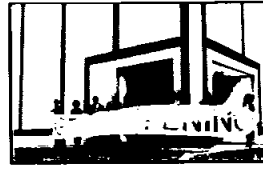


Two White Sands employees have worked together on their own time to design some low-technology that should help Grenada's economy. Story on Page 3.



The Mission Support Directorate is getting ready to welcome visitors to its new Central Computing Facility next week. Photo on Page 4.

Space News Roundup

Vol. 28

February 3, 1989

No. 5



JSC Photo by Jack Jacob

STS-29 crew members inspect the contents of their emergency medical and medication kits during the recent bench review of middeck locker equipment that will be available during their upcoming flight. From left are Mission Specialist Jim Buchli, Pilot John Blaha, Mission Specialist Jim Bagian and Commander Michael Coats. Bagian and Coats are checking a cue card listing the items in one of the kits.

Turbopump swap bumps blastoff into mid-March

Discovery is scheduled to arrive at Kennedy Space Center's Launch Pad 39-B early today, but the launch of the 28th Shuttle mission will be delayed until mid-March while three main engine oxidizer turbopumps are replaced.

The three high pressure oxidizer turbopumps will be replaced with new pumps to avoid any chance of cracks developing in them similar to a problem found in one *Atlantis* turbopump following the last mission. A tiny crack was discovered in a bearing race of the *Atlantis* turbopump, a fault later determined to have been caused by stress corrosion. The corrosion apparently was caused by moisture that remained inside the turbopump after assembly.

During manufacturing, the pumps are dried by baking in a vacuum to remove residue condensation that occurs after certain parts are heated and others chilled to make them expand or contract as needed for assembly. The drying process apparently was insufficient to remove all moisture from the *Atlantis* turbopump.

Since that same process was used for the *Discovery* turbopumps, Shuttle program officials said prudence dictates that they be removed and replaced with new pumps manufactured using different drying techniques. The three replacement turbo-

pumps are now being built by Rocketdyne and should be delivered to Kennedy by Feb. 17.

"From a technical standpoint, it's the right thing to do," NSTS Program Deputy Director Richard Kohrs said Thursday. "We've changed the vacuum baking process and can eliminate that moisture."

The delay in *Discovery's* launch is not expected to have any impact on the following Shuttle flights scheduled this year, but that schedule will become tighter, Kohrs said. The flight following the next mission has a high priority launch date of April 28, the opening of a window for deployment of the Magellan planetary probe to map Venus. The position of Venus in relation to Earth sets a narrow launch window for the mission.

"If *Discovery* launches in mid-March, the delay shouldn't have any impact on the Magellan flight," Kohrs said.

Rocketdyne technicians will begin removing *Discovery's* turbopumps Sunday, and the new pumps are scheduled to be fully installed by Feb. 23. No problems are foreseen in changing the pumps with the Shuttle in a vertical position, Kohrs said.

While the pumps are being replaced, preparations for launch will

Please see **STS-29**, Page 4



Space Center Houston donations surpass \$2 million

Contributions for construction of Space Center Houston, the \$50 million JSC visitors' center now under development, are mounting as fundraising activities shift into high gear.

The Manned Spaceflight Education Foundation, the non-profit organization sponsoring the project, has

collected more than \$2 million of a needed \$8 million in donations, a goal hoped to be reached by April 1. The major funding for the project will be generated via a revenue bond issue, said Chuck Biggs, vice president and secretary of the foundation. The \$50 million total will cover design and

construction costs for the participation-oriented center, predicted to become a major state tourist attraction.

"We have contributions coming in daily," Biggs said. "With all the help and enthusiasm we've seen from the civic and business communities, our

motivation and confidence are really building."

The pledges to date have come from all areas, including industry, individuals, foundations, community groups and civic groups. NASA employees have donated more than \$7,000 through Combined Federal

Campaign contributions. Among the largest contributions as of Wednesday were \$750,000 from the Wortham Foundation; \$300,000 from the Enron Foundation; \$200,000 each from Browning-Ferris Industries and Friendswood Development Co.; and

Please see **DONATIONS**, Page 4

Flashback for the space backpack

Manned maneuvering unit celebrates fifth anniversary

On Tuesday, it will be exactly five years since astronaut Bruce McCandless pushed a lever and became the first space walker to fly freely above Earth.

McCandless' untethered flight with the manned maneuvering unit (MMU) was the fruition of a dream that had been moving toward reality since the early 1960s, a dream enjoyed by many at JSC. This center managed and performed much of the work on the MMU, which was built by Martin Marietta.

On Feb. 7, 1984, McCandless piloted the nitrogen-jet propelled MMU a little more than 100 yards from *Challenger*, creating a scene of space-age freedom that became immediately famous as it fired the public imagination. McCandless was accompanied by astronaut Bob Stewart who flew a second MMU. Together, the two tested the units and found their performances flawless.

It was a triumphant moment for both McCandless and Ed Whitsett, project engineer for the MMU and a man involved with the concept since his graduate thesis in 1960. The two

had worked together on the MMU off and on for about 16 years.

"We had a lot of confidence in it. We knew it was a good machine," Whitsett said recently. "But, obviously, the first time he flew away from the Shuttle, a lot of people were uptight."

That was not the case for McCandless. "I had a lot of confidence in the hardware," he said. "I knew that the laws of physics hadn't been repealed recently."

McCandless said he experienced no new physical sensations as he became, essentially, a second spacecraft. After having been in orbit aboard *Challenger* for four days, the only difference he felt in the MMU was "a sense of professional satisfaction."

"I did not feel alone or isolated," he remembered. "I attribute that largely to excellent radio communications. Vance (Brand) and the guys were reading off ranges and talking to me, so I didn't feel I was isolated."

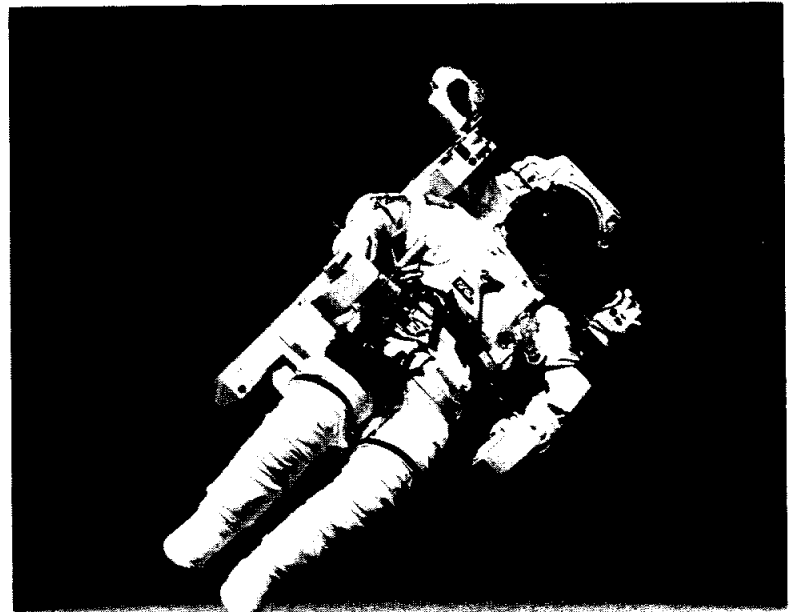
The first flight was the result of development work that began with an awkward, difficult-to-control, hand-held maneuvering unit used during

the Gemini program. The work proceeded through the Skylab missions, where crew members evaluated another hand-held unit, a device called "jet shoes" and the first backpack thruster unit. Among these three, the backpack, flown by five different astronauts for a total of 14 hours within the orbital workshop, easily won.

Development of the MMU during the Shuttle program was spurred, at first, by a desire to have a method the crew could use to inspect the bottom of the Orbiter in flight, Whitsett said. But its major use, and the event that put its operation in high gear, was a need for satellite retrieval and repair. McCandless' flight was a dress rehearsal for repairs of the Solar Maximum Mission satellite.

The MMU was used on two following Shuttle flights to work with three satellites—Solar Max, Westar VI and Palapa B-2. All of the flights took place within a year, and, in total, six astronauts have flown MMUs for a combined 10 and a half faultless hours.

Please see **BACKPACK**, Page 4



NASA Photo

In a now-famous photograph, Astronaut Bruce McCandless II hovers a few meters away from *Challenger* in a manned maneuvering unit (MMU). McCandless and fellow STS 41-B mission specialist Bob Stewart became the first humans to fly untethered in space on Feb. 7, 1984.

JSC

People

Chevers named division chief

Edward S. Chevers recently was appointed chief of the Spacecraft Software Division in the Mission Support Directorate. Chevers had been assistant chief of the Avionics Systems Division in the Engineering Directorate since May 1984.

In his new job, Chevers will oversee development of flight software for the Shuttle program. In addition, the division has responsibility for developing a software support environment for space station and a multi-system integration facility to be used for software integration verification for space station.

NPMA officers are installed

The JSC chapter of the National Property Management Association (NPMA) installed its 1989 officers Jan. 12.

New officers include: President Elaine Dawson of Johnson Engineering Corp.; Vice President Margaret K. Holmes of the JSC Logistics Division; Treasurer Brian Bounds of

Krug International; Secretary Sina Hawsey of Stellacom Inc.; and Certification Officer Elizabeth J. Meyer also of the JSC Logistics Division.

ASME forms local chapter

An Aerospace Technical Chapter of the American Society of Mechanical Engineers has been formed in the Clear Lake area. Chapter officers were elected at a kickoff meeting in November 1988.

Officers include: Chairman Dr. Sam Veerasamy, Vice Chairman John Toney, Vice Chairman Lisa Francis, Secretary-Treasurer Edward Carter, Secretary-Treasurer Rick Emshoff and Program Chairman Tom Gasear. Monthly dinner meetings of the chapter will be at the King's Inn, 1303 NASA Road 1. The next meeting is scheduled for 6 p.m. March 21 and will feature Dr. Kumar Krishen giving "An Overview of Robotic Vision for Space Applications."

For more information about the chapter, call Veerasamy at x31581.

JSC

Ticket Window

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

FBA membership cards (available to civil service employees and retirees): free. Premium membership (includes Houston Gold C coupon book): \$4.

General Cinema (valid for one year): \$3 each.

AMC Theater (valid until May 31): \$2.95 each.

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

Rodeo—The Judds (Feb. 19, 4 p.m., Astrodome): \$8.50.

Rodeo—Crystal Gayle (Feb. 20, 7:45 p.m., Astrodome): \$7.50.

Rodeo—Larry Gatlin (Feb. 24, 7:45 p.m., Astrodome): \$8.50.

Rodeo—Reba McEntire (Feb. 26, 7:45 p.m., Astrodome): \$8.50.

Rodeo—Barbara Mandrel (March 4, 7:45 p.m., Astrodome): \$8.50.

Rodeo—Alabama (March 5, 4 p.m., Astrodome): \$8.50.

The Arkansaw Bear (Feb. 18, 7 p.m., Bayou Theatre, UH-CL): \$3.

Pericles, Prince of Tyre (April 22-28, 8 p.m., Satellite Theatre, UHCL): \$4.

x31206 or 538-1147.

Sale/Lease: Middlebrook II, 3-2-2, 1,940 sq. ft., FPL, fence, new paint, new A/C compressor, refrig., \$78,900, assume 9.25% or rent \$700/mo., no pets. 480-3260.

Large Vail, CO. condo, sleeps 10, 3 baths, great clubhouse, March 18-25, \$1,000. 303-484-1888.

Sale: Friendswood/Heritage Park, 4-2-2, FPL, corner lot, cul-de-sac, landscaped, ceiling fans, miniblinds, and other extras, less than 2 yrs. old. Dee, x32425 or John, 996-8975.

Sale: Friendswood/Sun Meadow Estates, wooded lot in estab. neighborhood, cul-de-sac, bordered by stream and golf course on 2 sides, approx. 245' deep and up to 86' wide, util. on site, \$31,500. Doug, x32860 or 486-7412.

Cars & Trucks

'81 Dodge Aries, 4 dr., 2.2 L eng., 61.5K mi., P/S, P/B, A/C, \$1,800. 996-8138.

Sale: '85 35' Mallard motor home, loaded, low mi., \$34,000. 337-4051.

'77 Porsche 924, new carpeting, reupholstered seats, and inspection, runs good, \$2,000. Karl, x31236 or 554-6180.

Sale: '59 Mercedes Benz 220S, \$3,000. David, x35464.

'86 Chev. S-10 P/U, 38K mi., 4 spd., like new, A/C, camper, 2 yr. warranty, \$5,500, OBO. Linda, 282-2810 or 480-3909.

'82 Olds Cutlass Calais, blue, 8 cyl., AM/FM, A/C, cruise, tilt steering, wire wheels, 70K, one owner, \$3,000. 282-2544 or 488-3726.

'86 Chrysler Fifth Avenue, fully equip., AM/FM/ST tape, wire wheel covers, gunmetal metallic, low mi., like new, below NADA, \$10,300. 482-1535.

'29 Mercedes Replicar, still in kit form, assembly not started, has Ford frame, takes either a Pinto or Mustang II, retails: \$8,000, was \$6,500, now \$5,500. 280-4381 or 484-7834.

'85 Toyota Celica GT, red, AM/FM cass., A/C, tinted windows, 70K mi., \$5,900. Whitnah, x36607 or 481-2854.

'63 Ford Fairlane, 2 dr., 3 on floor, good hobby car, needs work, see and make offer. Jim G., x35126.

'75 Oldsmobile Cutlass Supreme, \$400. Mike, 554-7659.

'77 GMC 4x4 SWB pickup, 1 owner, 75K, \$1,450. 480-0952.

'79 Dodge 3/4 ton van, silver, customized, maroon int., Captains chairs, bed, table, storage, CB radio, ex. mech. cond., Michelin tires, low mi., \$2,795. Dean Thompson, 332-2229.

Today

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

Saturday

Young people's concert—The Bay Area Houston Symphony League will present its annual Young People's Concert featuring the Houston Symphony Orchestra at 10:30 a.m. and noon Feb. 4 at the Webster Intermediate School Auditorium. Gisele Ben-Dor, assistant conductor for the Houston Symphony, will conduct the program, entitled "Wild, Wild West." Tickets will be on sale at the Clear Lake and LaPorte Chambers of Commerce and Randall's supermarket on El Dorado Blvd. For more information, call 474-5866 or 486-5242.

Monday

NAMU meets—The next meeting of the NASA Area Macintosh Users (NAMU) will be at 7 p.m. Feb. 6 in the RSOC cafeteria, 600 Gemini. For more information, call Shawn Harrison, x33348 or 326-1608.

Cafeteria menu—Entrees: beef chop suey, breaded cutlet with cream gravy, grilled ham steak, weiners and baked beans (special). Soup: beef and barley. Vegetables: buttered rice, Brussels sprouts, whipped potatoes.

Tuesday

Cafeteria menu—Entrees: fried shrimp, pork chop with applesauce, turkey a la king, pepper steak (special). Soup: celery. Vegetables: au gratin potatoes, breaded squash, buttered spinach.

Wednesday

CLASS meets—The Clear Lake Area Space Society (CLASS) will meet at 7 p.m. Feb. 8 in the party room of Mr. Gatti's Pizza on El Camino Real. Peter Lange will discuss what it takes to become a flight controller. For more information, call Jeff Larson at x35532.

Dates & Data

Cafeteria menu—Entrees: fried catfish with hush puppies, braised beef ribs, Mexican dinner (special). Soup: seafood gumbo. Vegetables: Spanish rice, ranch beans, buttered peas.

Thursday

Grand opening—The new Central Computing Facility, Bldg. 46, will celebrate its grand opening from 11 a.m. to 6 p.m. Feb. 9. More than 60 vendors will display PC and mainframe computer hardware and software inside the building. Several JSC and contractor organizations also will provide information on the services they provide.

EAP seminar—The Employee Assistance Program (EAP) will present a free brown bag lunch seminar entitled, "Gender Issues—One more Stressor in the Workplace," at 11:30 a.m. Feb. 9 in the Bldg. 30 auditorium. Linda Calvert, an associate professor of management at the University of Houston-Clear Lake, and John Hough of the Center for Creative Resources will speak. For more information, call the EAP at x36130.

IEEE meets—The next technical luncheon of the Galveston Bay Section of the Institute of Electrical and Electronics Engineers (IEEE-GBS) will be at 11:30 a.m. Feb. 9 at the Gilruth Recreation Center. JSC's Dr. Jon D. Erickson will discuss "Manned Spacecraft Automation and Robotics." The meeting coincides with the annual IEEE-GBS Pro-Am Day, where senior students from six area universities spend a day with engineers from NASA and local companies. For reservations, call Marcia Taylor, x30125, by noon Feb. 6.

NPMA meets—The JSC Chapter of the National Property Management Association (NPMA) will meet at 5 p.m. Feb. 9 at the Rec Center. Harvey Hartman, deputy director of JSC's Human Resources Office, will discuss plans for Space Center Houston, JSC's new visitor center. For more information, call Ray Whitaker, x36695.

Cafeteria menu—Entrees: corned beef with cabbage and new potatoes, chicken and dumplings, tamales with chili, hamburger steak with onion gravy (special). Soup: split pea. Vegetables: navy beans, buttered cabbage, green beans.

Feb. 10

Picnic ideas due—The deadline for entries in the 1989 JSC Picnic theme contest is Feb. 10. The winner will receive a \$75 savings bond, a picnic T-shirt and two picnic tickets. Send ideas to Picnic Theme Contest, Sandy Perry, Code FR. For more information, call Perry at x35239.

Information systems conference—Registration deadline for an all-day conference entitled, "Information Systems for Project Management: Coordinating Large, Complex Computing Systems," is Feb. 10. JSC and the University of Houston-Clear Lake will cosponsor the conference Feb. 22 at the Westin Oaks-Galleria in Houston. Brenda Dervin of Ohio State University will give the keynote speech on "Making Information Systems Work: The Human Dimension." Cost is \$125 per person, or \$100 for university and federal employees. Federal employees should call Glen Van Zandt, x33069, to register. For more information call 488-9433.

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

Feb. 13

Softball registration—Registration for spring softball leagues will be Feb. 13-17 at the Rec Center. NASA-badged teams will sign up at 7 a.m. each day. Non-badged teams will sign up for all leagues at 5:30 p.m. Feb. 17. The sign-up days for the various leagues are: Feb. 13, men's C and D recreational; Feb. 14, men's C; Feb. 15, men's A and B; Feb. 16, men's A; Feb. 17, women's open and Friday special. For more information, call x30304.

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

Sale/Lease: 10 acres on FM 517, 1/2 mile west of Hwy. 146, barn, stocked ponds, concrete fence posts, util., etc., owner financing avail. 280-4381 or 484-7834.

Lease: Pagosa Springs, CO., house has everything, sleeps 8, FPL, whirlpool, seven days (Sat. to Sat.), you pick the week, ski, Wolf Creek/Purgatory, \$490. Scott, x34614 or 334-2278.

Lease: Clear Lake, spacious 2 BR apt., includes W/D, nice, month free rent, \$365/mo. Eric, x38420 or 484-9179.

Lease: Friendswood/Sun Meadow, 3-2-2D, \$600/mo., no pets. 996-9157.

Sale: University Green, 2 plus study, 2-2D, low maint., privacy, and luxury, bright and clean, just outside the JSC/Clear Lake gate, \$98,700, OBO. 488-0397.

Sale: League City, 3-2-2, cul-de-sac, landscaped, \$3,000/down, FHA 10% fixed assum. David, x35464.

Sale: League City, 3-1-1, near Civic Center, fenced yard, \$37,500. x30810 or 488-0597.

Sale: Big Bend area hunting land, 160 acres, \$150/acre, OBO. 337-4051.

Sale: Heritage Park, 3-2-2 custom home, tile entry, walls of windows in living and dining rooms, beautiful custom kitchen, new deck and fence, both baths redone and vanities custom, new paint inside and out, wallpaper, miniblinds, carpet throughout, \$58,500. Tony or Lori, 482-5139.

Lease: Condo near NASA, attractive 2-2 upstairs, FPL, W/D, new paint, carpet, miniblinds, \$420 plus dep. Gilbert, 333-4306.

Sale/Lease: Nassau Bay townhouse, 4-2-2, w/2 story den, over 2,000 sq. ft., deck, atrium, FPL, oversized garage, \$950/mo., or \$99,900. Jerry, x38922 or 333-9003.

Sale: Heritage Park, 3-2-2, great first home, assume 10.5% fixed, decking, landscaping, sec. system, window treatments, estab. neighborhood, open house 1-28-89. 996-1990.

Rent: West Galveston beach house, 2-2, beach 100 yards, boat landing, marina w/pool, \$500/week, weekend rates avail. Fendell,

'81 Chev. van, V-8, blue, AM/FM, P/S, P/B, auto., air, good tires, customized bed, table, storage, \$3,495. 484-6814.

'87 Toyota MR2, 5 spd., loaded, sec. alarm, 7,900 mi. Jim, x34809 or 480-9563.

'84 Bronco II, XLT, 4x4, auto., ex. cond., \$6,995. x36726 or 488-0919.

Cycles

Honda CR125 dirt bike, very good cond., \$250. 474-2200.

Boats & Planes

Ready to fly! R/C airplane (Aerobatic) with motor (S.T. 60) and radio (Kraft 7 channel - 76 series), \$275. Carlos, x38879 or 554-7727.

Bic windsurfer, great beginner board, ex. cond., \$350. 474-2200.

Mistral Bermuda windsurfer, complete rig, ex. for beginner, \$500. 488-6526.

Audiovisual & Computers

Original IBM PC, not a clone, 640K RAM, 20MB harddisk, serial and parallel port, Monochrome, ex. cond. Larry or Kathy, 996-5296.

IBM PC Jr., color monitor and printer, \$500. Renee, 482-0804.

Atari 2600 and 20 game cartridges, \$50; AKAI 7" reel to reel and 15 tapes, \$100; Trackstar Apple II card and Apple disk drive for your IBM PC/clone, was \$500, now \$350. Tony, 280-1564 or 482-4156.

Tandy 1000, 640K computer, dual 5 1/4 floppy disk, w/RGB color monitor, and a Tandy DMP 130 Dot Matrix printer will also include MS DOS and basic manual's fully IBM compatible, computer also has a 300 baud internal modem, Haynes compatible, \$1,200 firm. Jim, 489-1235.

Commodore 64 software and books, diskette boxes, 5.25". Steve, x35272.

Household

1 sofa chair, new, \$100; ash rocking chair, \$60; 2 Sears prof. tool chests, \$300. x37192 or 996-9724.

Junior bed, mattress, and bedding, all for \$50. Keith, 486-9173.

Walnut dining room table, 1 Captains chair, and 5 mates chairs. 488-8080.

Oriental design dining table, 37" x 63" with 12" leaf, dark wood, 6 hi back chairs, 2 Captain, ex. cond., \$575; rattan round table w/2 chairs, \$55; queen size sleeper sofa (interspring), used twice, purchased in Nov., contemporary

cream, mauve, blue, \$750. 996-9690.

Antique hump back steamer trunk, 34L x 21W x 28H, has 95% HDW/trim, \$195; elect. dust collector for furnace, H/P, "Edison", w/pressure switch, 800-1600 CFM, was \$380, now \$150; dehumidifier "White Westinghouse" 21H x 12 x 12, 20 pts/24 hr., auto., shutoff, used 4 mo., \$99; mirrors, gold-veined (2), 45 x 91 1/2, \$100/ea. Doug, x32860 or 486-7412.

Pecan dining room set, 4 chairs, 2 leaves; large French Provincial style, ex. cond., \$350, OBO; 2 brown velvet bar stools, ex. cond., were \$175 ea.; new, now \$60/ea. or \$100/both. Hansen, x38033.

Living room set, gold couch, two swivel rockers, coffee table, two end tables, two lamps, and mirror, \$400. Kandy, x37256 or 482-2750.

1 triple dresser, wood framed mirror, 30" x 51", 1 high boy, 1 king size headboard, 1 coffee table, large w/glass top, all in pecan finish, \$250. 532-1332.

Grandeur Noritake china, 8 pc. setting, 63 pieces, perfect cond., \$750, OBO. Dawn, 474-9274 or 480-0907.

Sears Kenmore heavy-duty washer and dryer, white, 3 yrs. old., \$200/each or \$350/pair; 7 pc. dinette set, glass top, \$150; multi-color queen sleeper sofa, \$100; microwave, \$35. Chris, x33278 or 480-5768.

19" RCA color TV, \$75; dining table, 6 chairs, hutch, \$500; child's bedroom furniture, platform bed w/mattress, dresser, nightstand, \$300. x33440 or 486-8330.

Queen size mattress, box springs, frame, \$75; round table w/4 chairs, \$25; rect. table, \$15; swivel rocker, needs repair, \$10. 482-2138.

Wanted

New 1988 van needs riders, West Loop Park & Ride to NASA area. Richard Heetderks, x37557.

Want two or three large wooden crates suitable for use as a child's "fort", also want rough lumber for the same purpose. Bill, 326-2187.

Want used fishing equip., rods, reels, and boat equip. Mike, 474-4805.

Want to do sewing for you. Vilma, 480-6547.

Van pool riders wanted, from Sugar Land or Loop 610 Park & Ride to JSC area. Alice, x35234.

Want baby items (playpen, walker, etc.), band saw, rear-tine tiller. Kathleen, 337-3977.

Want small size microwave oven ideal for dormitory use. 409-762-1799

Want to buy elec. trains. Don, x37832 or 996-1425.

Photographic

Konica FP-1 camera and lens, \$150; various lenses, \$40-\$90. all mint. x30577.

Pets & Livestock

Free kittens to a good home. 554-6471.

Free to good aquarium home, 7" freshwater Plecostomus. Forrest, x35178 or 944-2391.

Musical Instruments

Baldwin Spinnet piano and bench, walnut, ex. cond., tuned, \$1,200. 482-1659.

Miscellaneous

Cowgirl boots, beige antelope, size 7A, \$45, OBO., orig. price \$160; child's cowboy boots, black elephant, size 6 1/2B, like new, \$20, OBO. x36960 or 998-9489.

Boys matching ski outfit, size 12, \$20. Sue, 480-5027.

6' satellite dish, BO, or trade for rear-tine tiller. 337-3977.

Wedding dress, ivory, summer style, tea-length, size 8, w/gloves and shoes, all for \$150. 481-4889.

Utility car/boat trailer, single axle w/car ramps and spare tire. \$500. Tony, 280-1564 or 482-4156.

One loose round diamond, weight .83 points, I color, S11 appraised at \$2,600, will take \$1,700. Al, 643-1003.

VDO gauges, 2 temp, 1 ea. of volt, PSI, fuel, vac plus fuse block to many misc. switches and indicator lights, \$50, OBO. Patricia, x39375 or x39377.

Sears Craftsman 11hp riding lawn mower. 5 spd. trans., 36" cut, rear bagger incl., used 1 summer, \$900. Steve, x35450.

Wedding gown, never worn, white, size 10, bridal orig. #3803, chapel length, \$400, OBO. 486-1632.

Golf clubs, Tour Model System II irons, 1-9 PW, SW, new, peripheral weighted, ex. clubs, \$185. 554-5514 or 282-3827.

Snow skiing equip., men's size 12 rear entry boots, 190cm Rossignol skis and reflex poles, and Tyrolia 470 bindings. \$300, OBO. Glenn, x38825 or 487-8018.

Aquarium (30 gal. oceanic) w/light and stand w/all access, \$250. Carlos, x38879 or 554-7727.

David Phippen, left, and Jack Stradling check the effectiveness of their homemade egg candling apparatus. They used the box to check the progress of developing chicken embryos during incubation.



CHICKMAKER:

White Sands engineers take high-tech timeout to build low technology for Grenada

About the same time the crew of STS-29 is performing a high-technology study of chicken embryos in space, two White Sands Test Facility engineers should be shipping a low-technology incubator that may help fill one small country's basic need for jobs.

David Phippen, chief of the White Sands Laboratories Office, and Jack Stradling, a special projects manager at White Sands, have been working diligently since mid-summer to design, fabricate, and deliver a working incubator to a volunteer doctor friend in Grenada.

Named "Chickmaker I," the incubator has just hatched the first 12 chicks of its initial 'check-out' eggs, proving that the relatively simple design concept really works, Phippen said.

"It all started when Dr. John Zwerneman, a young medical doctor serving in Grenada under the sponsorship of the Catholic Church, wrote me a letter describing the terribly high unemployment rate of the young people there," Phippen said. "When my wife, Sheila, was in graduate school at New Mexico State University in Las Cruces, she and 'Dr. John' became pals as they shared some biology courses. Dr. John has since married. He, his wife and three children (two of whom were born in Grenada) established a home there, and we correspond frequently.

"In addition to helping a needy people with their medical problems, he has decided to single-

handedly solve their unemployment problem. He says all he needs to do is purchase fertile eggs from the United States and hatch them there. Since most chicks are now imported, he can buy the eggs for less than a dollar each and sell chicks to a local distributor for about two dollars apiece. All he needs is to convert 3,000 eggs to baby chickens each month. And who knows, maybe an entire chicken raising industry will result and create a hundred or so jobs."

Phippen said Zwerneman then explained several problems. Problem 1: no money. He works for subsistence and donations that go for medical supplies. Problem 2: commercial incubators are designed for reliable power and lower ambient temperature than can be economically provided in Grenada. Problem 3: Zwerneman knows nothing about mechanics or electronics. Problem 4: people in Grenada have few technical skills.

"Jack and I were discussing these issues one morning before work and we came to the conclusion that we could design and build one for less than \$1,000 in materials," Phippen said. "Jack would be responsible for the mechanical things and I the electronic. Jack has this tremendous shop that has every saw, welder, sander, and tool known to man. I have an electronics shop that has accumulated odd electronic 'bargains' for 30 years.

"We brainstormed many

heating concepts including solar, kerosene, bottled gas, wood, and electricity with both generator and battery backup. The basic concept that emerged would use a heated water reservoir to provide heat for the eggs during the frequent power outages and brown-outs experienced in Grenada. Dr. John says that water is one of the few things readily available in Grenada if you rule out bugs, tree frogs, and mosquitoes. The periods of zero, or significantly reduced, power last up to 8 hours a day several days a week. We decided to design an incubator to hold 360 large chicken eggs, the minimum order from the fertile egg suppliers we contacted."

Armed only with simple engineering principles, they started small and planned to add incubators if the concept worked. They used light polyurethane insulation reinforced with thin tempered hardwood and redwood to reduce shipping weight and degradation in the high humidity and heat.

To achieve a design that would require human labor, and thus produce jobs for the young people, they would not automate the incubator more than necessary.

Electricity would be used, while it was available, to heat the water reservoir and eggs. A small electric fan would circulate the incubator air through a remote "hot box" to maintain the required incubating temperature. If the temperature began to go too high, the fan speed would decrease, and vice versa. If turning the fan off didn't keep the temperature

from getting high enough to damage the eggs, then a cooling fan would turn on, drawing air from an electronically cooled (Peltier Effect) "cold box."

In the likely event of power failure, the hot water would heat the circulating air to maintain the incubation temperature. A pan of water would be used to provide the required humidity. If low humidity ended up being a problem, an intravenous drip tube could be used to drip water on the "hot box" water container which would quickly vaporize the water.

"I went to work on the electronic control system and after a dozen or so evenings the system was designed and a bread-boarded circuit to control the temperature was operational. A reference book said the temperature for a circulating air incubator needed to be controlled to 99 1/2 to 99 3/4 degrees Fahrenheit," Phippen said. "The brooding hens we had on the farm during my boyhood days didn't control temperature this closely, but who am I to question modern poultry raising techniques?"

Meanwhile, Stradling was working on the basic incubator. He built it to handle 32 dozen eggs that could all be rotated at the same time. During incubation, eggs need to be rotated four to five times daily to keep the embryo from sticking to the shell. Stradling used the simplest of design and construction techniques so that the Grenadians could easily build any additional

incubators they might want.

All went well and the pair stayed pretty much within their estimated materials cost and the schedule.

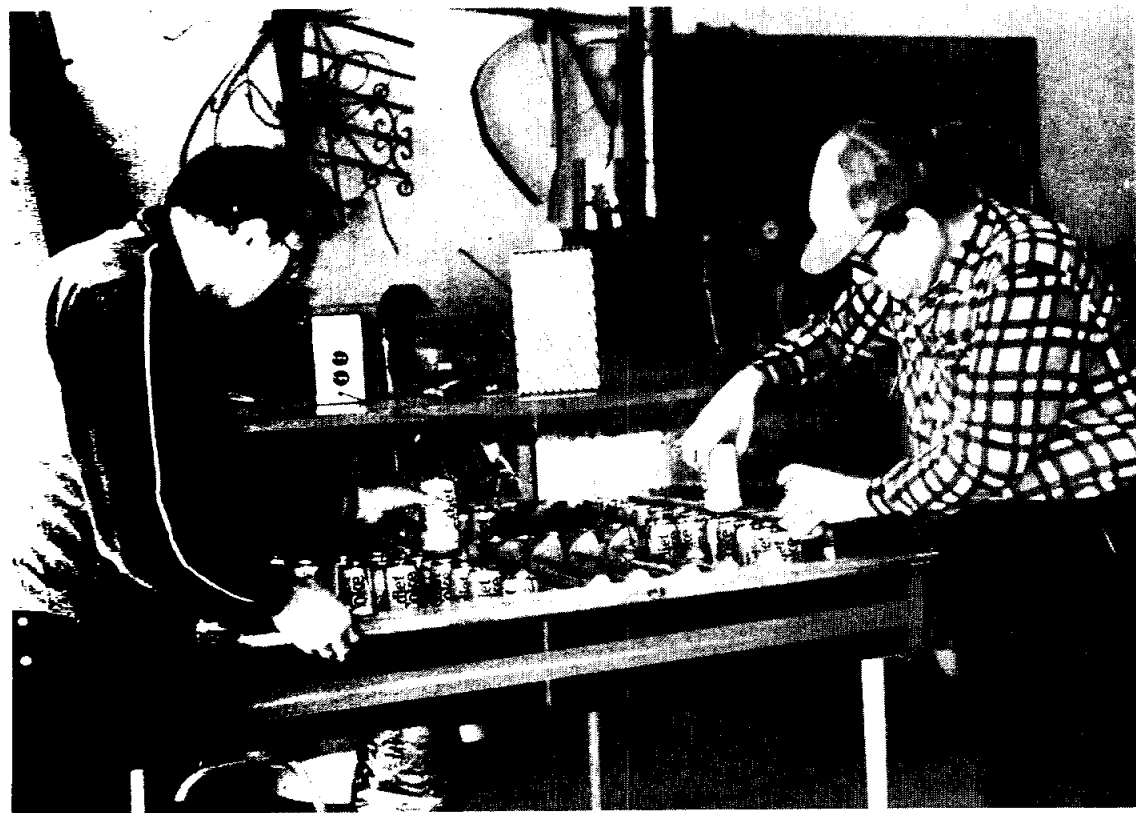
Two months later, the time for integrating the incubator to the electronics came during the Christmas holidays. Phippen and Stradling, his wife Ann, two children John and Tammy, spent the better part of a week assembling the egg racks, gluing, sawing and getting everything ready.

They connected everything, turned on the 240-volt AC power, held their breaths and watched for smoke. Everything worked for a couple of hours, but then the "hot box" began to smoke. The commercial plastic cooler converted to a hot box would have to be replaced by a 30-gallon metal drum.

A neighbor tipped the Las Cruces newspaper, and interested readers supplied more than two dozen fertile eggs to try out the final configuration. The builders used 60 beverage cans, each filled with about 12 ounces of water, to simulate the thermal characteristics of the other 28 dozen eggs that would normally fill the incubator.

The first eggs hatched Jan. 22 and by the following Tuesday, Ann Stradling was the "mother" of 12 Rhode Island red chicks. Eggs hatched at every critical location within the incubator, so the builders are confident their low technology will continue to work.

Phippen and Stradling said their next challenge is figuring out how to ship the incubator to Grenada.



Left: Phippen and Stradling load the incubator with simulated eggs (beverage cans filled with water) through the double-pane Plexiglass viewing window. Above: Test eggs are loaded in the incubator with the simulated eggs.

Photos by Ann Stradling

Scholarship applications being accepted for employees' children

Applications are being accepted for two separate scholarship programs available to dependents of JSC employees. Scholarships are offered by the JSC Employee Activities Association and the NASA College Scholarship Fund.

Three EAA scholarships will be awarded this year and may provide \$4,000 for study at any college or university. Students may receive the support in varying increments up to \$1,000 a year. Since the 1967 inception of the EAA program, 54 dependents of JSC employees have received scholarships.

The application period for the EAA Scholarships runs through March 31. Application forms are available in Bldg. 45, Room 712. For information call Sandy Ogden, x33164.

EAA scholarships are open to students who will graduate from a public, private or parochial high school in 1988 or students currently enrolled in college with a good academic standing. High school applicants must have a grade point average of at least 2.5 on a 4.0 scale or the equivalent. Applicants must be dependents of JSC employees who have worked at the center, White Sands Test Facility, Downey, or at KSC Resident Offices for at least two years as of Jan. 1, 1989. The scholarship winners may pursue any course of study leading to a recognized degree from an accredited college or university.

Dependents of JSC employees who during the past year were medically retired or deceased and

who otherwise would have met these qualifications also are eligible. For the purposes of the scholarship, dependence is defined as having been listed on an employee's federal income tax return as a dependent or being a natural, adopted or foster child for whom the employee furnishes the majority of support.

The scholarship will be awarded on the basis of scholastic achievement, extent of financial need and breadth and substance of school and community activities.

High school students are expected to provide a transcript and a record of their scores on the ACT or SAT tests. College students also are expected to provide a transcript of both high school and college grades, as well as their ACT or SAT

scores.

Scholarship winners will be announced by the end of April.

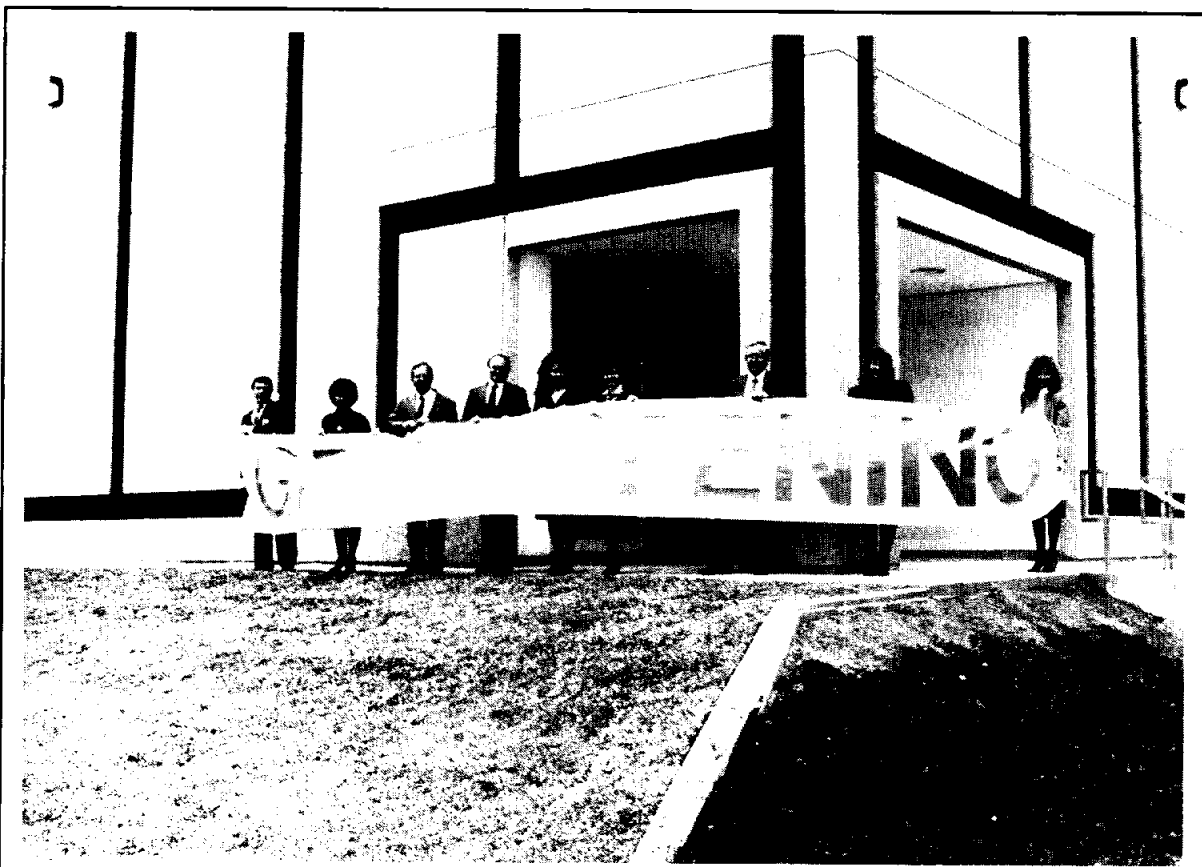
This year, three \$1,500 scholarships will be awarded by the NASA College Scholarship Fund Inc. The fund was set up in 1982 through a gift by author James Michener. The corporation has offered scholarships since then to qualified dependents of NASA and former NASA employees, agencywide.

Generally, the NASA scholarship is \$1,500 per student, per year, not to exceed \$6,000 over six calendar years. Eligibility requirements are similar to those for the EAA scholarship, however, the NASA scholarship is limited to students studying in the engineering or science fields.

Applicants are ranked on the basis of academic preparation, school activities, community activities, performance on ACT and SAT tests, written recommendations from instructors or other references, and a one page statement of academic purpose written by the student.

Many NASA employees have made tax-deductible contributions to the fund, mainly through the Combined Federal Campaign, said Teresa Sullivan, manager of the scholarship selection process.

Application forms for the NASA College Scholarship are available in Bldg. 1, Room 840. Interested persons may call Mary O'Connell, x39168, for more information. The deadline for applications is March 24.



JSC Photo by Bill Blunck

Mission Support Division representatives stand ready to welcome JSC and contractor employees to the grand opening of the new Central Computing Facility in Bldg. 46. From left are: Steve Hawkins, Josephine Jue, Don Simanton, Ron Berry, Nancy Ankenman, Janet Montoya, Charles Mains, Wanda Spain, and Charlotte Owens. The opening is scheduled from 11 a.m. to 6 p.m. Thursday.

Debris-tracking radar to supply details for JSC

Proposals have been requested from industry for a ground-based radar to track orbital debris 180-360 miles above Earth, supplying information that will help a JSC group determine how much shielding Space Station *Freedom* will need.

The radar would complete a five-month testing period at Goldstone, Calif., by October 1991. It would then be moved to a permanent overseas location and be operational by March 1992.

The radar would have the capability of detecting debris as small as 1 centimeter in diameter, contrasted with the 10-centimeter capability of current radar systems. Even the smallest pieces of orbital debris pose a potential hazard to spacecraft, and current information about the number of small orbital debris pieces at *Freedom's* planned 300-mile altitude is very limited.

"We'll receive data from the radar and use it to better develop our orbital debris model," said Drew Potter, chief of the Space Science Branch, the JSC branch that includes the Orbital Debris Group. "We need data down to about one-half-inch pieces, and we need to know exactly what the number is in the area where the space station is going to fly."

Current predictions are that *Freedom* will need a protective shield against orbital debris up to one-half-

inch in diameter, Potter said. But such shielding adds weight to the station, more weight that must be placed in orbit.

"It would be nice if there is less debris of that size than we expect," Potter added. "But there may be more, and we may have to shield up to 1 inch. Our prediction is just an educated guess."

The Air Force Space Command tracks orbital debris that is above 4 inches in size, but at present there is no method for tracking smaller debris.

The concept for a radar to track such orbital debris originated in the JSC Space Science Branch about two years ago. "When the radar is on line, we'll finally get the data we need," he said. "We're really happy about it."

The contract for the radar and its operation will be managed by NASA's Jet Propulsion Laboratory in Pasadena, Calif. The orbital debris radar facility will conduct preliminary processing of data before sending it to JSC.

Under the agency's request for proposals (RFP) issued Jan. 19, an offeror would design, construct and test an orbital debris radar and associated hardware and software. The deadline for responses to the RFP is seven weeks from the date of issuance.

STS-29 launch delayed until March

(Continued from Page 1)

continue with the Terminal Countdown Demonstration Test (TCDDT), a dress rehearsal of launch day, scheduled for Thursday. A specific launch date for *Discovery* will be announced following the flight readi-

ness review, a meeting of Shuttle program officials and managers, now scheduled March 1-2 at Kennedy.

Prior to roll out, the Shuttle Interface Test, a check of all electrical and mechanical connections be-

tween the Shuttle components, was completed Wednesday night. *Discovery* had been powered up for the test on Sunday. Last weekend, technicians had completed connections between the solid rocket boosters, external tank and *Discovery*.

Donations mount for Space Center Houston

(Continued from Page 1)

\$100,000 from the Fondren Foundation.

Locally, Clear Lake contributors have donated more than 75 percent of that area's \$650,000 goal. Overall, more than 75 separate donations have been pledged.

"The contributions from the Clear Lake area are really excellent, especially since we announced the local drive less than two months ago," said Hal Stall, JSC's director of Public Affairs and president of the Manned

Space Flight Education Foundation. "It shows tremendous community support for the project."

Among the community contributors are municipal donations, including one from the City of Nassau Bay and a pending pledge from the City of Webster.

"The local support, along with the response we're getting from corporate and business groups, underlines the importance of the economic benefits the center will spur," Stall said. "But those benefits are only a spinoff from

our primary objective—a public better educated about the space program, past, present and future."

The Clear Lake-area fund-raising effort is led by Roy Pezoldt and Larry Griffin, both leaders of the Clear Lake Economic Development Foundation, and by Realtor-developer Jerry Pennington and a team of local volunteers.

Groundbreaking for the project is planned later this year, with construction under way before 1990. The center is planned to be opened in 1991.

Backpack celebrates fifth anniversary

(Continued from Page 1)

MMUs aren't currently scheduled for any future flights, although it is possible they will be used for a Space Station Radiator Assembly Demonstration (SRAD) flight experiment sometime in 1993. Still, Whitsett said, one can never tell when the need could arise for an MMU mission.

"The Westar and Palapa mission wasn't planned far in advance. It just happened that the MMU was needed," he explained.

The MMUs, proven dependable fliers, are in storage now at Martin Marietta. "They're in good shape, able to be used whenever the need arises again," McCandless said.

Completing development of the MMU, a project that spanned so many years, was a little bittersweet for those

devoted to it. "Everybody who worked on it was extremely enthusiastic. People were nearly fighting to get on the project," Whitsett said. "It's sort of like raising a child. When they go off and get married, you're still proud of them. But they're not there anymore."

Many of those involved with development and flight of the MMU plan to honor the fifth anniversary of the first flight on Tuesday.

The MMUs remain ready and waiting as they are, but they may be improved by work now under way on the Extravehicular Activity (EVA) Retriever, a fetching space robot being developed at JSC. "A lot of the retriever work will feed into MMU updates, such as a fault detection system and caution and warning lights," said Whitsett, who now works

as systems integration manager for space station EVA systems.

McCandless also has special ideas for the future of the MMU. "I'd dearly love to see us mount the IMAX camera on the MMU for a flight," he said. "You could get stand-off imagery of the Orbiter with Earth in the background. I think that would be very dramatic."

McCandless said he does have one minor regret about the first MMU flight. "I had intended when I got out 30 feet or so to stop and face away from the Orbiter and look at the cosmos," he said. "I forgot; I was concentrating on watching the Orbiter."

McCandless is now deeply involved in preparing for another Shuttle flight, STS-31. Scheduled for December, the mission's primary objective will be to deploy Hubble Space Telescope.

NASA technician earns quality award

R.L. Clay, an electronic technician in the Power and Pyrotechnical Test Laboratory, has earned the second JSC Quality Partnership Award.

JSC Director Aaron Cohen presented the award to Clay on Wednesday. The award, established by the Safety, Reliability and Quality Assurance Office, is designed to recognize the quality-related contributions of a professional who does not work in the quality field.

Clay performs space flight hardware certification, qualification, pre-flight and post-flight testing, as well as development hardware testing. Much of the testing in Clay's area in Bldg. 352 is not standardized, and requires the technicians to design and build

test fixtures and equipment and help develop test procedures.

"Mr. Clay's attitude toward quality is most noticeable in his attention to detail," reads the nomination submitted by co-workers Phillip Corral and Randall Welch. Clay records not only the test data requested by the test manager, but also personal notes that he feels, from past experience, may have some future bearing on that an associated test program.

"R.L. also does not believe that being 'in the ballpark' is acceptable," the nomination reads. "For example, when selecting resistors or setting voltages or any other operation where a tolerance is called out, he strives to achieve the desired setting and 99 times out of a hundred gets it."

The next Partnership Award will be presented in April. Nominations should be sent to T.J. Adams, chief of the Quality Assurance and Engineering Division, Code ND.



Clay

Space News Roundup

The Roundup is an official publication of the National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Texas, and is published every Friday by the Public Affairs Office for all space center employees.

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