improvement methods of the award recipients to others.

"I'm a true believer in the George M. Low Trophy process and the TQM philosophy," said NASA Administrator Dan S. Goldin. "The award recognizes superior performance by contractors and facilitates the transfer of successful strategies throughout the country. These strategies insure that quality products and services accommodate our various customers to the highest degree."

George A. Rodney, NASA Associate Administrator for the Office of Safety and Mission Quality, announced the finalists after an intensive six-month application and review process.

"Since establishing NASA's excellence award, many private and government agencies have created their own quality award," Rodney said. "More and more organizations are incorporating continuous improvement at the top of their goals and vision."

Following the review and recommendations of the Low Trophy Evaluation Committee, NASA's TQM Steering Committee, — comprised of center directors and Headquarters associate administrators — will make the final recommendation for award recipients to the NASA administrator.

Goldin will announce the award recipients at the NASA/Contractor Conference on Oct. 20 in Pasadena, Calif. There is no limit to the number of awards which can be given among the finalists.

The recipients of the 1991 George M. Low Trophy were Thiokol Space Operations, Bringham City, Utah, and Grumman Technical Services Division, Titusville, Fla., a subcontractor to Lockheed, Space Operations Co., Kennedy Space Center, Fla.

Previous recipients of the award have been Lockheed Engineering and Sciences Co., Houston; Rocketdyne Division, Rockwell International Corp., Canoga Park, Calif.; Martin Marietta Manned Space Systems Co., New Orleans; IBM's Systems Integration Division, Houston; Rockwell International Corp., Space Systems Division, Downey, Calif.; and Marotta Scientific Controls, Inc., Montville, N.J.

The award is administered for NASA by the American Society for Quality Control, Milwaukee, Wis., a professional association and a worldwide leader in development, promotion and application of quality and quality-related technologies.