



Ellington's workers have kept NASA's T-38 fleet in the air for more than 200,000 hours. Story on Page 3.



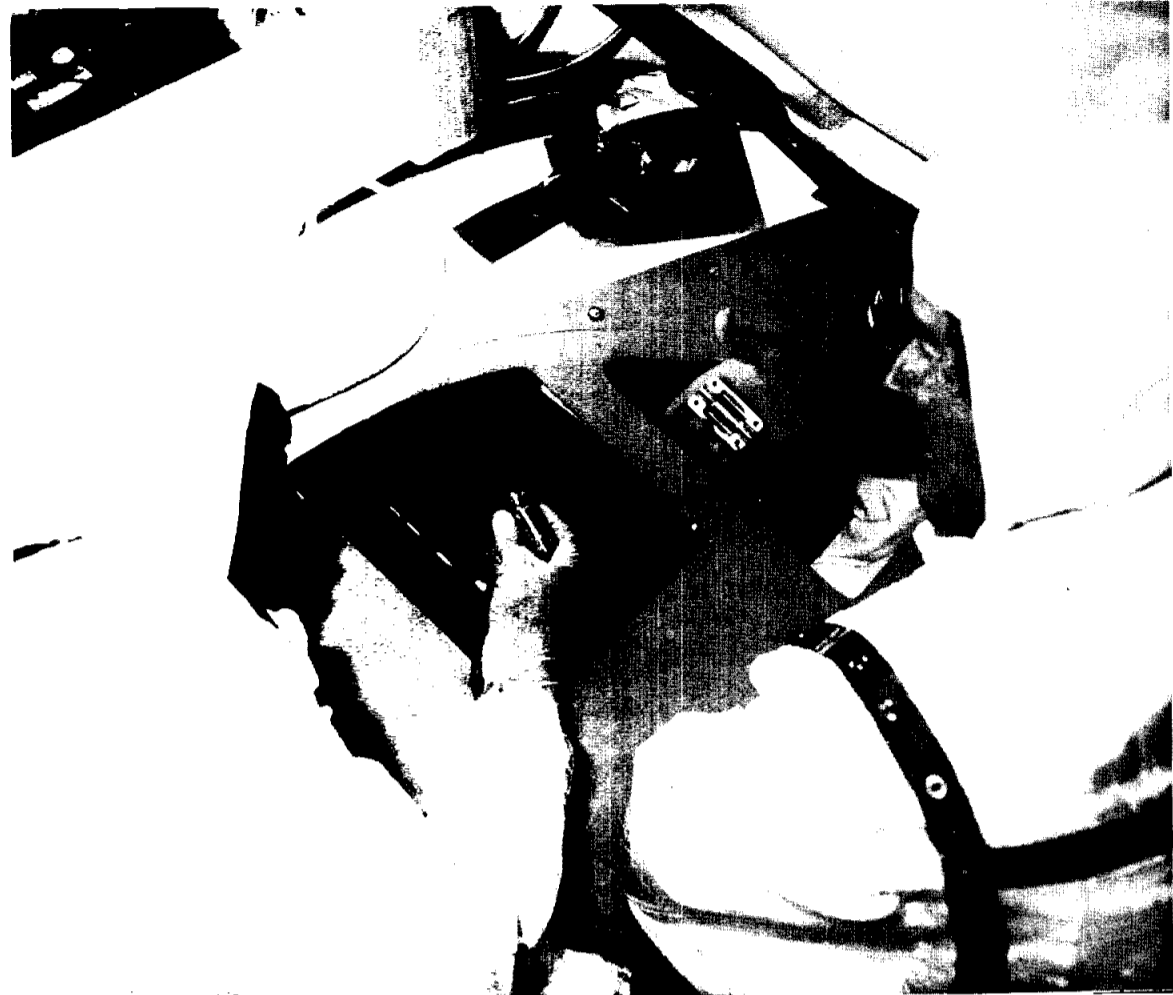
The crew of STS-29 takes a look at the student experiments it will work with. Photo on Page 4.

Space News Roundup

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August 26, 1988

No. 24



Claude "Bo" Willis, left, a Rockwell manufacturing engineering specialist, and George Gallagher, a manufacturing supervisor, prepare to install a clamshell-like leak repair device in *Discovery's* left Orbital Maneuvering System pod. Gallagher performed the repair operation using the two newly cut access ports in the Orbiter's aft bulkhead.

Discovery ready for packing

With repair of a leaky fitting in a Reaction Control System (RCS) oxidizer vent line completed, *Discovery's* bags are to be packed Monday with TDRS-C, her primary payload, for its journey to space.

Next week at JSC, STS-26 flight control teams, the *Discovery* crew and support personnel, a total of about 300 employees, will go through a "final, full-up dress rehearsal" for the return to flight, said Larry Bourgeois, lead flight director for STS-26.

The 56-hour Long Duration Simulation (LDS) for STS-26 will begin at JSC at 8 a.m. Tuesday and end at 5 p.m. Thursday. "The reason we do the LDS is so we can practice not only the final objectives of the flight, such as deployment of TDRS-C, but also how we plan operations from day to day," Bourgeois said.

The White Sands Ground Terminal and the STS Operational Support Complex at Onizuka Air Force Base also will participate in the sim. "We want to exercise not only us, but also our customer," Bourgeois explained. An LDS is held about four to six weeks before each mission.

The Mission Management Team will provide support for the simulation.

The Space Center Blvd. JSC gate will be open from midnight Tuesday until 3 a.m. Wednesday and from midnight Wednesday through 3 a.m. Thursday, in addition to regular hours, to accommodate the change of shifts during the rehearsal.

Meanwhile, the real thing moves closer daily at Launch Pad 39B. Repair of *Discovery's* leaky dynatube fitting, located in the left Orbital Maneuvering System pod and reached by access holes cut through the aft payload bay bulkhead, was finished ahead of schedule on Aug. 19. "The RCS repair has gone extremely well. The leak is no longer there," Chester Vaughn, JSC Propulsion and Power Division chief, said Wednesday.

The fitting, covered by a sealant-filled, clamshell-like device developed by JSC and Rockwell, was monitored during the weekend, and no leakage was found. The repair has continued to be watched this week, and it has passed all checks with flying colors. The fitting will continue to be monitored until launch via the normal monitoring of pressure in the nitrogen tetroxide tank.

Today, the pad was to be cleared for technicians to finish loading hydrazine propellant into TDRS-C, the

Please see **ENGINE TEST**, Page 4

STS-26 crew enthusiastic; ready to fly

By James Hartsfield

The crew of *Discovery*—Commander Rick Hauck, Pilot Dick Covey and mission specialists Mike Lounge, Dave Hilmers and Pinky Nelson—is excited, confident and anxious to fly, Hauck told international news media at a JSC briefing Monday.

"We can let ourselves get excited now," Hauck said. "I'm at that stage. It's an exhilarating feeling. You can't carry that through 24 hours a day for the next month, but I'll tell you what—it's going to happen."

"We'd like to fly yesterday, given the opportunity," Nelson said. "Training for this mission has been a delight ... at times each of us has been impatient for things that seem to go slowly. But we understand they've had to go at that pace to do the thorough job that's been done to get the Shuttle ready to fly again. Essentially, we're trained and ready to go, standing by, waiting patiently for the chance."

The news conference was the highlight of a series of all-day pre-flight briefings at JSC regularly held about one month before each Shuttle mission. The crew will not meet with the media again before STS-26.

Hilmers took the conference as an opportunity to thank America for her attention.

"I have really received a lot of support and prayers from people around the country," he said. "It's really amazing how much attention this flight has been given, and how much people have responded. And that makes me feel good about the direction of our country."

Discovery is almost ready, and the crew expressed obvious pride and confidence in their spacecraft. "The last time I went down to the Cape, and saw *Discovery* out on the launch pad, I allowed myself to start to get excited about this flight," Hauck said. "When you get out there and see the hardware all poised and ready to go, or almost ready to go, there's a thrill that runs through you."

The importance of their flight, as the

first Americans to leave Earth in more than two and half years, as a rebirth of regular space travel, as a test of the Shuttle's modifications, and as a reaffirmation of American technology and hard work, is evident to the crew. For Hauck, it will confirm the work of the past two and a half years.

"I'm sure we'll have some mechanical failures during the flight. But because we have a machine that's built to withstand failures, I'm sure they won't be life-threatening. We need to demonstrate to the country, to the

folks that are paying the taxes, that we're spending their money well. We need to demonstrate that we're back in business."

For Covey, it is, along with its primary goal of launching TDRS-C, a flight-test. "Our mission is indeed a flight test of those changes to *Discovery*. There's always a risk involved in the first time you fly a piece of equipment that's been changed. But we feel very confident that everything that's been done up to this point has been done in the correct manner to ensure that it's an improvement to safety. I have a great deal of confidence in the machine."

For Nelson, any personal pressure about the mission has been offset by his family and the NASA team. "I think we all get a lot of support from our families and from everyone here at the center. The fact that people here, at Marshall, at KSC and all of the other centers are working as hard as they can ... that gives us a lot of confidence. The pressure we put on ourselves for any particular flight, we can't be more than perfect, I think that's what we all try to be. That pressure is kind of normal to us."

For Lounge, the flight is symbolic; though to his children, it hasn't quite sunk in. "This is a real high visibility flight, and I'd probably change that if I could. I don't enjoy that too much," he said. "My wife works here at the center, and she understands the challenges well. To my two little

Please see **STS-26**, Page 4

Advanced solids competition opens

Firms will vie to build replacement Space Shuttle boosters

NASA invited industry on Monday to compete for the design, development, test and evaluation of a Space Shuttle advanced solid rocket motor (ASRM) to replace in the mid 1990s the current redesigned solid rocket motor.

The planned development of a new motor will provide substantial improvements in flight safety design margins and reliability, and achieve improved Shuttle payload weight capability. The program will use the latest technologies in manufacturing, automation, and non-destructive testing and is vital for maintaining a sound, competitive industrial base in the U.S. solid rocket motor industry.

On July 26, the agency announced its selection of the government-owned sites to be available as locations for the new rocket motor production and test facilities, subject to completion of the necessary environmental impact

statements. The Tennessee Valley Authority property known as Yellow Creek, Mississippi, is the government site selected for the production facility, and NASA's Stennis Space Center near Bay St. Louis, Mississippi, is the site selected for the test facility.

Firms which respond to the request for proposals will use the Yellow Creek and Stennis locations as a common basis for proposing government-owned, contractor-operated facilities. The companies also will include in their proposals a private-financing option for construction of the same facilities on those government sites.

Companies also will be encouraged to make use of available manufacturing space and computing capabilities at NASA's Michoud Assembly Facility and Slidell Computer Complex, both located in southeastern Louisiana.

In addition, the request for proposals permits an optional proposal under

specified conditions for a privately owned rocket facility to be located on a site of the company's choice.

Firms will have 60 days to prepare and submit their proposals. A contract award is anticipated in early 1989.

The overall cost of the design, development, test and evaluation effort is estimated at just under \$1 billion. An additional \$200-\$300 million cost is anticipated for construction of the facilities. In addition to the basic design and development, the contract also will include delivery of rocket motors for six Shuttle missions.

The five-year design, development, test and evaluation contract will lead to delivery of the first flight set by 1994 and a flight verification program of six Shuttle missions. Plans call for a three-year phase-in of the new motor.

The performance goal is to provide a 12,000-pound increase in the Shuttle's payload capacity.



VERIFICATION TEST—Production Verification Motor-1 roars in the Utah desert during the final full-duration firing of the redesigned solid rocket motor before STS-26. Early indications are that the test was a success, but analysis is continuing.

NASA Photo

JSC

People

Employees help scouts get badges

Several JSC employees recently provided a video-taped interview to an Illinois Girl Scout troop to help the scouts earn aerospace merit badges. Dorothy Schuster, Diana Villareal, Susie Rogers of Lockheed, Carl Adams, Keith Grimm, Jerry Reuter and Mary Cleave answered a variety of questions on the tape, and sent it to Troop 697 in O'Fallon, Ill. The scouts had sent a list of questions to Charles R. Price, chief of the Teleoperator Systems Branch, who organized the 45-minute interview.

The list included questions about

the nature of zero-G, the duties of astronauts, NASA machines, the makeup and size of the NASA workforce. The video presentation also included a tour of the Apollo-Saturn exhibit and the laboratories in Bldgs. 16 and 9A.

Enterprise reunion

A reunion of former team members of the *Enterprise* Approach and Landing Test Program is being planned. Interested persons should contact one of the following before Aug. 30: Ron Lang, Beach Villas Apts. No. 303, Long Beach, Calif. 90802; or Daniel Jensen, 40022 Bluebird Lane, Palmdale, Calif. 93550.

JSC

Dates & Data

Today

SEDS conference—The Texas area chapters of the Students for the Exploration and Development of Space begin an international conference at the Nassau Bay Hilton today through Aug. 28. The conference will feature JSC tours, a space career exposition and several well known speakers from the space industry. For more information, call Peter Lange, x30850.

Cafeteria menu—Entrees: barbecue link (special), liver and onions, broiled codfish, deviled crab, seafood gumbo. Vegetables: buttered corn, green beans, new potatoes.

Monday

Space '88—A Space '88 Conference focusing on engineering, constructions and operations in space will be Aug. 29-31 at the Albuquerque Hilton Hotel in Albuquerque, N.M. The program will include the presentation of more than 130 contributed papers on topics such as extraterrestrial, orbital and specialty operations. Speakers will include John Aaron, chief of the NASA Office of Exploration, STS-61B Mission Specialist Woody Spring, Dr. Michael Duke, program manager for construction experiments in space, former U.S. Senator and Apollo astronaut Dr. Harrison Schmitt, and Barney Roberts, manager of the JSC Exploration Studies Office. For more information, call Ray Leonard at (505) 455-3484.

Cafeteria menu—Entrees: chili and macaroni (special), barbecue sliced beef, parmesan steak, spare rib with sauerkraut, french onion soup. Vegetables: ranch beans,

English peas, mustard greens.

Tuesday

Cafeteria menu—Entrees: corned beef hash (special), meatballs and spaghetti, liver and onions, baked ham with sauce, split pea soup. Vegetables: buttered cabbage, cream style corn, whipped potatoes.

Wednesday

Flag football sign-up—Registration for the men's Saturday flag football league will be at 7 a.m. for badged personnel and 5:30 p.m. for non-badged teams Aug. 31 at the Rec Center. The league will start play Sept. 10. For more information, call x30303.

JSC Blood Drive—The JSC Blood Bank committee will schedule appointments for the Sept. 12 blood drive. Employees may also walk-in from 8 a.m. to noon and from 1 to 4 p.m. For appointment call Bob Jones, x33004.

Cafeteria menu—Entrees: barbecue link (special), cheese enchiladas, roast pork and dressing. Vegetables: pinto beans, spanish rice, turnip greens.

Thursday

Cafeteria menu—Entrees: chicken fried steak (special), roast beef with dressing, fried perch, chopped sirloin, beef and barley soup. Vegetables: whipped potatoes, peas and carrots, buttered squash.

Sept. 2

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

sauce.

Sept. 7

Aerospace education conference—JSC will host the 27th Annual Education Project Conference Sept. 7-14. Specialists from each NASA center will participate in the week-long training. For more information, call John Poindexter, x38624.

Sept. 9

AIAA China trip—A technical delegation from the Houston Section AIAA will depart for a trip to China to visit with the Chinese Society of Astronautics. Participants will meet with technical counterparts in Chinese space facilities at Beijing, Xian and Shanghai, home of Houston's sister section, the Shanghai Astronautical Society. Non-technical activities are planned for spouses. The delegation also will visit scenic and historic sites at Guilin and Hangzhou. For information on applications, call Jim McLane, 488-0312.

Sept. 12

Dance class—Country and western dance classes will begin Sept. 12 and continue for six weeks, meeting from 7-8:30 p.m. each Monday at the Rec Center. Cost is \$20 per couple. Call x30303 for more information.

Sept. 14

Hypermedia '88 conference—JSC and UH-Clear Lake will sponsor a two-day conference dealing with software engineering, documentation and education training. For registration and program information, call Glen Van Zandt, x33069.

JSC

Library's Latest

New items now available in the JSC Technical Library in Bldg. 45, open from 8 a.m.-4:30 p.m. Monday through Friday, include:

- *A User's Guide to Microcomputers*, by N.B. Stern.
- *Computer Aided Design on the Macintosh*, by G.P. Hastings.
- *Essential Standards for Biomedical Equipment Safety and Performance*, by the Association for the Advancement of Medicine.
- *Fractals in Physics*, by L. Pietronero.
- *Dynamics of Comets: Their*

Origin and Evolution, by A Carusi.

- *Human Factors in Engineering and Design*, by M.S. Sanders.
- *Mathematics for Computers*, 3 by A.D. Kramer.
- *Pioneering the Space Frontier (video tape)*, by NASA.
- *Strain Measurement at High Temperature*, by R.C. Hurst.
- *Welcome to Moonbase*, by B. Bova.

For more information about the library or its offerings, call the JSC librarian at x34240.

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. Send ads to Roundup Swap Shop, Code AP3, or deliver them to the deposit box outside Rm. 147 in Bldg. 2.

Property & Rentals

Rent: Lake Livingston waterfront, 3-2, fully furnished, covered decks, pier, ex. fishing, swimming, skiing, new cond. 482-1582.

Sale: Inside lot at Rayburn Country, Jasper, Tx., 80' x 200'. 645-0008.

Rent/Sale: Lake Livingston townhouse, 2-2-2CP, sec., clubhouse, pool, tennis and volleyball courts, playground, boat ramp, on water. 554-5514.

Lease: Condo, 2-2, split bedroom plan, W/D, refrig., remain, \$415/mo. or \$35,000 cash. Rick, x36156 or 480-1218.

Sale: Middlebrook, 3-2-2, FPL, wet bar, covered patio, lg. lot, FHA assum. 10%, \$81,000. 480-9363.

Sale: College Station, 3 blks. from TAMU, 3BR, small down, assume 9.5% FHA loan. 326-1278.

Sale: Heritage Park, 3-2-2, lots of windows, atrium, fenced & decked yard, custom kitchen cabinets, new vanities, cedar accents, new paint, new tile baths, mini blinds, new carpet, \$60,500. Lori or Tony, x32304 or 482-5139.

Lease: Baywind I condo, 2-1, upstairs, W/D, fans, \$385/mo. x37595 or 488-1359.

Lease: Eldorado Way condo, 2-2-1, covered parking, FPL, W/D, ex. cond., \$400/mo. plus dep. Danny Taylor, x39884 or 326-5754.

Sale: Friendswood/Sun Meadow Estates, wooded lot in estab. neighborhood, cul-de-sac, bordered by stream & golf course on 2 sides, approx. 2.4' deep & up to 86' wide, approx. 1/3 acre, util. on site, \$31,500. Doug, x32860 or 486-7412.

Sale: Lakehouse, 2 acres, wooded, private lake, 2.5 mi. from Livingston, 3-2, A/C, furnished, \$45,000. 472-3103.

Lease: CLC, King's Village townhouse, 2-2-1, \$450/mo. plus dep. Elaine, x36652 or 554-4299.

Lease: Freeway Manor/Sun Valley, lrg. fenced yard, A/C & C/H, nice trees, \$400/mo., plus dep., avail. Sept. 1. Chuck, x34241 or 487-2978.

Sale/Lease: Friendswood, 3-2-1, Galveston County, Friendswood School District, \$540/mo. or \$47,500. 996-1907.

Lease: Baywind condo, 1-1, new carpet, paint, close to JSC. Paula, 333-6692 or Wendy, 333-6216.

Sale/Lease: Forest Bend townhouse, 2-1.5-2CP, patio, storage room, W/D conn., \$375/mo. or \$44,000. 482-2138.

Sale: League City, The Landing, 3-1-1, assume fixed 11% FHA, no down, no qual., owner will pay closing costs, \$642/mo. 554-6471.

Sale: Kirkwood So., lg. custom built 2-story, 4-2.5-2, 2,400 sq. ft., formals, FPL, study, intercom, oversized cul-de-sac lot, near Dobie H.S., \$76,500. 488-5210.

Lease: University Green, 2-1-2 patio home, mini-blinds, all appl., FPL, lg. covered brick patio, det. garage w/opener, no smokers/pets, \$850/mo. x30624 or 486-7713.

Lease: CLC 1BR condo, ceiling fan, appl., tennis, exer. room, W/D conn., low dep., 2 wks. free. Jim Briley, 488-7901.

Cars & Trucks

'79 Mustang V-6, air, auto, trans., \$1,000 firm. Plauche, x39034 or 474-2660.

VW, new paint, runs great, \$1,295. John, x36484 or 486-1186.

'67-'68 Ford Mustang "Parting Out", many parts disassembled. Jesse, 538-3629.

'80 Buick Regal, blue, AM/FM, some rust, 96K mi., \$800. Susan or Kay, x32251 or 331-3379.

'78 Oldsmobile station wagon, A/C, P/S, P/B, 90K mi., \$650. x39001 or 326-4395.

'69 Dodge customized 3/4 ton van, Capt's chairs, low mi., ex. cond., \$2,500. Dean Thompson, 332-2229.

'84 Chevy S-10 PU, 4 cyl., A/C, 4 spd., std. shift, long bed, P/B, camper shell, 60K mi., clean, \$4,500. OBO. x36514 or 333-3409.

'67 Mustang, red, 3 spd., 289 V-8, A/C, good tires, new exhaust sys., good cond., \$3,295. OBO. Michael, x38169 or 482-8496.

'69 Camaro Z28, yellow, AM/FM w/cass., 4 spd., tinted windows, ex. cond., \$3,200. OBO. Leticia, x34183.

'85 Isuzu Impulse, 5 spd, A/C, AM/FM, cass., 71K mi., good cond., \$6,600. OBO. Rod Toler, x33856.

'88 Toyota PU, ch. grey, A/C, 4 spd., AM/FM, cass., pick up payments. Lance, x30695 or 554-2079.

'80 Mazda GLC, 5 dr., auto., radio, new tires, 51K mi., 1 owner, good cond., \$2,300. Linda, x30718 or 996-0462.

'87 Dodge custom van, pwr., cruise, A/C, AM/FM, cass, CB, high caliber Swordsman conversion, x36729 or 480-1223.

'87 Nissan Pulsar SE, 5 spd., A/C, AM/FM, cass., red, 16K mi., ex. cond., \$9,000. Dick, 481-1518.

'58 Porsche 356A coupe, '64 C eng., \$5,500. David, 554-2992.

'86 Jeep Cherokee Laredo, 2WD/4WD, select trac, loaded, 26K mi. 280-0144.

'76 Olds Cutlass, 350 V-8, maroon, A/C, AM/FM, cass., auto., new tires, runs good, \$1,200. OBO. Carolyn, x35938.

VW type rebuilt eng., 2110 CC, approx., 150hp, all new parts, bench run, \$2,100; VW trans., Porsche axles, Super-diff., Beef-a-diff., steel forks, never used, \$550. David, 554-2992.

Cycles

'83 Suzuki GS550E, helmet, ex. cond., 5,600 mi. 673-7667.

'72 Honda 350 XL, 2,199 mi., does not run, \$300. Kay or Susan, x32251 or 331-3379.

'86 BMW K75C, blk., 8,200 mi., 1 yr. warr., new tires, bags, \$4,250. John, x36484 or 486-1186.

'83 Honda 650 Nighthawk, garaged, helmet, ex. cond., 3,600 mi., \$1,300. David, 282-1987 or 480-4692.

'85 Honda V-30 Magna, low mi., garaged, like new, \$1,200. 534-4262.

'75 Kawasaki Z1-900, 40K mi., needs elec. work, new Metzler front tire, BO. Rob, x39052.

'76 Honda V50, faining, crash bars, \$650. Tim, 996-9191.

'87 Yamaha 80 Moto4 four wheeler, new cond. \$800. 482-4365.

Boats & Planes

Beginner's windsurfer, \$200. Tim, 996-9191.

16.5' Wellcraft ski/fishing boat, McClain trailer, 115hp Mercury outboard, pwr. trim/tilt, \$2,200. x39001 or 326-4395.

17' Sears fiberglass canoe and paddles, \$100. Sean, 480-8190.

Shakespear trolling motor, 3 spd., \$75. 280-8796.

Curtis Hawk windsurfer board, beginners, good cond., \$300. OBO. mike, x36246 or 474-7217.

'79 17' Glastron, 140 Mercruiser I/O, V-hull, galv. trailer, S/S prop, skis, extra equip., \$3,200. 486-5734.

'85 Wellcraft 23 Nova XL 485-0900.

16' Hobie Cat, 2 sets of sails, harnesses, trapeze & life jackets, \$1,400. John, 482-6364.

'83 Suzuki GS550E, helmet, ex. cond., 5,600 mi. 673-7667.

'81 18' Newman Cam II runabout, 100hp outboard w/trailer, ex. cond., \$3,800. OBO. 480-9363.

15' center console w/25hp Evinrude, galv. trailer, trolling motor, less than 100 hrs. on motor, access., good cond., \$1,800. Don Thompson, x39475 or 644-5044.

'85 Isuzu Impulse, 5 spd, A/C, AM/FM, cass., 71K mi., good cond., \$6,600. OBO. Rod Toler, x33856.

'88 Toyota PU, ch. grey, A/C, 4 spd., AM/FM, cass., pick up payments. Lance, x30695 or 554-2079.

'80 Mazda GLC, 5 dr., auto., radio, new tires, 51K mi., 1 owner, good cond., \$2,300. Linda, x30718 or 996-0462.

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'76 Honda V50, faining, crash bars, \$650. Tim, 996-9191.

'87 Yamaha 80 Moto4 four wheeler, new cond. \$800. 482-4365.

good cond., \$40, or OBO. 480-0287.

Sony Trinitron 26" color TV, '80 model, wood cabinet, \$150. 333-3672.

Queen size waterbed mattress, \$50. Tim, 996-9191.

GE counter top elec. range, sep. oven, and sink in yellow, all \$75. 946-7587.

Brass day bed, incl. one twin matt. and trundle, ex. cond., was \$600, now \$350. Paul, 554-4594.

Wanted

Want 4 person dinette set in good cond., inexp. Audra, x39174.

Female roommate to share 3-2 house, non-smoker, pets OK. 486-6813.

Need occas. ride to and from work from La Porte, 8 a.m. to 4:30 p.m. x39137 or 471-2258.

Want gas lawnmower, low price or will trade B/D elec. lawnmower, mower is 1 1/2 yrs. old. Jean, 332-5622.

Want repairable refrig., freezers, A/C units, hot tub/jacuzzi, will trade for A/C or refrig. repair, free removal. A.A. Johnson, x36580 or 339-1402.

Want gas or elec. stove, almond, in good cond. Ann, 280-2229.

Need riders for van pool from So. Post Oak at Braeswood to NASA area. Richard, x37557.

Photographic

Mamiya RB67 Pro-S, W.L. Viewfinder, 120 back 90/3.8 lens, focusing screen, ex. cond., was \$1,400, now \$800. OBO. 554-2035.

'85 Isuzu Impulse, 5 spd, A/C, AM/FM, cass., 71K mi., good cond., \$6,600. OBO. Rod Toler, x33856.

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Queen size waterbed mattress, \$50



KEEPING them FLYING

Ellington's workers tune T-38s to impressive 200,000-hour record

By James Hartsfield

Beauty is simplicity, speed and grace as far as NASA's fleet of 27 T-38 Talon jets is concerned, and whenever the time comes to replace the trainers, those who fly them say NASA may never do better.

Ask those pilots what the charm of the T-38 is, and you'd better be ready to listen.

"It's handling characteristics, the way it flies, are part of it—it's an extraordinarily honest airplane," says Astronaut Dr. Story Musgrave, the man who has flown more in a T-38 than anyone on Earth "and maybe in the universe"—about 6,100 hours. Musgrave, like almost all T-38 pilots, becomes a bit sentimental as he speaks.

"It's like a really sensitive polo pony, move the reins over a little bit and it responds perfectly. Whenever it does something, you know why it did it, you know why it got that way," he says. "You become attached to airplanes because they become an extension of yourself, your body and mind, especially a plane that's so responsive, so extraordinarily agile. The plane and the pilot become one."

Sometime in the near future, NASA's T-38 fleet will surpass a combined total of 200,000 flying hours, equal to almost 23 years in the air, seven days a week, 24 hours a day. The first T-38 was manufactured in 1958, and the plane became the advanced trainer for Air Force pilots. NASA got its first T-38 24 years ago, and the fleet is still going strong because of a crew of about 230 workers at Ellington Field that provide "the best maintenance in the world," Musgrave says. "Our engines are better kept and better tuned than anyone's."

As supersonic jets go, maintenance on the T-38 is relatively easy, says Ace Beall, former T-38 project pilot and now a Shuttle carrier aircraft pilot. "It was built with ease of maintenance in mind," Beall says. "It's got simple systems, and if something breaks, it's easy to fix."

The two 2,900-pound thrust engines in a T-38 can slide in and out, and if an engine needs work, it is quickly replaced with one of 15 spares on hand. "They're totally inter-

changeable in all the airplanes," Beall says. "That's a common concept in planes now, but when the T-38s were built, it was just coming into being." About 70 percent of the T-38s NASA owns fly daily.

But the basic reason for the superb performance of NASA's T-38s comes down to the hands that work on them. Many of the mechanics at Ellington have worked on NASA's T-38s since they first came into existence. "They know those airplanes," explains Henry Hartsfield, deputy director of flight crew operations. "We're very fortunate to have a lot of maintenance people who've been with us for years and years. These guys are really good."

Maintenance standards at Ellington are far above any other such standards for T-38s in the world, explains Jose Rengau, T-38 maintenance officer. "We've added more pre-flight items that are critical to our checklist than the Air Force or anyone," Rengau said. "We're really perfectionists. You know, one engine problem is too many."

From flight to flight, turnaround maintenance on NASA's T-38s is usually not extensive. "Almost all you've got to do is check the oil, put in gas and go," says Hartsfield. "It's almost that simple."

And what keeps it that simple is a rigorous program of built-in inspections. Each T-38 undergoes a two-day inspection every 150 hours of flying time; a three-week inspection every 450 hours; and is virtually completely taken apart during a month-long inspection every 900 hours, Rengau says. The extensive inspections keep day-to-day problems in check.

The T-38 is lightweight for a trainer, about 12,500 pounds with two crew members. It cruises at nine-tenths of the speed of sound, and it can leave sound far behind at only 5,000 feet, a speed and altitude that's enough "to pin your hair back to your ears," in the words of Ken Cockrell, current T-38 project pilot.

In the early 1960s, the T-38 set a host of records for quick climbs, closed-course speed and short-distance speed. Its maneu-

erability and simplicity make it perfect for NASA's needs.

"It's a good, stable, forgiving airplane. Its twin engines make it reliable," Hartsfield says. "From handling a high-performance airplane you learn the man-machine characteristics you use on the Orbiter. Night flying, formation flying, acrobatics, the kind of flying that makes you a good pilot, we do all of that. It does a super job."

"It is primarily a flying machine," Musgrave says. "The simplicity of its systems means you can concentrate on flying."

The T-38 is a good spaceflight readiness trainer, adds Beall. "It's good just to get you used to that 18-degree glide slope of the Orbiter. We had to bolt on special speed brakes to get the steep descent necessary to chase the Orbiter. It's just too sleek."

NASA's T-38 fleet is now undergoing a renovation program that will be completed in 1993. One by one, the planes are being modified by strengthening the wings, improving the skin and reinforcing their structural backbone, the dorsal longeron, to extend their operable lifetimes.

The Air Force has announced plans to continue using T-38s, which have not been manufactured since 1972, until 2010. And NASA may do the same. "They're cost-effective. They're all paid for and the maintenance is not that high," says Hartsfield. "We've looked at others, but we've never gotten far."

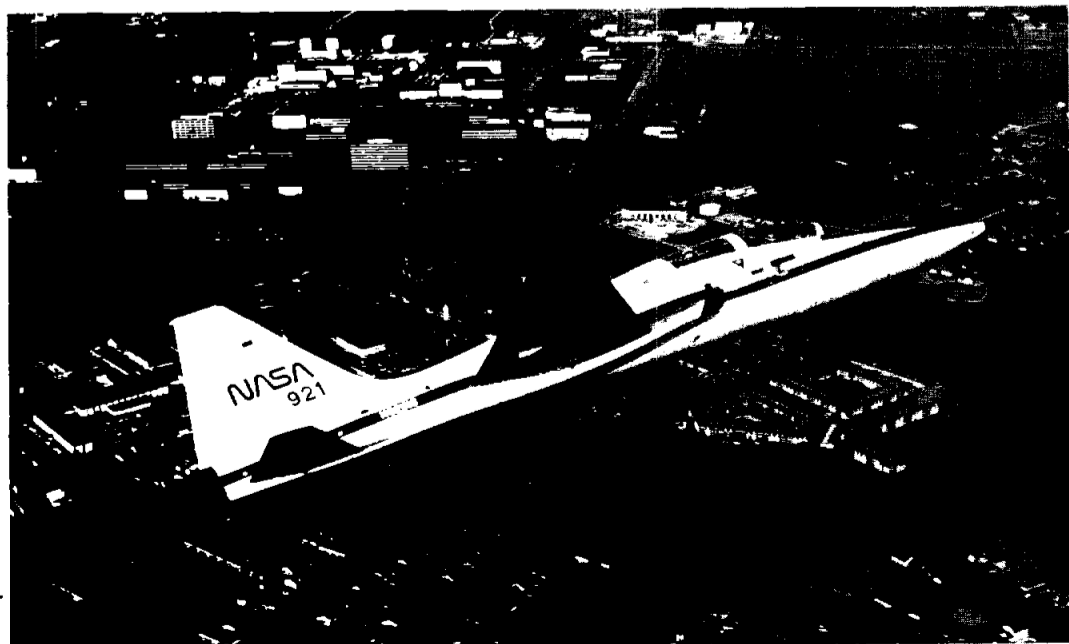
For one thing, most trainers today aren't supersonic. And the more modern the airplane, often the more complex are its systems and its maintenance.

"Whenever we do have to replace the T-38s, it's going to cost more and we're going to get less," Cockrell says.

With their blue paint and logo, the T-38s have the "classic fast-jet look," Beall says. And the look doesn't lie.

"It's beauty isn't only skin deep," explains Musgrave.

"There's a direct relationship in the world of airplanes between beauty and performance."



JSC Photos by Bob Waick



Top left: Technician Steve Armstrong pulls out a T-38 engine for servicing in the JSC Aircraft Operations Hangar at Ellington Field. Top right: Northrup Quality Control Inspector Bob Mullen, left, and technician John Schanzer work under a T-38 wing. Right: Technician Stan Schenk works inside a T-38 engine cavity. Above: A T-38 cruises high above JSC.

NASA agrees to fly commercial Spacehab flights

Private man-tended research part of President's Commercial Space Initiative

In a step to encourage the growth of a strong U.S. commercial space industry, NASA has agreed to provide six shared Space Shuttle flights for a privately developed and financed middeck augmentation module.

NASA and SPACEHAB Inc. signed a Space Systems Development Agreement (SSDA) on Aug. 11 that provides for flights of the company's Shuttle-based module, beginning in 1991.

SPACEHAB Inc., based in Washington, D.C., has initiated final design and construction of a pres-

surized module that will augment the existing pressurized volume of the Space Shuttle middeck. The company is marketing access to the module and its support facilities on a commercial basis.

McDonnell Douglas Astronautics Co., Huntsville, Ala., has been selected by SPACEHAB as the prime contractor for final design and construction of the modules. Aeritalia, Torino, Italy, and United Technologies Corp., Hamilton Standard Division, Windsor Locks, Conn., are subcontractors on the project.

The Spacehab module is a metal

truncated cylinder measuring 10 feet in length by 13 feet in diameter, designed to fit in the Shuttle's cargo bay. Shuttle crew members will access the module through a tunnel between the Shuttle's middeck and the module. The company will make available to customers a variety of locker and rack accommodations, with associated support and integration services.

Under the terms of the agreement, SPACEHAB will pay \$28.2 million in fiscal 1988 dollars for standard services for each flight, with payment due 30 days following the landing of

each mission. Spacehab does not use the full payload bay. The \$28.2 million charge, based on SPACEHAB's share of a mixed payload flight, will be escalated at the time of actual payment to allow for inflation. SPACEHAB also will pay interest on the deferred charges.

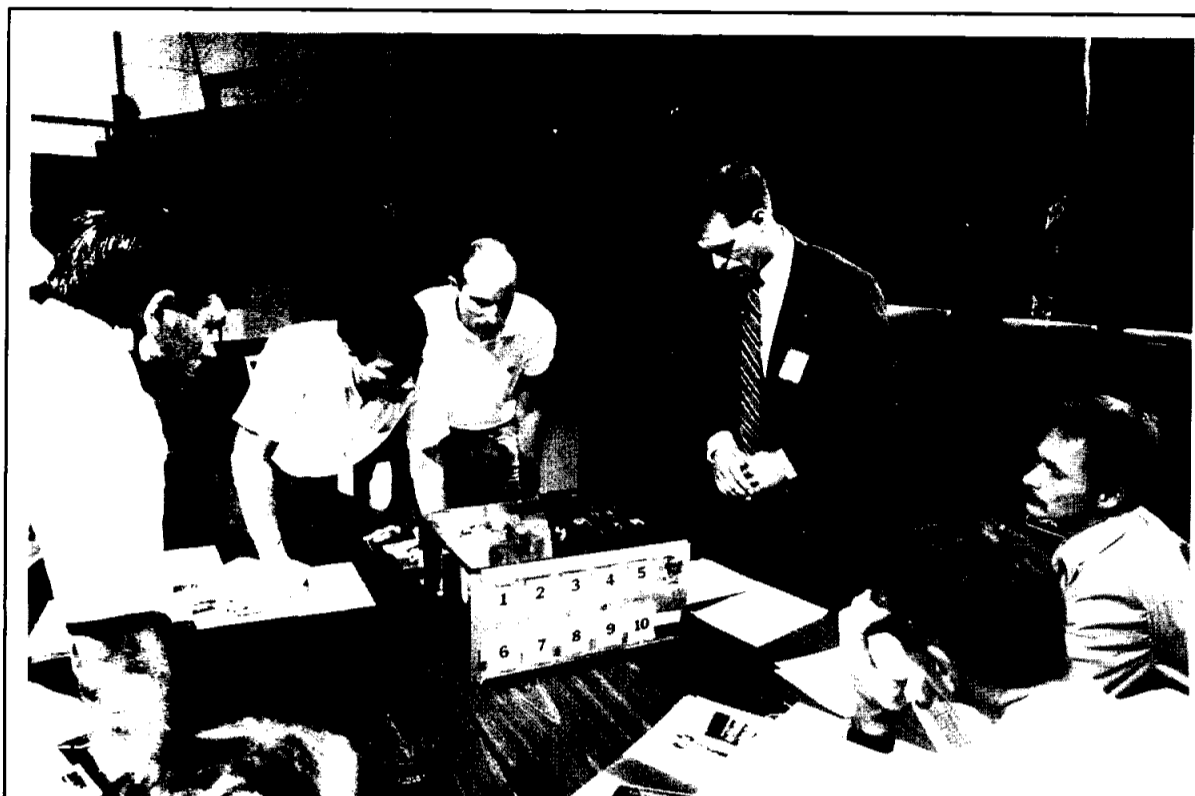
In addition, SPACEHAB will be charged in advance of each flight for optional services provided by NASA at the request of SPACEHAB.

The deferred payback provision of the NASA SSDA is one of the mechanisms that has been established to encourage greater investment and

involvement by the U.S. private sector in civil space activities. This is the third such agreement signed by NASA.

Commercial ventures and sponsored research requiring "man-tended" access to the environment of space will provide the primary target market, according to SPACEHAB officials.

Spacehab was specifically identified in the President's Commercial Space Initiative, announced in February, in which the Administration committed to make best efforts to launch the commercial module in the early 1990s.



CHICKS IN SPACE—The crew of STS-29 discusses one of the mission's student experiments with the experimenter, John Vellinger of Purdue University. Vellinger's experiment will study the development of chicken embryos in space, looking forward to future food sources and human reproduction during space exploration. Clockwise from left are Commander Mike Coats, John Blaha and James Bagian, Vellinger, sponsor Mark Deuser and Bob Springer.

Board OKs promotions based on job growth

JSC's Senior Promotion Board approved 27 nominees for promotion in August based on expanding responsibilities and career growth.

The promotions follow a change in JSC's promotion policy that allows managers to bypass the board on GS/GM 14 and 15 positions filled through the Competitive Placement Plan.

"When we fill a supervisory position, we do that through competition," said Jack Lister, director of Human Resources. "But these promotions are for those who have grown and assumed greater responsibilities in their current positions. They're mostly nonsupervisory people who are experts in their fields or who have major program responsibilities throughout the center."

Those receiving promotions to the 14 or 15 level are:

Administration Directorate: John H. Beall.

Flight Crew Operations Directorate: Cynthia N. Major.

Mission Operations Directorate: James M. Heflin Jr. and John E. Hoover.

Engineering Directorate: John W. Alred, Donald R. Blevins, Glenn M. Ecord, Richard W. High, Richard D. Juday, Joseph J. Kosmo Jr., Raymond L. Nieder, Henry A. Rotter Jr. and Virginia Whitelaw.

Mission Support Directorate: Louis DeWolf.

National Space Transportation System Program Office: Newton T. Buras Jr. and Elmer L. Taylor.

New Initiatives Office: Dean C. Glenn and William D. Womack.

Center Operations Directorate: John P. Herrmann.

Space Station Projects Office: Kenneth J. Demel and James P. Ledet.

NSTS Operations Integration Office: Richard D. Tuntland.

Space and Life Sciences Directorate: Michael S. Brzezinski, Donald J. Kessler, David S. McKay, Gerald R. Taylor and Barbara J. Woolford.

"I think we are promoting some extremely good people," Lister concluded.

STS-26 crew ready to fly mission

(Continued from Page one)

children that live at home, it hasn't quite become real to them yet. I mean, we talked about going to Florida to see daddy launch, and they'll get to go to Disney World. And I'm not sure which is the more important of the two. It's an important flight because of what it symbolizes, and we're anxious to get that first step completed."

And for Hilmers, STS-26 is a way to put the past in the past and open the future.

"On the one hand, we can't forget

what happened or we're prone to make the same mistakes we made in the past," he said. "On the other hand, we can't dwell on what happened in the past, or we'll never look forward to the future. When we're on the launch pad, we'll be thinking about (the *Challenger* crew). We'll have them in our minds, but I think our thoughts will be looking even more forward and upward."

"I'm very concerned about folks who feel we ought not to take risks," Hauck said. "I'm in the category of people who think that if we, American

society, are ... not willing to take risks, we might as well find out who's going to lead the world and start following them."

"I don't feel a lot more pressure because of this flight," explained Hilmers. "We're professionals here and we've been there before. We know what we're going to do; we know what we have to do. We've been in training for a long time. We all know this is an important flight, and we all want to get our country looking forward again. I think we're ready."

Space News Roundup

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Engine test results still being checked

(Continued from Page 1)

Orbiter's auxiliary power units and the solid rocket boosters' hydraulic power units.

Also, explosive charges are scheduled to be installed on the Inertial Upper Stage (IUS) that will boost TDRS-C to a 22,250-mile high orbit. The ordnance devices will allow TDRS-C and the IUS to separate. On Monday, the TDRS-C/IUS combination is scheduled to be installed in *Discovery's* payload bay, and tests of the connections between *Discovery* and the payload will be conducted next week.

Other upcoming or ongoing return-to-flight milestones include:

- Engineers and program officials are continuing to study the implications and available options concerning a tiny hydrogen leak in the vicinity of *Discovery's* 4-inch disconnect cavity. However, the amount of leakage appears to fall well within the Orbiter's flight specifications. The leak was detected during *Discovery's* flight readiness firing (FRF) in an area of the Orbiter never before monitored.

- Meticulous inspections of *Discovery's* main engines following the FRF are continuing. The inspection of Engine No. 1 has been finished, and the results are excellent.

- Disassembly of Production Verification Motor-1 (PVM-1) following its full-duration test firing, the final such test before STS-26, is under way. PVM-1 included an unprecedented number of built-in severe flaws. The forward segment of PVM-1 is now being taken apart and fully inspected.

Preliminary indications from sensors on the full-scale solid rocket motor and a quick-look inspection showed a superb performance.

NASA-JSC

New superconductor

Material can be suspended under magnet

A team of NASA scientists has discovered a new high-temperature superconductor that can be suspended below a rare earth magnet.

All other reported high-temperature superconducting compounds can float above a magnet when cooled, but weight too much compared to their attractive forces to be suspended below the magnet.

The scientists, from Marshall Space Flight Center, Lockheed and the University of Alabama in Huntsville, reported their discovery in the journal *Applied Physics Letters*.

According to their paper, samples of yttrium-barium-copper oxide, when mixed with silver oxide, heat treated and exposed to minus 320 degrees Fahrenheit, can be suspended below a rare earth magnet by the magnetic field trapped in the sample. Because a superconducting material excludes a magnetic field, by floating a superconductor beneath a magnet, the two materials are firmly

attracted to each other but never touch.

"In space, with the elimination of the weight associated with gravity, it should be possible to develop low-vibration, low-friction couplings and bearing," said Dr. Palmer N. Peters, a member of the team from Marshall's Cryogenics Physics Office. "Below a certain transition temperature, superconductors lose all electrical resistance. In space, we might be able to store solar-generated energy in superconducting magnetic coils instead of batteries."

Peters said the material also should be easier to fabricate.

"The importance of the discovery is that this new material not only has stronger suspension forces but exhibits other unusual magnetic properties: it has demonstrated a lower electrical resistance at normal temperatures, is easier to solder, and is less brittle than other high temperature superconducting materials," he said.



A sample of a new superconducting material is suspended below a hand-held magnet.