FOR SOFT LANDINGS–

Orbiter Landing Aids Shipped to DFRC

Cutler-Hammer's AIL Division Tuesday shipped the first ground based components of the Space Shuttle Microwave Scanning Beam Landing System (MSBLS). This equipment, in conjunction with other AIL components installed in the Shuttle Orbiter, will be used during the final approach and landing phase of every Shuttle mission to precisely guide the Shuttle to a safe landing on the runway.

Installation of the MSBLS ground based equipment will be made on a runway at NASA's Dryden Flight Research Center, California, where initial flight tests of the Space Shuttle Orbiter are scheduled to begin in mid-1977. At that time the Orbiter will be carried aloft to an altitude of about 25,000 feet atop a specially modified 747 aircraft and will then be released allowing the crew to fly the Orbiter to the ground.

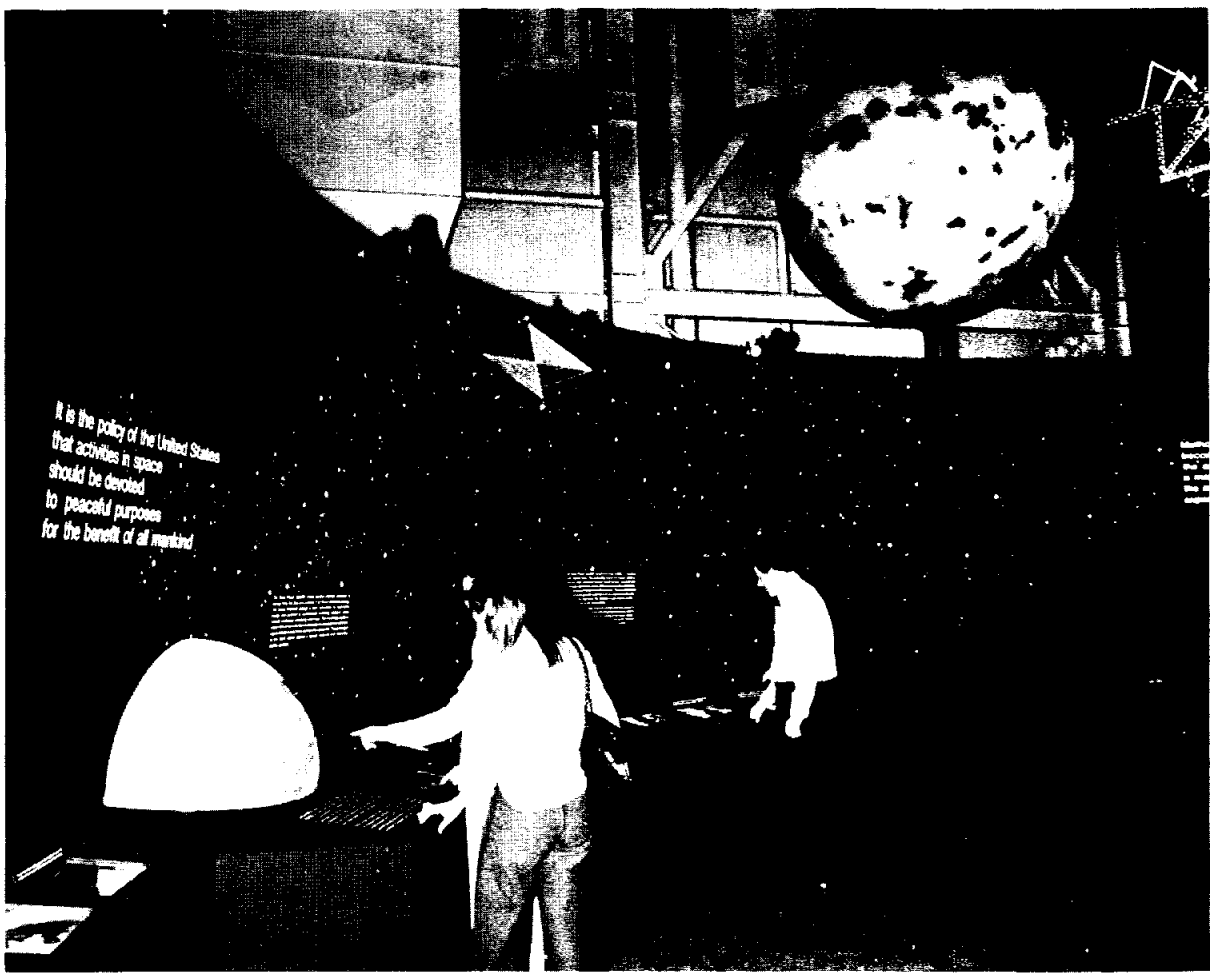
A second MSBLS will be installed on the newly constructed runway at the Kennedy Space Center where the initial orbital Space Shuttle missions are scheduled to begin in 1979. Both locations will be equipped for approach from either direction and each landing system will be fully redundant. A comprehensive monitoring system with automatic switchover is included in each installation, along with an uninterruptible power supply.

Electronic beams have been used to guide aircraft for almost a half century and have been used to provide what has been called landing guidance since World War II. The instrument landing system (ILS) that all airliners can use is an electronic beam that provides the pilot guidance along a straight line starting about five miles from the end of the runway and down to the point where his altitude is about 200 feet. From that point on, airline pilots generally see the runway and land the airplane. While a few of the most advanced airliners can use ILS guidance to fly the airplane by automatic pilot, few airports have the sophisticated ILS's required to allow the airplane to use electronic beams to actually guide all the way to a touchdown.

The Space Shuttle must descend in a glide that begins at a very steep angle that gradually moderates, or flares, to make the touchdown soft. To fly such a path precisely a computer is required to actually fly the aircraft through an automatic pilot. The computer must know precisely where the aircraft is at every instant throughout the landing. The standard ILS type electronic beam cannot do this. Consequently, a type of electronic beam created by a microwave scanning beam landing system (MSBLS) is required. This type of system, instead of providing just a single straight path for the aircraft to follow, provides a total field of positions throughout all the possible approach paths the aircraft can take.

The scanning beam feature of this system provides a flat, wide beam that sweeps across the landing sector. Pulses from the ground transmitter carry a code that identifies the exact angle at which the beam is pointing at each instant of its sweep. In the Space Shuttle a receiver picks up these pulses and decodes them to determine the track on which it is flying.

The computer aboard the Shuttle can, therefore, compare with great accuracy the exact location of the Shuttle with the desired location. If there is a discrepancy the flight path is corrected automatically. The MSBLS provides this positional guidance with a degree of accuracy never before available in a landing system.



BICENTENNIAL PREVIEW – A new circular walk-through exhibit on solar energy conversion is checked out in Bldg 9 before being crated for shipment to NASA Kennedy Space Center where the exhibit will become part of NASA's Bicentennial display in KSC's Visitor Information Center, Vehicle Assembly Building and in geodesic domes adjacent to the VAB.

ROUNDUP

NASA LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

VOL. 15 NO. 10 Friday, May 21, 1976

Curator Duke Takes Lunar Rocks To Space Exploration Essayist

The 465 students at South Charleston Junior High School, West Virginia, are in for an exceptional educational experience on May 27. On that Thursday the school will host JSC Lunar Sample Curator Dr. Michael Duke and lunar sample material collected during the Apollo explorations on the moon.

South Charleston Junior High students and educators will get a firsthand look at results of extensive analysis on the samples and an explanation from Duke of the moon's history, how the moon and the earth fit into the solar system, and opportunities to discuss the lunar and planetary exploration programs of NASA.

The junior high school was not selected by the agency for this program, rather a student from the school, 15-year-old David Simpson, was chosen as first prizewinner in an essay contest – the prize for which was Duke and the chance to view lunar material in the school.

The essay contest was sponsored by the secondary school magazine *Current Science* and asked students to answer the question "How Should the United States Continue Its Space Exploration Program?" *Current Science* is published by Xerox Education publications.

This will be the first time such a program has been scheduled at a secondary school. It will also be the first time lunar material has been used in a secondary school as part of an instructional program.

David's prize winning essay encouraged continued exploration of the solar system using unmanned probes. He said, "I believe that the United States should continue its efforts in space exploration largely through the use of unmanned probes...International cooperation would be an important factor in such an endeavor. Several nations contributing to a project would considerably reduce the expense for any one nation, and the combined technologies pave the way for larger and more ambitious projects...Such international cooperation would help promote world peace. And once world peace is established, a large portion of government funds could be turned over to space exploration, as a great deal of technology is derived from this field. Such technology could be put to use not only in the exploration of space, but also into other important (areas) such as disease, starvation, and ignorance. Thus, through the exploration of space, man can not only solve serious problems at home, but can learn more about the heavens which have intrigued him since the beginning of history."

The contest drew over 3,000 entries from students across the US and Canada. Contest rules and an article explaining the objectives of the essays were published in a Xerox magazine *Current Science* distributed to secondary schools. The winning essay was independently chosen from 20 semi-finalists by both Dr. Duke and editors of *Current Science*.

David Porterfield, vice-principal for South Charleston Junior High, said that the entire school was "excited" over the prospects of the presentation. "We've had visits from industry and other programs for the students in the past, but this will be a new experience for us. We're very excited about it," he said.

David Simpson, the essay winner, is also excited about the visit from Duke and felt that more programs of this nature would help explain some of NASA's scientific objectives to students. David said he plans a career in a science,

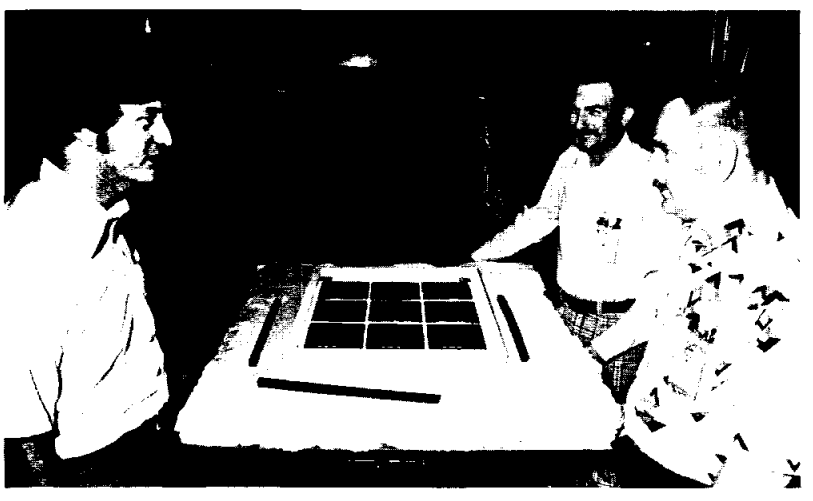
(Continued on page 4)

Orbiter Insulation Tiles Pass 100-Reentry Heat Chamber Tests

Materials which are planned for use as part of the Space Shuttle Orbiter heat-protection armor were recently subjected to the pressures and 2,300 degree F heat of 100 reentries with no damage, according to thermal specialists at JSC.

The Shuttle Orbiter which is designed for reuse up to 100 times without major refurbishment, will have four separate light-weight, reuseable heat-resistant materials affixed to the exterior of the 122-foot long space plane. The thermal protection system (TPS) which will provide heat management as the vehicle speeds into orbit and returns to earth, consists of coated reinforced carbon-carbon (RCC) for nose cap and wing leading edges where temperatures exceed 2,300 degrees F; high temperature reusable surface insulation (HRSI) for areas where maximum surface temperatures reach 1,200-2,300 degrees F; low-temperature reusable surface insulation (LRSI) for surface temperatures which reach 700-1,200 degrees F and flexible reusable surface insulation (FRSI), 3 by 4 sheets of Nomex fiber, for areas where temperatures will not exceed 700 degrees F.

(Continued on page 2)



HEAT PROTECTION ARMOR – NASA and Lockheed thermal engineers look over high temperature reusable insulation for Space Shuttle Orbiter which recently underwent heat and pressure tests simulating 100 reentry cycles. The test was designed to test a new glass coating which was baked onto the reusable tiles. Left to right are Robert Stuckey, subsystem manager for the reusable insulation of the Structures and Mechanics Division; O. J. Clevinger, Northrop Services test engineer; and Donald J. Tillian, of the Thermal Protection Branch of Structures and Mechanics Division. The nine test tiles are shown in front of the test chamber at JSC where the month-long tests were conducted.

CASH FOR IDEAS – This group of JSC employees shared $540 in suggestions and Tech Brief award money at an April 19 presentation ceremony. Award amounts and Suggestion or Tech Brief topics are as follows: Seated, left to right: Silvie Gaventa, $50, Suggestion-One-Page Schedule of Holidays, Paydays and Salary Rates; Kathryn Harvey, $50, Suggestion-Numbering of Floor Levels in Stair Wells; Elizabeth Sjoberg, $25, Suggestion-Procedure for Submitting Programs-Bldg 12; Mary Fosbrink, $35, Suggestion-Hand Railing at Steps; Standing: William Karpf, $25, Suggestion-Sign for Visitors; Dr. Frederick Dawn, $50, Tech Brief-Lightweight Ducts Fabricated from Reinforced Plastics and Elastomers (shared with Thomas J. Ballentine, not in photo); Lubert J. Leger, $50, Tech Brief-Method of Attaching Insulation Tiles; John L.C. Mire, $35, Suggestion-Ace Award Certificate; JSC Suggestion Committee Chairman Jack Kinzler; Douglas R. Cooke, $35, Suggestion-Acronym and Specialized Terminology Clarification; Don A. Nelson, $35, Suggestion-Fire Alarm Locator; Dr. George W. Hoffler, $50, Tech Brief-Computer Programs for Analysis of Vectorcardiograms; Not in photo: Oral R. Smithwick, $50, Suggestion-Freon Evaporation System.

Orbiter Tiles Pass Heat Tests

(Continued from page 1)

The HRSI tests completed one week ago at JSC, began in early April, and were supervised by NASA engineers. The test specimens were supplied by the Lockheed Missiles and Space Co. (LMSC), Sunnyvale, CA, which has the responsibility for developing the Orbiter (HRSI) thermal protection system. The test centered on the high temperature insulation materials which were coated with a new glass mixture developed by thermal specialists at the NASA Ames Research Center, Moffett Field, CA.

The insulation tiles were placed beneath a graphite heater in a test chamber in a thermal laboratory of JSC's Engineering and Development Directorate. Nine high temperature tiles were used in the test.

Each tile, nominally 6 by 6 inches, was sprayed with the glass mixture (silicon tetroboride additive with bora silicate glass) and then placed in the chamber and exposed to reentry temperatures of 2,300 degrees F. Pressure inside the chamber was also regulated to duplicate the variable pressures the Orbiter will undergo during the reentry phase of the Shuttle mission which begins at 400,000 feet altitude. The maximum reentry heat is experienced when the Orbiter reaches 200,000 feet altitude and is traveling at 12,000 miles per hour.

The test sequence, which lasted up to 30-minutes, was repeated during the month-long program to duplicate the 100 missions the Orbiter will execute before refurbishment and maintenance of the thermal protection system will be necessary. This is the first time that the high temperature tiles have gone beyond 60 test cycles in NASA thermal test facilities without showing some signs of degradation.

At the end of the 100th test and after inspection of the tiles, Robert Dotts, subsystem manager of the reusable surface insulation system for JSC said, "We now have a system (the tiles plus the new glass coating) which can fly 100 missions. We have a lot of confidence in the new development."

The high temperature tiles nominally vary in thickness from three-quarters of an inch to three inches. Approximately 25,000 of these tiles will be bonded to the Orbiter's aluminum exterior. They will cover portions of the upper and lower fuselage, or about 5,000 square feet of the vehicle's surface.

The HRSI is made of a low density, high purity silica (glass) fiber insulation which is made rigid with a silica binder. The new coating, reaction cured glass which is formed by mixing silicon tetroboride with boro silicate glass, is mixed with alcohol and sprayed on the tiles and then heated in an oven to a temperature of 2200 degrees F. This results in a black waterproof glassy covering capable of withstanding the 2300 degree heat of reentry.

The reaction cured glass was developed by NASA Ames research team headed by Howard Goldstein. This coating was introduced into the LMSC, Sunnyvale tile production facility in late 1975. LMSC fabricated the tiles and submitted them to JSC for the month-long test program.

More than 50 percent of the Shuttle Orbiter is covered with the low temperature reusable surface insulation (LRSI). Approximately 7,000 of these tiles nominally 8 x 8 inches square, will be applied to the upper wing and side fuselage. They are the same material as the high temperature tile except for the differences in coating and optical pigment used to obtain solar absorptance and high emittance.

The reinforced carbon-carbon insulation covers those parts of the Orbiter which will experience the highest heat load (in excess of 2300 degrees F) and it covers about 500 square feet, along the nose and leading edge of the wings. The carbon-carbon is an all-carbon composite made up from layers of graphite cloth.

Altogether the insulation materials (RCC, HRSI, LRSI and FRSI) weigh approximately 20,000 lbs. The Orbiter, which is 122 feet in length, weighs, without fuel and payload, 150,000 lbs at liftoff.

The successful completion of this NASA test program along with Lockheed's effort has lead to the implementation of the new RCG coating for the Orbiter HRSI thermal protection application.

INVENTION FOLLOWS NECESSITY – Invention award money totaling $775 was taken to the bank by these JSC employees April 19. From left to right are JSC Suggestion Committee Chairman Jack Kinzler; Arthur L. Schmitt, $125, Sun Angle Calculator; Director of Engineering and Development Maxime A. Faget, $100, Space Shuttle Vehicle and System; William A. Petynia and Willard M. Taub (and Faget) each $100 for Space Vehicle System; and Herbert S. Kobayashi, $250, Pulse Code Modulated Signal Synchronizer.

Luella Avery Picked April JSC Secretary

Luella R. Avery, secretary to E&D Experiment Systems Division chief Dean F. Grimm, was named April JSC Outstanding Secretary.

In nominating Avery for the award Grimm wrote, "Although the nature of her duties have become progressively more difficult and with more responsibility, she has made the transition with no difficulty. Her adaptability is one of her most notable characteristics.

"She has kept herself informed to the greatest degree possible, updating her knowledge of mission functions as needed so that her capability is always current... She is so well acquainted with our mission objectives that she can detect and correct administrative deficiencies at their source. This knowledge also permits her to weed out unrelated and unnecessary information, thus saving a tremendous amount of time for the staff.

"She has the superior ability of learning the desires and requirements of her supervisor and responding with immediate efficiency...and her positive and cheerful response to outside callers create a favorable impression to all with whom she has contact."

Mathews Sends Thanks to JSC

Retiring NASA Associate Administrator for Applications Charles W. Mathews sent the following message to JSC employees following a luncheon at the Center in his honor:

"Dear Friends at JSC:

"The surprise luncheon at the Gilruth Center was a real honor. More than that, it gave me a chance to see and talk to you, my friends and outstanding associates, of those wonder-filled years I spent in Houston. The gifts were great, too, and rest assured I'll make good use of the camping equipment. I want to thank each and every one of you and wish you all well.

Sincerely yours,
Charles W. Mathews."

Mathews, formerly Gemini Program Manager at JSC, retired at the end of February after 33 years federal service.

ROUNDUP

NASA LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

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

Editor: Terry White Photographer: A. "Pat" Patnesky

EAA ATTRACTIONS

TICKETS

On sale bldg. 11 - 10 am to 2 pm.

Windmill Dinner Theatre, $14 couple May 25 thru June7; Dwayne Hickman - In *"Natalie Needs a Nightie"*. Dean Goss, $16 couple May 18th thru June *"Night Watch"* a mystery. ABC Interstate Theatre - $1.50.

Tickets are on sale now for SeaArama $3.25 adults and $2.25 children. Free Disney Magic Kingdom cards. Houston Astros gift coupons, $4 boxseats and $3.15 reserve seats.

Six Flags Fun Seekers Club cards, good for $1 off each Astroworld and Six Flags Over Texas ticket, are now available. The FSC cards are also good for a 10-percent discount at hotels listed in the club guide and for family vacation packages. See your EAA rep for free Fun Seekers cards.

JSC Tennis Club 1976 Memorial Day Tennis Tournament

To be held May 29 – 31 at JSC, CCHS, and CLHS

There will be four events:
- Championship Singles
- Men's Singles
- Women's Singles
- Mixed Doubles

No one is allowed to enter more than one singles event and one doubles event.

Singles will be played on Saturday and Sunday, Mixed Doubles on Sunday and Monday.

You must be a member of the JSC Tennis Club.

For further information on membership or participation in the Memorial Day Tournament, contact Carolyn Thompson, ext. 4551 or Jim Walker, ext. 2541. Entry deadline is COB Tuesday, May 25.

JSC TENNIS CLUB
TOURNAMENT SCHEDULE-1976

DATE	TOURNAMENT	EVENTS
May 29, 30, 31	Memorial Day	Singles, Mixed Doubles
June 19, 20	Summer Doubles	Men's & Women's Doubles
July 17, 18	Firecracker	Singles
Sept. 4, 5	Bobby Riggs	Singles and Doubles
Oct 9, 10	Fall Tournament	Singles, Doubles
Nov. 20-21	Turkey Tourney	Handicap Doubles

All dates subject to change by the tournament committee.

JOINT SUPER BOSSES – JSC West Coast Procurement Office chief Charles M. Page and assistant Richard E. McGrath recently shared a joint "Boss of the Year" award from the Santa Monica Chapter of the American Business Women's Association annual dinner meeting. They were nominated for the award by secretary Cora Fiscus. The office is part of JSC's outpost at Rockwell International's Space Division plant at Downey, California.

Olympic Game Tickets, Rooms Become Scarce

Tickets and hotel rooms are becoming scarce for the Summer Olympic Games in Montreal in July. The American Consulate General in Montreal advises that tickets and accomodations assistance will not be available from the Consulate or from the American Embassy in Ottawa.

"Residual tickets for events at the Olympic Games have now been recalled from other countries for direct sale by the organizing committee," said the advisory. "Few if any tickets are available for final events, but the committee says there are blocks available for field hockey, soccer, track and field, equestrian, canoeing, judo, handball, archery, shooting, modern pentathalon, some preliminaries in boxing and basketball and perhaps a few gymnastic events.

"Additionally, the Games Housing Authority has reported a substantial number of room reservation cancellations recently by travel agents who have evidently been over-optimistic in their projections of ticket/rooms package sales, and it is possible that even better seats and rooms may be available from such a source."

If travel agencies have no tickets, write the Olympic Organizing Committee, 388 St. James Street, West, Montreal, PQ, Canada. For rooms, write Mr. Blair F. Armitage, Chef de Service Invitees Speciaux, 201 E. Rue Cremazie, Montreal, PQ, Canada.

PanAm, JSC Negotiate

Pan American World Airways, Inc., Aerospace Services Division, Cocoa Beach, FL, has been selected for negotiation leading to award of a contract for engineering support services at JSC.

Pan American will be responsible for providing engineering design support for facilities and test programs at JSC.

The contract will be a cost-plus-award-fee type contract and is to be awarded for a 1-year period beginning June 1, 1976, and ending on May 30, 1977. The contractor will employ approximately 69 persons and the amount of the contract is expected to be approximately $1.15 million.

AIAA Holds Aerodynamics Update Course

The AIAA Houston Section will hold a technical refresher course on high-speed aerodynamics May 24, 25 and 26 and June 2 and 3 from 4:30 to 6 pm in Bldg 13 Rm 108.

Covering aspects of general flow considerations, shock wave formation and geometry considerations, course lecturers will be Dr. John Bertin of the University of Texas and Dr. Winston Goodrich of JSC Structures and Mechanics Division.

Course fees are $20 for AIAA Members and $25 for nonmembers. Lecture notes will be handed out at the first class. For reservations call Ernie Hillje at 2048 or John Sunkel at 5273.

JSC Extends Serv-Air Pact

JSC has awarded an eight-month extension to an existing contract to Serv-Air, Inc., Division of E-Systems, Inc. for continuation of maintenance and modification of aircraft assigned to JSC.

The eight-month extension of the cost-plus-award-fee-contract was for $3.04 million and brings the total estimated contract value to $12.61 million.

The aircraft involved are earth resources survey aircraft and air proficiency training craft flown by astronauts. The contract covers ground support in addition to engineering, design, fabrication and installation of electronic and mechanical systems and related logistic functions.

Elliott Named Indian Engineer Board Member

Jerry Elliott of the JSC Space Shuttle GFE Project Office was named to the board of directors of the National Society of American Indian Engineers at the Society's April 15 incorporation meeting. Elliott is a member of the Osage tribe.

The NSAIE was formed with the goal of increasing the number of Indian engineers through supporting and improving education programs and opportunities. It is estimated that there are less than 1500 Indian engineers in the nation – about one tenth of one percent of all US engineers.

Indian engineers interested in joining NSAIE should write to George Thomas, Director of Indian Programs, Oklahoma University College of Engineering, 202 West Boyd Street, Norman, OK 73109.

Metro Gets JSC Contract For Logistics

Metro Contract Services, Inc. of Houston has been awarded a $1.3 million contract to furnish logistic support at JSC.

Metro, which will employ approximately 123 persons on the contract, will be responsible for management and operation of JSC's logistics support services which include transportation services, packing and shipping, identification and cataloging, and receipt and inspection of property. Metro will also be responsible for warehouse operation, operation of a temporary storage program, and logistics plans and analysis.

The contract, which is a cost-plus-fee-award, became effective on May 1, 1976, and will run through April 30, 1977.

Roundup Swap-Shop

Swap Shop advertising is open to JSC federal and on-site contractor employees. Goods or services must be offered as advertised, without regard to race, religion, sex or national origin. Non-commercial personal ads should be 20 words or less, and include home telephone number. Typed or scribbled ad copy must be received by AP3/Roundup by Thursday of the week prior to publication.

BOATS

18-ft Sigma fiberglass open-bow deep-V cathedral hull, ideal ski/family boat, 130-hp Chrysler, trlr, skis, dual 15-gal fuel tanks, $3600. Rees, 534-4929.

73 Spyder 16-ft fish/ski boat, tri-hull, 6 lounge seats, 45-hp Chrysler, trlr, $1875. 482-7029.

VEHICLES

74 Suzuki GT250, less than 1000 miles, $600 firm. 554-6168 after 6.

73 Plym Fury sta wgn, air, radio, 3 seats, auto, xlnt cond. Avila, 485-9532.

74 Kawasaki 350, xlnt cond, $495. 488-8507.

72 Honda 350, 7000 miles, $550. 471-4080.

74 Honda Trail 90 and 74 Yamaha Enduro 125, both with less than 800 miles, like new, $450. Lindsey, 488-0517.

67 Dodge Dart 2-dr hrdtp, air, needs work, $200 or best offer. Charlie, 729-3698 after 6.

73 Pontiac Catalina white/maroon 4-dr hrdtp, xlnt cond, one-owner family car. Lamb, 781-1840 after 6.

66 Chevy pickup, all pwr, auto, camper shell, xlnt cond, $695. Stephens, 481-0095.

64 MGB white, one-owner car, many xtras, $900. Samouce, 488-0406.

73 Ford Ranchero truck, pwr, air, radio, $1975. 482-7029.

73 VW Superbeetle, orange, air, radio, good tires, xlnt cont, $2195. Kuehn, 668-5500.

73 Honda CL350, 3000 miles, like new, lug rack, backrest, $625. 482-5607.

70 Pontiac Catalina 4-dr, auto, air, pwr, new tires, $950. Piland, 474-3559.

72 Olds Cutlass Supreme cnvrtbl, end of an era, loaded, $2600. Allgeier, 474-3961.

72 Travel Trailer 20-ft, air, sleeps 6, fully self-cont, $3200. Smith, 482-0668.

74 Pinto Runabout, std shift, AM/FM stereo tape in dash, new radials, good cond, $2000. 488-5010 after 6.

73 Maverick 4-dr, 38,000 miles, 302 V8, auto, air, pwr steer, vinyl top, xlnt, $2200. Harris, 944-2131 after 6.

Rent motorhome $125/week plus 6 cent/mile (incl ins), daily rates avail. 471-5161 after 6.

Rent Jayco hrdtop fldwn camper, kitchen, icebox, sleeps 8, low profile, pulls easy, $10/day, $57/week ($25 minimum), $25 reserves. Kilbourn, 482-7879.

73 Volvo 4-dr 4-spd, 25 mpg, xlnt cond, $500 under list. 487-0942.

69 VW, orig owner, 69,350 miles, radio, air, good tires, new brakes, runs well, $825. 474-4790 after 5.

PETS

Free pups and mother, frisky and beautiful, 2 males, 2 females, mother is Terrier/Chihuahua, father must have been fantastic, see to believe. 333-4362.

Male Golden Retriever pup, housebroken, reasonable. Elena 437-8307 or Bob, 334-3478.

WANTED

Young couple wants to rent house w/yard, duplex or garage apt in Houston. Barnes, 483-3466.

Set of recent used Childcraft encyclopedias, must be in good cond. 333-3090.

72 or 73 economy sta wgn — Colt, Datsun, Toyota or Pinto. Stephens, 481-0095.

PROPERTY & RENTALS

Luxury 2-bdr apt in By-the-Sea Condominium at Galveston West Beach, air, carpeted, color TV, kitchen, fully equip, wkly rental. Clements, 474-2622.

2 hvly-wooded acres Stagecoach Farms NW Houston in Montgomery County, 2 spring-fed lakes in walk dist, pvt park. Arnim, 483-2074.

Lease avail July 1: 3-2-2 brick Colonial in Fairmont Park, central air, dshwshr, fenced, pool prvlgs avail, $250/mo, 1st and last month rent reqd plus damage deposit; prefer deposit and 6-mos lease w/option to buy in Jan 77, can then reduce rent during 6-mos lease period. 471-3762.

85x140-ft wooded lot on cul-de-sac in Sect 1 River Plantation Golf and Country Club, lot in Shiloh Park. 643-1611.

Wooded waterview lot Point Lookout, Lake Livingston, 75x137, utilities, restrictions, pvt campgrnd, $3295. 946-7587.

Nice lot on water, Bay Haven-Lake Livingston, 100-ft frntg, 95-ft deep, all utilities, hrdtp roads, $5000. Sauers, 333-2394.

HOUSEHOLD ARTICLES

Coldspot frostless upright freezer 17 cu ft, holds 600 lbs, like new, $185. 482-7029.

Upright piano, needs repair, $100. 332-5553.

Honeywell electronic air filter (installs in return-air grill) 2000 cfm capacity, like new, cost $315, sell $200. Avila, 485-9532.

Walnut/black bar w/2 stools, $50; brass stereo table, $25. 482-6550 after 6.

Early American wingback sofa, green/brown/orange tweed. 946-1869.

MISCELLANEOUS

16-channel Tennelec programmable scanner VHF/UHF, fully guaranteed, in warranty, used five hrs, $275. Lindsey, 488-0517.

UV water sterilizer for frsh or salt water aquarium, like new, $25. 487-2554.

Bay Area Singles Club get-acquainted dance tonight (May 21) at Balboa Apts party room on Upper Bay Road, Nassau Bay. Info from Ray or Jim at 2815.

Complete color/B&W darkroom equipment: Chromega B8 enlarger w/80mm Componon lens, voltage stabilizer, enlarging meter, timer, Kodak K-11 color processor; standard, borderless and multi-print easels, other necessary lab items; new value more than $1700, sell $800. McCreary, 483-4202 or 946-5285.

2 C78x14, 2 E78x14 new tires, $20 each. Cunningham, 474-4313 after 5.

Alter men's and women's clothing: length, waist, zippers, buttonholes, belts, hems, pantsuits, blouses, coats, repairs, anything. Allmond, 946-5459.

Paint easy professional way: rent 1-hp spray compressor w/3-gal tank and 25-ft material/air hose. 334-1138.

One new Goodyear J78-15 polyglas belted tire, $20; one new Shell 5.60x15 4-ply nylon, $10. Payne, 485-3821.

74 World Book Encyclopedia, delux edition, incl yearbooks, xlnt cond, $190. Kilbourn, 482-7879.

FOUND

Topaz ring in Gilruth Rec Center ladies locker room May 4 pm. Call Carolyn at 2181 and identify.

Found onsite: black/tan mixed small female dog. Andrea or Judy, 483-4441.

Aviation Study Looks Into Next Century, Stresses NASA First 'A'

By the year 2000, passenger air travel may offer advanced rotorcraft capable of quiet, vertical takeoff and landing (VTOL) aircraft from small, convenient urban center airports.

Or, one might board an environmentally acceptable supersonic or hypersonic transport for an intercontinental hop in a truly global air transportation system.

These and other scenarios are projected as possible long-term directions and opportunities in civil aviation by a NASA study called *Outlook for Aeronautics* published recently by the agency.

As the nation's primary aeronautical research and technology agency, NASA conducted the study to determine probable directions of civil and military aviation, the role that NASA should play in research and development and the technical advances that may be needed.

Conducted during a period when the aeronautical industry is experiencing economic setbacks and environmental pressures, the study indicated that relatively few major new developments can be expected through the early 1980s. But it determined that new opportunities will exist for needed advances in aviation in the 1985-2000 period if adequate research and technology investments are made over the next decade.

Future demand for air passenger transportation is expected to grow from the current level of 250 million to approximately 1 billion passengers annually by the year 2000. At this rate of growth, air traffic will exceed the capacity of the current airport system by the late 1980s.

Congestion of major hub airports will give impetus to the introduction of short haul aircraft that can use smaller regional airports. Aircraft developments foreseen include quiet, efficient transports capable of operation from shorter runways, followed by intercity VTOL and rotorcraft transports in the 1980s.

Increasing costs of air transportation will drive new developments in subsonic aircraft toward greater efficiency and economy while improving safety. Aircraft developments predicted for the 1980s include improvements to present models and new subsonic transports, and improved general aviation aircraft.

The introduction of supersonic transports into service will require increased US technology efforts to maintain US leadership in civil aviation and to preserve the US option for competing in world markets for supersonic aircraft. It is clear that any new subsonic aircraft must have improved fuel efficiency and prove environmentally acceptable to be an approved element in the air transportation system of the future.

In military aviation, the US will need to develop long endurance and very long range subsonic aircraft to maintain a worldwide logistics capability.

These airplanes will allow ocean surveillance from the US and permit US based forces to be deployed without the use of intermediate refueling sites.

Reductions in the number of permanent overseas bases used as logistics and staging areas will require development of multimission rotorcraft and VTOL aircraft for naval and limited land-based operations.

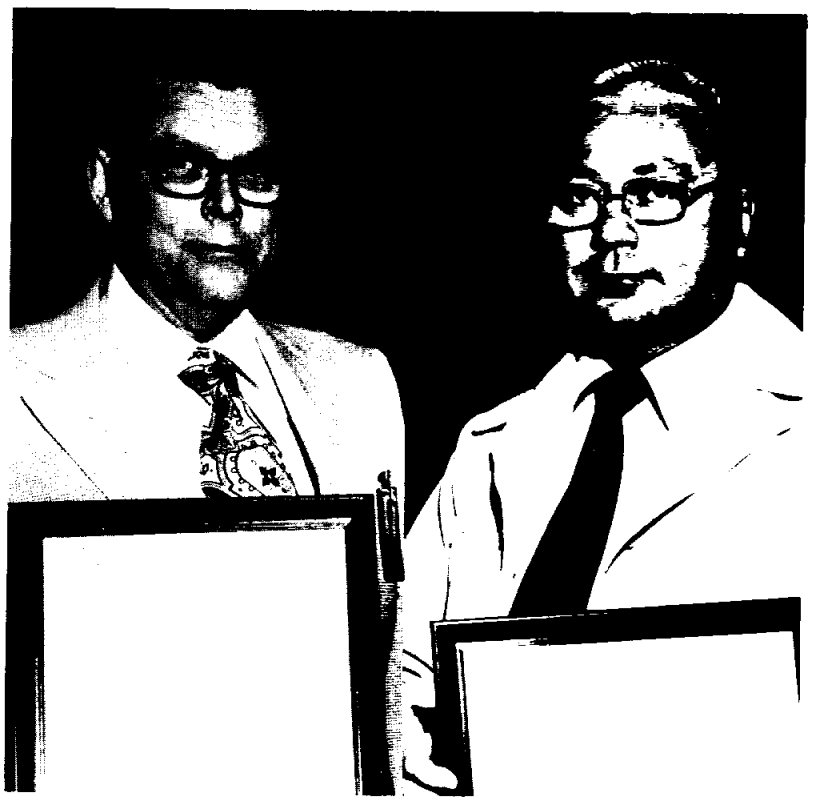
The high cost of weapons systems will force introduction of more effective tactical weapons systems, lower cost fighter aircraft, the use of lasers for improved communication and fire control, and the widespread use of remotely piloted vehicles.

Perhaps the report's most far reaching expectation from aeronautical technology is the evolution of a truly global air transportation system. The use of environmentally acceptable long range supersonic aircraft, allowing intercontinental flight over distances of 9,600 to 12,800 kilometers (6,000 to 8,000 miles) within a flight time of four hours, would stimulate world trade and communication. If environmental considerations prohibit use of convenient airport sites, airports for supersonic, and ultimately, hypersonic aircraft could be located on offshore man-made islands.

Large scale movement of goods by air is also seen as a significant outgrowth of air transportation. With reduced transfer time and accessibility to remote areas, air cargo facilities may have many different uses in the future. Large scale shipment of livestock, transportation of major quantities of agricultural nutrients and large scale disaster relief may become possible.

Aeronautics has been intimately related to US economic progress and military defense during aviation's short history. Its importance is not likely to diminish in the next 25 years. But the degree to which aviation can continue to contribute to the national well-being will depend on further investments in research and development by private industry and government, the *Outlook for Aeronautics* report said.

To insure future progress in aviation and to realize its benefits to the US economy and defense, a new generation of aeronautical technology must be created within the next decade. NASA has an essential part to play in the creation of this technology. Its primary role is to provide a firm technical basis for future developments in civil and military aviation, the *Outlook for Aeronautics* study concluded.



PRESIDENTIAL RECOGNITION – A first-year combined savings to JSC of $218,500 resulted from suggestions by S. Harry Berlocher, left, and R. Dean Bratton. Framed letters from President Gerald Ford recently were awarded the two as part of the President's program to foster government cost reductions beyond regular job requirements. Bratton of the JSC Earth Observations Division developed a technique for microfilm duplication of color imagery for a FY74 savings of $196,000 in earth resources aircraft photography processing. Berlocher's suggestion for reclaiming Center airconditioning condensate water for reuse netted an annual savings of $22,500.

Johnston Appointed To Mathews Vacancy

Bradford Johnston has been named NASA's Associate Administrator for Applications effective June 7, 1976.

Johnston is presently engaged in private management consulting in Milwaukee, Wis.

As Associate Administrator for the Office of Applications, Johnston is responsibly for planning and directing the agency's program to identify and demonstrate engineering and science techniques which will benefit users of data returned to Earth. Such work includes NASA efforts in developing advanced meteorological, Earth resources and communications spacecraft.

Johnston succeeds Charles W. Mathews who retired from the post Feb. 27, 1976.

He was born in Indianapolis, Ind., in 1929 and received his BA degree in economics from Wabash College in 1952 and the MBA degree from Harvard Business School in 1964. His career includes sales, marketing and management consulting with the Link-Belt Co. and the Johnston Container, Annandale and Congoleum corporations.

Mr. and Mrs. Johnston and their three sons presently reside in Milwaukee.

Weitz Retires, Goes Civilian

Astronaut Paul J. Weitz, Captain US Navy, will retire from military service on June 1, 1976, and remain with NASA as a civilian in his present job.

Retiring after 22 years US Navy service, Weitz is one of the 19 astronauts selected by NASA in April 1966. He is currently working on payloads and flight crew documentation for the Space Shuttle program.

Weitz was pilot on Skylab 2, the first manned mission, a 28-day flight from May 25-June 22, 1973. Accompanied by Charles Conrad, Jr., spacecraft commander and Dr. Joseph P. Kerwin, science pilot, the three crewmen were able to save the Skylab by erecting a "parasol" shade alleviating a thermal problem caused by the loss of the micrometeoroid shield during Skylab 1 launch.

They were also able to deploy a jammed solar power wing to assure sufficient electrical power to successfully conduct their mission and two follow-on missions of 59 and 84 days respectively.

Faget Receives IEEE Award

JSC Director of Engineering and Development Maxime A. Faget yesterday received the Institute of Electrical and Electronics Engineers, Inc. 1976 Harry Diamond Award at the IEEE National Aerospace & Electronics Conference in Dayton, Ohio.

Presented at a Conference board of directors luncheon, the Diamond Award "for contributions to the design and development of Gemini, Apollo and Space Shuttle manned spacecraft" included a $2000 honorarium.

Two Centers Test SRB 'Chutes

Officials of NASA Dryden Flight Research Center and Marshall Space Flight Center last week signed a memorandum of understanding covering the Space Shuttle Solid Rocket Booster parachute system test program.

The 120-ft diameter parachutes are the largest ever used in the space program; the Apollo command module main parachutes were 80 feet in diameter.

DFRC will provide the aircraft and flight crews for dummy booster drop tests over the National Parachute Test Range one hour's flight time from DFRC. MSFC manages booster development.

Dietlein Gets USPHS Award

JSC Acting Director of Life Science Dr. Lawrence F. Dietlein, Jr. May 14 was awarded the US Public Health Service Meritorious Service Medal in Washington ceremonies.

Essayist

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although he is not sure which field at the moment.

Duke's presentation will take special note of the rapid development of the space agency's interplanetary explorations, which to date have ranged to Jupiter and beyond and which this July will include a Viking biological package landing on Mars, the Red Planet.

Duke and his curatorial staff believe there are broad opportunities for presentations of this nature. Duke considers the South Charleston Junior High visit a prototype program and feels programs of this nature are needed in the secondary schools across the nation.

Presently the curatorial staff has educational packages available for college- level instruction. The packages use thin-section microscope slides of lunar material and a suggested course outline for use of the slides in petrology classes.

NASA Opens SimCom Pact Negotiations

NASA has selected the McDonnell Douglas Corp., Technical Services Co., Inc., St. Louis, Mo., and the Singer Co., Simulations Products Div., Binghamton, N.Y., for parallel negotiations leading to the award of a contract with one of the companies for maintenance, modification and operational support of the JSC simulator training complex. These simulators will be used for flight crew training for the Space Shuttle program.

The training complex will initially consist of the Shuttle Procedures Simulator (SPS) and the Crew Procedures Evaluation Simulator (CPES). The Orbiter Aeroflight Simulator (OAS) will be added to the training complex early in the contract period followed by the Shuttle Mission Simulator (SMS).

The initial two-year contract period will date from July 1, 1976, and the contract will provide for two additional optional performance periods of 24 months and six months, respectively.

The work to be performed includes systems and hardware engineering, software development, drafting and illustration, configuration control, installation and testing of modifications to update simulation equipment to configurations compatible with NASA requirements. Also required is the maintenance, servicing and operational support of the equipment, plus other miscellaneous tasks such as documentation and logistics support.

The Management and Technical Services Co., General Electric, Daytona Beach, Fla., and Computer Sciences Corp., Applied Technology Div., Falls Church, Va., also submitted proposals.