



CLAUSTROPHOBES NEED NOT APPLY — Any time a cable harness, connector or other component has to be installed in the remote recesses of Space Shuttle Orbiter 101, petite Bobbie Welder is called upon to crawl into access ports on the vehicle to work in tight places. The Rockwell International electronic assembler, inside 101's vertical tail, is assisted by Bob Stevenson, on workstand below, at R1's Orbiter assembly plant in Palmdale, California.

Johnston Leaves JSC To Join Bunker Ramo

JSC Director of Life Sciences Richard S. Johnston will leave NASA to join the Bunker Ramo Corporation, Oak Brook, Illinois, as special assistant to the president effective January 1, 1976.



"My decision to leave NASA was probably the most difficult decision I've had to make in my life," said Johnston who spent 16 of his 29 years government service with NASA.

"My years with NASA were certainly my most rewarding of my life and I leave with many regrets, accompanied by high expectations for this new phase of my career. I had this opportunity to go into the business world, and I am at the age where if I am going to make such a move, I'd better do it. I look back with special pride toward my part in developing the bright, young people who will be the future leaders of the space program."

Bunker Ramo Corporation is an international manufacturer of electronic components, information systems and knitted deep-pile fabrics. Former Johnson Space Center deputy director George S. Trimble is Bunker Ramo president.

Johnston, 49, began his 29-year federal service career in 1946 when he joined the US Naval Research Laboratory, in Washington, D.C. where he was a research chemist involved in developing chemical oxygen sources for breathing systems. He also worked in evaluation

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Family Affair Yule Project Starts Monday

The Family Affair Christmas Project (formerly the Black Christmas Project) officials have announced that their annual fundraising campaign to assist needy families will begin December 8.

Julius Mayhorn, Project Chairman, says, "This year's goal is \$3000."

Confidence was expressed by Mayhorn concerning the up-coming campaign. "I believe that the response from the JSC and contractor employees will allow us to reach our goal again this year."

The number of families that the group has been able to assist has steadily increased, on the average of 20 per year since the project was started in 1971. During that year, a goal of \$500 was set and food and toys were provided for 22 families. Last year the group raised \$2500 and was able to help 80 needy families. They plan to aid 100 families this Yuletide season.

Families are selected from a number of sources. These sources include the Harris County Community Action Association (HCCAA), JSC and contractor personnel, and other charitable organizations. This year, in addition to the above sources, Channel 13 was contacted and several families were selected from Marvin Zindler's survey, "The Welfare Myth."

Although the group's primary objective is to assist low-income families during the Christmas

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FAREWELL MEMENTO — ASTP Technical Director for the US Glynn S. Lunney, left, presents his Soviet counterpart Prof. Konstantin Bushuyev a framed group of mission photos and crew patch at a November 20 farewell dinner at the Landmark restaurant, Watergate Marina. The two project directors and their working groups had completed the ASTP final mission report. Mrs. Lunney is seated between her husband and the Professor.

ASTP Groups Complete Final Program Report

ASTP working groups for the US and the Soviet Union crossed the last t and dotted the last i November 20 in the Apollo-Soyuz final mission report after a two-week joint session at JSC.

US Technical Director Glynn S. Lunney, speaking at a press conference in the JSC News Center, said, "The results have come in and the studies show that we really didn't have any problems with any of the standard space flight equipment

that we were using, and the special equipment that we designed for the flight performed in excellent fashion."

"All of us are very pleased with the results of this flight. Personally and professionally it has been a real pleasure to have been able to work on a project like this and to work with the men from the Soviet Union."

Lunney's Soviet counterpart Prof. Konstantin Bushuyev told newpersons that "we quickly learned to understand each other and we did find the compromise and tradeoffs in most complicated problems. Only in such an atmosphere of friendliness and mutual understanding could we solve all the problems."

"This mission gave us broad scientific results," continued Bushuyev, "and we gained a lot of experience for future international missions. This flight was also very important for mutual understanding between our nations and confirms that international cooperation is possible and advisable. The people of our country realize that this is probably the prime achievement of the mission."

Bushuyev later amplified his statement during the question-and-answer portion of the press conference: "My opinion is that the most important achievement was made in the technical and scientific field, but for the public docking and all these technical matters are not as important as the evidence that two great nations can cooperate successfully."

Professor Bushuyev was guest of honor at a farewell dinner November 20 at the Landmark restaurant, Watergate Marine the evening following the press conference. (See photo above)

JSC Experiment Arrives in Moscow For Launch Aboard Kosmos Satellite

Four U.S. biological experiments including one from JSC were carried into orbit November 25 aboard Kosmos 782 as part of a Soviet biological satellite payload. The satellite will remain in orbit 22 days.

Dr. William H. Scheld of the JSC Health Services Division Biology Branch last week arrived in Moscow hand-carrying a JSC self-contained fish egg experiment package for loading aboard a Soviet Kosmos biological satellite. Scheld was joined at the USSR Institute for Biomedical Problems by Dr. John Tremor of NASA Ames Research Center who delivered three Ames experiments for the satellite.

"This flight provides an excellent opportunity to continue basic experiments on the effect of zero gravity on living organisms," says Dr. Richard C. Simmonds, the Ames project manager.

If it were not for the Soviet flight opportunity, U.S. biology payloads and weightlessness experiments would have to await flights of the Space Shuttle in the 1980s. The last US biological research spacecraft to be launched was Biosatellite 3 in 1969.

In addition to the four US experiments, American scientists will carry out seven specific investigations using bone and tissue specimens from rats and fruit flies which Soviet investigators are flying on the Kosmos spacecraft.

After recovery of the Soviet spacecraft, about 22 days after launch, Dr. Simmonds, Dr. David Feller and Dr. Delbert Philpott of Ames Center will return the ex-

(Continued on page 2)



EHH, WHAT'S UP, DOC? — Carrots, or at least carrot-cell cultures, will be up for 22 days aboard a Soviet Kosmos biological satellite as part of four US experiments in the Kosmos payload. US Project Manager Dr. Richard Simmonds of NASA Ames Research Center, formerly with the JSC Health Services Division, is shown with an engineering model of the self-contained experiment canister similar to the canister carrying JSC experimenter Dr. William Scheld's fish-egg experiment on Kosmos. The carrots, incidentally, were uprooted at a Fort Collins, Colorado truck farm.



NEW EAA BOARD FOR '76 — Newly-elected members of the JSC Employee Activities Association Executive Board will take office January 1. Seated, left to right, are: Donna Tarpey, vice president-youth activities; Ursula Nuechtern, secretary; Geraldine Taylor, vice president-organized clubs; Rachel Windham, vice president-publicity and promotion; Frances Barbee, executive vice president; Glenda Lancon, vice president-social activities; Kathy Spencer, retiring vice president-social activities. Standing: Jerry Jones, vice president-facilities; Jim McBride, president; Loreta Bradley, retiring treasurer; Bill Forsyth, retiring executive vice president; Stan Weiss, treasurer; and Jack Boykin, vice president-athletics.

Johnston To Join Bunker Ramo

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of submarine air purification systems while at the Laboratory.

In 1955 Johnston joined the US Navy Bureau of Aeronautics (BuAer) where he worked on development of liquid oxygen breathing systems for aircraft and low-altitude aircraft escape systems.

Transferring in 1959 to the NASA Space Task Group at Langley Field, Virginia, Johnston began NASA service as an environmental control system project engineer on Project Mercury, later becoming chief of the Manned Spacecraft Center (now Johnson

Space Center) Crew Systems Division. He was responsible for the Division's work in spacecraft environmental control systems, spacesuits, waste management systems, space food systems and other aspects of spaceflight life support.

In 1968, Johnston was named special assistant to the JSC director and was responsible for technical operations at the Center, including managing the Apollo Lunar Quarantine Program and preparation and operation of the Lunar Receiving Laboratory. Additionally, he was appointed manager of the Apollo

Lunar Experiments Program responsible for development of lunar orbit and lunar surface experiments flown in the Apollo Program.

Johnston was appointed deputy director of JSC Medical Research and Operations in 1970, and became Director of Life Sciences in 1972 — the post he held until retiring to join the Bunker Ramo Corporation.

As JSC Director of Life Sciences, Johnston managed the overall flight crew medical program, development of life sciences experiments to be flown on Apollo, Skylab and Apollo-Soyuz Test Project, and the future international Spacelab to be flown as a Space Shuttle payload early in the 1980s. Johnston also was responsible for overseeing applications of space medical technology to earth-bound uses.

Among Johnston's honors and awards during his 29 years of government service are the American Astronautical Society's Victor A. Prather Award for outstanding development of extravehicular protection in space; the NASA Distinguished Service Medal, NASA Exceptional Service Medal, NASA Superior Achievement Award, the Presidential Medal of Freedom, and the American Institute of Aeronautics and Astronautics John Jeffries Award for outstanding contributions to the advancement of aerospace medical research through development of life support systems for manned space flight.

Johnston is a member of the American Institute of Astronautics and Aeronautics, the Aerospace Medical Association and in 1973 was elected a Fellow of the American Astronautical Society.

Johnston is a native of Keyser, West Virginia, and received a BS degree in chemistry from the University of Maryland. He is married to the former Jean Armbruster. They have two children: Susan J. and Richard A.

JSC Experiment on Kosmos

(Continued from page 1)

periments from Moscow to Ames. From Ames, the separate experiments and specimens will be routed to scientists at five universities, Ames Center, JSC, and two Veterans Administration hospitals.

Preliminary results of the US experiments will be available about 90 days after spacecraft recovery.

U.S. scientists conducting the flight experiments are Drs. R. Baker and S. Kleinschuster of Colorado State University (Carrot Tumor Growth Experiment); Drs. F. C. Steward and A. Krikorian of the State University of New York at Stony Brook (Carrot Cell Culture Experiment); Dr. E. V. Benton of the University of San Francisco (Heavy Particle Radiation Experiment); and Scheld at JSC, *Fundulus Heteroclitus* Embryogenesis (Fish Egg Experiment).

Scientists concerned with work on organic tissue furnished by the USSR are Dr. Joan Vernikos-Danellis of Ames and Dr. J. D. Barchas of Stanford University (Effect of Space Flight on Gastric Ulceration); Dr. Adrian D. Mandel of Ames and Dr. E. Balish of the University of Wisconsin (Effect of Space Flight on Cell-Mediated Immunity); Dr. Henry A. Leon of Ames and Dr. S. A. Landaw of the Syracuse, N.Y., VA Hospital (Effect of Space Flight on Random Hemolysis and Mean Life Span of Red Blood Cells); Drs. Stanley Ellis,

Richard E. Grindeland and Lanny C. Keil of Ames (Effects of Space Flight on the Hormonal Content of the Pituitary Gland); Dr. Emily M. Holton of Ames and Dr. D. Baylink of the VA Hospital in Seattle (Quantitative Analysis of Selected Bone Parameters); Drs. Delbert E. Philpott and G. Harrison of Ames (Examination of Rat Eyes to Determine Effects of High Energy Particle Radiation on the Retina), and Drs. J. Miquel and Philpott of Ames (Effects of Weightlessness on the Embryonic Development and Aging of *Drosophila*).

Ames manages the project for NASA's Office of Space Science in Washington, D.C. Dr. Tremor is Project Scientist (Experiments) and Dr. Feller is Project Scientist (Investigations). The work is performed by the Ames Life Sciences Directorate under Dr. Harold P. Klein, Director, and Dr. Joseph Sharp, Deputy Director. The program manager at NASA Headquarters is Lawrence Chambers.

Naugle Named Associate Administrator

Dr. John E. Naugle November 23 was appointed NASA Associate Administrator — a post in which he had been acting since April 1975 with the departure of Rocco A. Petrone.

As associate administrator, Naugle has line authority over major portions of NASA R&D planning and management in the offices of Applications, Aeronautics and Space Technology, Space Sciences, and Tracking and Data Acquisition. Except for the Office of Space Flight, which reports to the Administrator, Naugle has responsibility for R&D and operations conducted by the agency.

Naugle was deputy associate administrator from March 1974 until he was named acting in the post vacated by Petrone. Earlier, he was associate administrator for space science and administered NASA programs in lunar exploration, planetary, physics and astronomy, and launch vehicle and propulsion.

NSA Course Has 3 Sessions Left

Part VI of the National Secretaries Association CPS review course, Environmental Relationships, has three remaining sessions December 8, 9 and 15 from 6:30 to 8:30 p.m. at Houston Lighting & Power Company, Seabrook. The first two sessions were held December 1 and 2.

Dealing with environmental psychology and management motivation, Part VI is taught by Dr. Walt Natemeyer, management motivation specialist, and Dr. Patrick Doyle, psychologist. Both are from UoffH.

CPS review course contacts are Lee Carr at 488-3173 and Virginia Thomas at 474-4191.

ROUNDUP



NASA LYNDON B. JOHNSON SPACE CENTER HOUSTON, TEXAS

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CUTTING FIGURES
...can be fun
be a GOOD SKATE
...GET IT DONE!!



Send your COST REDUCTION REPORTS to...
BH4 - COST REDUCTION OFFICE



GUARDING MOON JEWELS — Polly McCamey, Northrop employee in the Bldg 31 Lunar Curatorial Facility, carries a parcel of lunar rock samples returned from an Apollo lunar science investigator and is escorted by Wackenhut Services Inc. guard Robert V. Floyd. Returned samples are escorted by an armed guard until they are safely back in the Curatorial Facility.



AEROSPACE FELLOWSHIPERS — National Aerospace Fellowship recipients David Solis, left, and Alfred Ramirez mount a test wing airfoil section in the wind tunnel at Texas A&I University-Kingsville for lift and drag measurements. Solis worked at JSC last summer and Ramirez worked at Ames Research Center. (TA&IU photo)

A&I Students Put Theory to Work During NASA Center Summer Jobs

"It was a fantastic job. In school, you learn theory, but out there you get to use the things you learn," observed Alfred Ramirez, one of two Texas A&I University-Kingsville engineering students who worked for NASA last summer as part of a National Aerospace Fellowship program.

Ramirez, a junior mechanical engineering student, and David Solis, a sophomore electrical engineering student, both of Alice, hold NASA training grants for \$2,500 and summer employment for two summers at any NASA installation.

"Initially, I didn't want to work for the government, but this job changed my mind. The engineers went out of their way to make sure that we got a complete picture of NASA projects," explained Ramirez, who worked in the Thermal Protection Branch at the Ames Research Center in California.

Solis, involved with computers at JSC, praised the Center's work and added, "The government is pretty cost conscious, which really surprised me. It was a good experience to see how a government agency operates."

Both students agreed that the tone of each facility was "We want you to be happy and get into the

field you want." Solis and Ramirez worked on a number of projects in their respective fields with the aid of other engineers and reference materials.

"I had two to three weeks of reading before I could touch anything. Then I worked completely by myself on a design project, and there was an engineer I could go to if I had problems," emphasized Ramirez.

Solis, who worked at JSC during the Apollo-Soyuz mission, was impressed by the efficiency of the people involved with the flight. "There was really not that much excitement. People were going about their everyday work," he commented.

The two engineering students, who will graduate in May 1977, said that it was beneficial to be involved in the whole working process of a project — from the initial design or computer program to the finished product.

"They came back from their summer jobs really charged up and enthusiastic about finishing their college studies and getting out into the working world," commented Dr. Ernest A. Franke, dean of the college of engineering.

This is the first year that A&I has participated in the National

Aerospace Fellowship program, and it received two of the 50 fellowships that were awarded to students at 17 universities.

Ramirez and Solis, who were among the six to apply from A&I, were selected on the basis of academic record, personal accomplishments, study plan for the next two years and interest in engineering and space related fields.

Purpose of the program is to encourage minority group members to undertake professional careers in scientific and engineering fields so that the space related fields will be more representative of the US population.

Amina Cisco Named November Secretary

Amina S. Cisco, secretary to the Program Administrative Office, has been selected JSC Outstanding Secretary for November.

Former Program Administration Officer manager Robert J. Bailey, in his nomination of Cisco for Outstanding Secretary, wrote, "In each of her assignments she has shown that she has the ability to grasp requirements quickly, learn the functions of the office, and provide superior secretarial support with a minimum of instruction. In temporary assignments in more senior positions she has performed the duties with such skill and enthusiasm that the program managers have commented that she clearly has the ability to handle work at a higher level.

"She is an efficient, willing worker with a warm and friendly



manner who is unusually thoughtful in seeking ways to be of help to other office personnel," continued Bailey's nomination. "She does not question whether or not an assignment should be given to her but does it promptly and with enthusiasm ... She has shown great promise in her current position and the potential to assume greater responsibilities at the Center."

Family Affair Starts Monday

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season, they also spread "goodwill" at other times of the year. During the 1974 Easter season, for example, shoes were purchased for 30 needy children. A similar effort is being planned for 1976.

Employees who have not been contacted by project area coordinators and who would like to make contributions should contact Mayhorn, ext. 5540, mail code FD6. The fund-drive will end December 16.



DON'T FORGET THE CHILDRENS CHRISTMAS PARTY

Roundup Swap-Shop

Swap Shop advertising is available to JSC and on-site contractor personnel. Articles or services must be offered as advertised, without regard to race, religion, sex or national origin. Ads should be 20 words or less, including home telephone number. Name and office code must accompany, but need not be included in ad copy. Typed or printed copy must be received (AP3 Attn: Roundup) by Thursday of the week before publication.

BOATS

20-ft Chrysler Commodore Tri-Hull w/155-hp eng, trlr, xint cond, 50% off. 334-2360.

VEHICLES

New Donnalson 10-spd bike, never ridden. 538-2040 after 5.

73 Dodge Polara Custom, air, pwr, V/T, remote spkrs, cruise control, xint tires, low miles, perf cond. 488-5282.

74 22.5-ft Mini Motorhome, self cont, sleeps 6, still in warranty, xint cond, sacrifice \$1700 equity. 334-4018.

75 Honda CB750 w/Windjammer III fairing, cush bkst, eng guards, 4000 miles, xint cond, \$1950. Clowdis, 471-2447.

75 Honda CB550 K-1, 3500 miles, Windjammer II fairing, sfty bars, road pegs, comp air horns, lug rack, sldng leaner bar/pad, 10-in hndlbr, setback, lwrng blks, CB ant mnt, beautiful bike, always in garage, can't ride acct operation, \$1900. Possibly trade for pickup of equal value. 482-3100 after 5.

Schwinn 20-in 2-spd bike w/motorcross hndlbrs, number, good cond, \$20. 482-7786 after 6.

Sears 24-in 10-spd bike, new frnt whl, good cond, \$25. 482-7786 after 6.

Schwinn Continental man's 10-spd bike, xint cond, xtras, \$95. 554-7052.

PETS

Fawn Boxer at stud, Ch Morleen's Apache Ambush, and Ambush son. Bailey, 337-2855.

5 orphaned kittens (4 male, 1 female) need homes; orange, some w/white markings, 6 wks old. Lee Brubaker, 554-6034.

WANTED

Trade xtra-firm king-size mattress for firm or soft one. Haines, 941-2495.

Electric trains and accessories. 488-7513.

Small child's wooden table and chairs. 334-3447.

PROPERTY & RENTALS

4-2 1/2-2 colonial in El Lago, 2750 sq ft, oak-wooded acre, brick patio, walk dist to school, community pool, tennis, lake, by owner. 334-3001.

9.6 acres off NASA Road 1 near JSC. 334-2360.

Spend holidays in beach cottage overlooking Gulf, family rates, Reservations 334-2360.

2-acre lot in El Dorado subdiv Friendswood, \$7500. Zupp, 482-7156.

2 acres hvlly wooded, 2 spring-fed lakes, Stagecoach Farms NW of Tomball, \$5500/acre. Arnim, 333-4362.

51 acres @ \$800/acre, NE Intcntl arprt, 45 min, wooded, good schools, growing area, \$5000 down. 991-4699.

HOUSEHOLD ARTICLES

Galvanized hvy-dty swing set (2 swings, trapeze, teeter-totter); tetherball pole in concrete-filled tire, \$5. 334-3001.

Man's wooden valet stand \$5; baby portacrib \$17; baby dressing table w/pullout dwrs \$14; child's Mexican wooden chair \$2. 334-3001.

Exec office furnishings: desks, chairs, credenzas, lamps, etc. 334-2360.

Exercise bike, like new. 334-2360.

Studio piano, best offer. 334-2360.

GE 220v elec clothes dryer, cprprt, good wrkng cond, \$50. Arnim, 333-4362.

Birch baby bed and mattress, insprng mattress, xint cond. 482-7786 after 6.

Baby bed, mattress, sprngs, \$10. Nance, 488-3183.

MISCELLANEOUS

Bay Area Lions Club 6th annual Christmas tree sale, Dec. 6-7, lot next to Holiday Inn, NASA Rd 1.

Ham gear: Drake TR4 xcvr, pwr sup, spkr, xint, \$400; Clegg FM27B 2-meter xcvr, like new, \$250. Other items. Lindsey, 488-0517.

VM stereo record chng w/mag crtrg and diamnd needle, \$15. Gerlach, 483-1348.

Harman Kardon AM/FM stereo w/integ Garrard changer, 20 rms watts/chan, new Pickering crtrg, w/o spkrs circa \$80. Alan, 483-3511.

Sears top carrier, vinyl top, w/bar and lock, like new, used once, 36x48x15 in. Harris, 944-2131.

Alvin Aero Club has mbshp opngs, Cessna 150, 172, two 1775, Piper 140. Ward 6104, Nieder 2276, Disler 4761.

Farifisa Fast 2 elec organ, 48 key, 4 voices, swell pedal and case, like new, \$350 value for \$175. Clements, 474-2622.

Farifisa Combo organ, 100 watt, cust amp, carrycases, \$800. Overton, 534-2476 Dickinson.

Small stereo, ideal for student, needs minor repairs, \$15. 488-4467.

Quality cameras for Christmas: 35mm Leica, Kowa, superwides. 334-2360.

Caravelle student trombone w/Bach mthpc, case, \$125. Arnim, 333-4362.

Brnd new Windjammer fairing w/mtg hdwe, quartz-halogen lite, all accessories, \$210. 729-2774.

Chrtr mbshp in Bay Area Racquet Club, no due to mid-76. 333-2395.

20-gal long aquarium w/54-in door cabinet, \$60; 10-gal slim-jim, less stand, \$25. 554-7052.

60-in Spanish-style coffee table w/two side doors, \$65; walnut coffee table w/inlays, \$45. 554-7052.

Antique marble-top washstand, \$185; washstand svc set, \$90; 42-in oak mirrored buffet, \$285; oak rkng chair, \$110; birdseye maple rkng chair, \$75. 554-7052.

Wall-mounted 73-in steer horns, leather-wrapped center, \$60. 554-7052.

Magnavox portable stereo record-player w/ svc manual, \$20. 944-5749.

15x21-ft wool Axminster rug, Virginian pattern, Lee Carpet, nearly new, \$350. 554-6338.

7-dwr antique blue desk, perfect for students, \$15. Judie, 488-1244.

EAA ATTRACTIONS

EAA LEAGUES REGISTER

Registration will be held next week for the EAA basketball league season which starts January 6. Entry fees are \$75.

A Monday night ladies volleyball league will begin January 5, and registration will be December 15-19.

Teamless players wishing to take part in these leagues should call Doug Burns at 3594, who will find spots on existing teams or form a new independent team.

TICKETS AVAILABLE

On sale in Bldg 11 Exchange Store 10 a.m. to 2 p.m., no refunds: Astroworld-adults, \$5, children \$4 (regular \$6.50 and \$5.50); free Disney Magic Kingdom cards, Six Flags Over Texas Fun-

seekers cards and Lion Country Safari cards.

Dean Goss Dinner Theater has John Bouess comedy *The Loud Red Patrick*, \$16/couple (regular \$22) thru Jan 14, not valid Sat.

Windmill Dinner Theater, *Last of the Red Hot Lovers*, with Pat Paulsen, \$14/couple, Dec 4-Jan 2, valid only Tues, Wed and Thurs.

Sea Arama: adults \$3.25, children \$2.25 on sale.

CHILDREN'S CHRISTMAS PARTY

JSC Children's Christmas Party tickets go on sale Monday in the Bldg 11 Cafeteria at \$1.50/child. Only 500 tickets will be sold, and none will be sold at the door on party day. The party will be from 1 to 3 p.m. December 20 in the JSC Auditorium.



the universe... or nothing?

The following is a condensed version of an address by NASA Administrator Dr. James C. Fletcher before the National Academy of Engineering on November 10, 1975.

When space exploration was first conceived, the primary motives were adventure, scientific investigation and national prestige. During this exciting and spectacular period we developed the technology to put satellites into orbit, to send men to the moon and to begin exploration of the planets with automatic probes.

Our leap towards the stars was curtailed sharply by the realities of the 1970s. After decades of apathy, man had become concerned about his own planet. The wastes from his growing affluence were polluting the land, the oceans and the atmosphere...mineral and energy resources were becoming scarce...at a time when adequate communications were paramount, he faced a crisis in communication...his cities were deteriorating from unwise management and were battered by floods, storms and earthquakes...overpopulation and food shortages threatened famine for millions.

It was inevitable that the technologies fostered by our venture into space would be arrayed against these myriad problems. Today, our space programs are heavily oriented in the "problem-solving" direction, and have produced notable accomplishments. Meteorological satellites are adding a new dimension to weather forecasting and storm warning...communications satellites will soon carry the majority of the world's radio, telephone, television and data transmissions...navigation and traffic control for land, sea and air increasingly rely on space systems...resources satellites help us to manage our farmlands and natural resources; help us to locate new sources of water, minerals and energy; aid us in urban planning and keep a watchful eye on the inroads of pollution. Within a few years, the reusable Space Shuttle will add man's flexibility to the near-Earth space environment and open the way to the manufacturing and processing of new materials that cannot be duplicated on Earth.

These programs all have a common denominator — they are all space programs structured to provide a direct service to mankind. Their value is unquestioned, and they should and will be expanded. The very success of these and our other space programs, however, has whetted the appetite of the general public. Space technology has become a poultice for the physical and social ills of modern society. The often repeated question — If we can send men to the moon, why can't we do this or that? — has brought the space program down to Earth in search of...new energy sources...synthetic fuels...better engine design...new methods of mass transportation...environmental protection...and many other endeavors of a strictly terrestrial nature.

There is nothing wrong with this per se. Wherever and whenever space technology can help improve the quality and security of life beneath our atmosphere, it should be applied wholeheartedly and vigorously.

But...in concentrating on the "now" problems we are forced to ask questions about the future: are we losing sight of "the dream?" As one Congressman expressed it, Are we sacrificing our destiny in order to satisfy our desire for immediacy in everything?

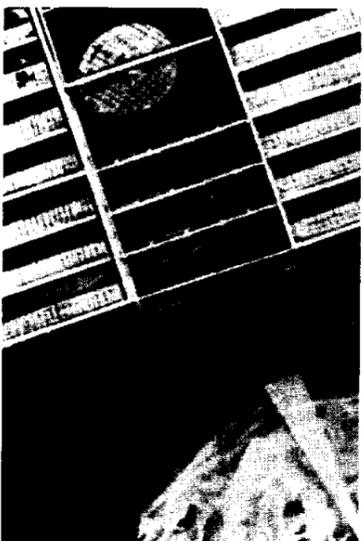
The old saying that sometimes you can't see the forest because of all the trees certainly applies to our exploration of space. We should not overlook the hidden values — the vast potential — of our national space program. Unfortunately, there are a few things harder to understand — and to pay for willingly — than a *potential*.

Dwindling resources and contamination of the planet Earth's environment are more recent examples of man's tunnel vision. And the blinders are still on. Our answer to the looming energy crisis is apathy. We should have been concerned about energy a quarter of a century ago. Instead, we recklessly plundered a leftover treasure from the Sun as if it was unlimited. Now, we are about to pay the consequences.

The same analogy holds true for space exploration. Unless we proceed forward with the same adventuresome spirit that characterized the earlier years of the Space Age, tomorrow's dreams will become tomorrow's problems.

With uranium and fossil fuels heading towards depletion, we should be giving serious attention to solar energy as a solution to our long-range energy needs. Terrestrial solar energy will find its place in applying these needs but it could be more useful as an energy source if solar energy should be collected constantly and in large amounts. This is difficult to do on Earth because of the problems of clouds, the day-night cycle, and the requirement of vast areas of open, uninhabited land for terrestrial solar collectors. No such restrictions are found in space. Large solar arrays could be positioned so that they are continually hovering in the sunlight above the same points on the Earth's surface. From these vantage points, they could beam solar energy in the form of microwaves to collecting stations below.

Space systems may not be the total answer to our solar energy needs, but they certainly represent one of the directions we should be looking in. What is important is that we begin to consider other



alternatives. If we had placed the same emphasis years ago on ways to utilize solar energy as we have put into the development of a nuclear generating capacity, we might already be well along the road to solving the energy shortage.

We should begin to think seriously about putting up a permanent, manned space station, an engineering feat well within the limits of current technology. An orbiting space base crewed by scientists, engineers and technicians



from all over the world would prove invaluable for studying the Sun, the stars and the near-Earth environment. It would have an unmatched capability for terrestrial weather, resources and environmental surveillance. It would offer a weightless laboratory for developing new materials and products impossible to duplicate on Earth. It could serve as an economical waystation for extended exploration of the moon, for establishing lunar bases and for manned and unmanned voyages to the other planets of the solar system.

We should not ignore new concepts such as the space colony recently proposed by Professor Gerard O'Neill. The wheel-shaped habitat would house up to 10,000



people along with shops, schools, light industry and a self-contained agriculture system. The principal industries would be the manufacture of more habitats and the construction of solar energy collectors that would be placed in orbit near the Earth to beam down cheap energy. Solar energy also would power the space colony. Heavy industry would be conducted outside the habitat to make use of the weightlessness and vacuum of space.

After completion of the first habitat, larger colonies could be constructed, some orbiting farther from Earth. The material of the asteroids, for instance, would be sufficient for the construction of colonies with a total land area thousands of times greater than all of Earth's continents.

We should also expand our exploration of the planets. From these undisturbed worlds we can gain a better understanding of the forces that shape our own planet and its evolution. It is not at all unlikely that someday we may look upon some of these distant worlds and their satellites as havens from a ravaged and teeming Earth — long-range alternatives to the orbiting space colony.

We have already completed flyby missions to Mercury, Venus, Mars and Jupiter. Soon, one of our Jupiter spaceships, Pioneer 11, will give us our first close-up look at ringed Saturn. Next summer, Viking spaceships will land on the surface of Mars to search for evidence of life on that planet. We are currently considering a probe to distant Uranus in the 1979 time period. But what about Neptune, Pluto and beyond? And should we consider the stars?

Why not!! Less than two decades ago, we were proudly pointing a grapefruit-sized satellite in orbit. Today, we are sending robot spacecraft to explore the surface of other worlds. A proposal by the British Interplanetary Society for an unmanned mission to the nearest star, Alpha Centauri, has been received with more than casual interest. Such a mission would require a new type of propulsion system and years of planning.

But why bother about Alpha Centauri and points beyond when we have not completed the exploration of our own solar system? For the best of reasons. Although the discoveries we shall make on our neighboring worlds will revolutionize our knowledge of the Universe, and probably transform human society, it is unlikely that we will find intelligent life on the other planets of our Sun. Yet, it is likely we would find it among the stars of the galaxy, and that is

cause he stands a far better chance of not having that ball game rained out when the forecast was for sunny skies. Selling him on the idea of financing a \$100 billion space colony for the 1990s must be viewed by him in the same context as convincing an eskimo that he needs a refrigerator for his igloo.

The attitude of the public leads to a second time horizon — the political term of office. A legislator must be responsive to the demands of his constituents. As a result, he seldom is afforded the luxury of thinking beyond his present term and thereby perpetuates the "now" philosophy.

A third time horizon evolves quite naturally from the other two. This is the budget cycle. The Office of Management and Budget, which controls the government's purse-strings, rarely plans beyond one or two years at a time. It is responsive to the dictates of political and economic pressures which more often than not reflect only the day-to-day needs of society.

NASA's Space Shuttle program is an excellent example of the effects of year-to-year budget cycles. The program has never been funded in its entirety, but has been piecemealed together out of the Agency's overall yearly budget at the expense of many promising long-range programs. Yet, if NASA did not proceed with the development of the Shuttle, the nation would be without a major new space program for the 1980s.

A final time horizon is the active professional career of the individual. The leaders of any institution are motivated by the same "now" syndrome that affects the average citizen. They want to see the fruition of their plans and dreams, and they obviously tend to favor projects whose culmination lies within their own career spans...or at least within their lifetimes. This temptation is doubly strong in respect to an agency such as NASA whose programs are sometimes measured in decades.

The restrictive elements I have just described should not be construed as excuses for NASA's lowered sights. They are causes... emotional, political and economic facts of life that in whole or part are holding back our outward flight into the future.

We cannot afford to let these obstacles deter us from our ultimate goals. We must somehow keep the dreams of space exploration alive, for in the long run they will prove to be of far more importance to the human race than the attainment of immediate material benefits...just as the effects of Copernican astronomy or Darwin's theory of evolution far outweighed their immediate practical results.

Space offers us an alternative for the future. Our race can squander its potential and continue our unchecked momentum down the slopes of time towards the shore of the primeval sea to join the great reptiles and nature's other unsuccessful experiments. Or we can accept the challenge of the great spaces between the worlds and establish our citadels among the stars.

The choice, as the historian Wells once said: "Is the Universe or nothing."