

## Launches slated for '79

### Comm and weather satellites dominate First crew-carrying Shuttle to orbit

NASA's work in 1979 includes the first orbital flight of the crew-carrying Space Shuttle; Jupiter and Saturn encounters by two Voyager spacecraft; and a flyby of the rings of Saturn by the Pioneer 11 spacecraft.

Three launch sites will be used for 16 launches: Cape Canaveral, Vandenberg, and Wallops Island.

As was the case in 1978, most of the 1979 launches will emphasize the use of space for the direct benefit of people on Earth—communications and environmental and meteorological information. During 1978, NASA logged 20 launches.

The first orbital flight of the Shuttle will be launched from Kennedy and land about 53 hours later at Dryden.

On March 5, the Voyager 1 spacecraft, launched from Earth on Sept. 5, 1977, is scheduled to make its closest approach to the planet Jupiter and travel on to make a close approach to the planet Saturn on Nov. 12, 1980.

Its sister spacecraft, Voyager 2, which was launched Aug. 20, 1977, makes its closest approach to Jupiter on July 9, 1979, and to Saturn on Aug. 27, 1981.

The Pioneer 11 spacecraft, launched April 6, 1973, on its primary mission to

fly by Jupiter, is scheduled to make its closest approach to the rings of Saturn on Sept. 1, 1979.

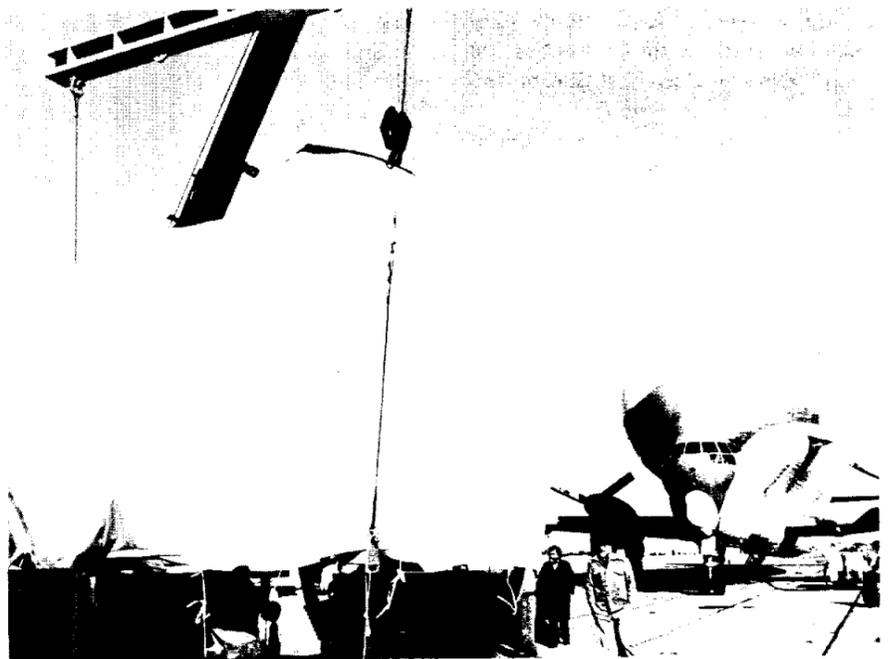
The 1979 schedule begins with two launches on Jan. 25. Spacecraft Charging at High Altitudes (SCATHA) will be launched aboard a Delta from Cape Canaveral for the Department of Defense. That same day, a NASA applications satellite, Stratospheric Aerosol and Gas Experiment (SAGE-A) will be sent aloft on a Scout from Wallops Island, Va.

Two more launches are earmarked for April: NOAA-A, a weather satellite to be launched for the National Oceanic and Atmospheric Administration, on an Atlas-F and Navy-20 for the Department of Defense. Both launches will be at Vandenberg.

FLTSATCOM-B, a Navy/Air Force communications satellite is on the calendar for May, aboard an Atlas Centaur from Cape Canaveral.

UK-6, a scientific satellite will be launched for the United Kingdom on a Scout launch vehicle from Wallops in June.

*Continued on page 4.*



**SUPER GUPPY**—One of the world's unique freight airplanes, the Super Guppy, delivered a high-fidelity Shuttle crew compartment mockup to Ellington last month. The detailed model of the Orbiter cockpit and living quarters was installed in Bldg. 9A. This marks the first time the Super Guppy was used to deliver Space Shuttle equipment.

## Spacelab scientists tour USA

Five European and American scientists selected last July to operate experiments on NASA's first Spacelab mission begin training in the United States this month.

They will take a training tour to seven U.S. cities and two in Canada, pre-

paring to operate equipment for the scientific investigations that will take place on Spacelab when it is carried into Earth orbit aboard the Space Shuttle in 1981.

They will be in Houston March 5-16.

The five payload specialists are not career astronauts. They were chosen for the mission by the scientists who devised the experiments to be flown. This will be the first time that Western Europeans will fly in space and the first time that NASA will have orbited people from a country other than the United States.

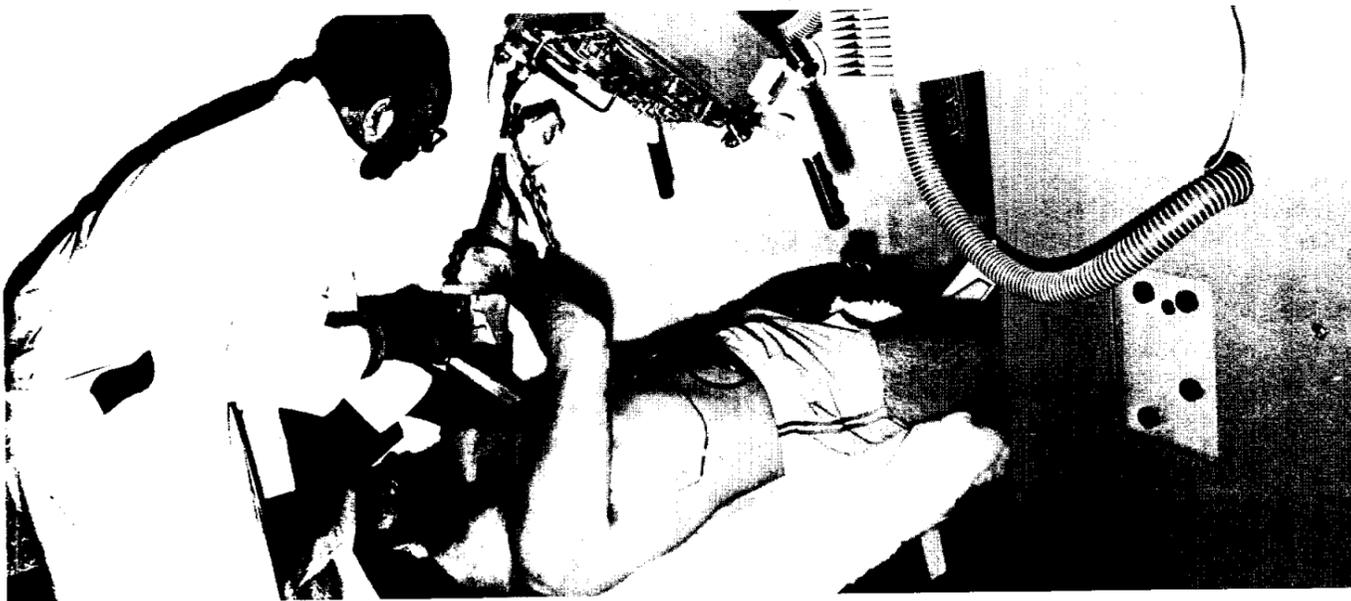
Of the five men training for the mission, two—a European and an American—will actually go into space aboard Spacelab 1. The other three will operate the ground-based experiment equipment and will support the two in orbit. Selection of the Payload Specialists who will actually fly will not be made until later in the training cycle.

All five have just returned from Europe, where they had been in training since October, learning to operate the experiments which will be placed on Spacelab by European scientists.

The Payload Specialists began their first American training tour Jan. 9, with a four-day session at Marshall. Marshall is NASA's lead center in development of Spacelab itself, and is managing the first three missions.

Forty instruments will fly aboard Spacelab 1. The science payload is about equally divided between NASA and ESA experiments in terms of weight, power, and volume requirements. Investigations will be conducted in stratospheric and upper atmospheric physics, materials processing, space plasma physics, biology, medicine, astronomy, solar physics, Earth observations, and in technology areas such as thermodynamics and lubrications.

The Marshall Center manages training in the U.S. and ESA manages training in Europe.



**BEDREST TESTS**—Eight volunteers completed 21 days of bedrest tests last month at the Public Health Service Hospital in Nassau Bay. The JSC Cardiovascular lab put the volunteers in an anti-

orthostatic (head down) position, hoping to bring about physiological changes more in line with the time course of spaceflight.

## US to help China develop a space program

A delegation from the People's Republic of China has been holding discussions with United States officials since Nov. 28 regarding possible U.S.-Chinese cooperation in the peaceful utilization of space technology.

As a result of these discussions, an informal agreement has been reached in principle on U.S.-Chinese cooperation in the development of the civil communications system of the People's Republic of China. This involves the purchase by China of a U.S. satellite communications system, including the associated ground receiving and distribution equip-

ment. The space portion of the system will be placed in geostationary orbit by the U.S., with continued operation to be carried out in China.

Similar informal agreement in principle has been reached regarding the purchase by China of a ground station capable of receiving Earth resources information from U.S. Landsat remote sensing satellites, including the Landsat-D now under development.

The U.S. delegation was headed by Dr. Robert A. Frosch, NASA Administrator, and the Chinese delegation was headed by Dr. Jen Hsin-min, Director of

the Chinese Academy of Space Technology.

The discussions were a follow-up to the visit of Dr. Frank Press, the President's Science Advisor, to China last July. In conjunction with the Washington discussions, the Chinese delegation, accompanied by NASA representatives, visited several NASA centers and U.S. aerospace industrial establishments.

The Chinese delegation will remain in the United States until mid-January in order to carry on further technical discussions with U.S. government officials and representatives of industry.

## Employee Bulletin Board

### AIAA Meetings

Using a theme, "The Wrights and Wrongs of Aviation" John Bertin of UT Austin delivered a program to the local American Institute of Aeronautics and Astronautics on Dec. 12 at Gilruth Center.

Using slides and dialogue, Bertin went from man's early attempts to fly with wings strapped to arms, through crude variations of "bird-like" craft, to weird designs that usually ended in failure or complete collapse. He showed early passenger and cargo planes, and discussed later fighters and bombers of the WWII period.

Members report it was an interesting and memorable evening.

Next meeting of the AIAA will be Jan. 16, again at Gilruth. The subject will be "Seasat A", presented by James H. Guill of Lockheed. The program begins at 8, after a 7 p.m. dinner and a social hour that starts at 6. Make reservations through Sharon Kemp at x2529 or Paula Ashcraft at 488-5660.

### L-5 Hosts Faget

Maxime Faget will speak on "Space Transportation in Support of Space Industrialization" at the monthly meeting of Houston L-5 Society, Jan. 19 at Museum of Natural Science. Program starts at 7:15. Faget is Director of Engineering and Development at the space center. The lecture is free, sponsored by the L-5 Society Houston branch, an organization formed to assist and encourage exploration, industrialization, and utilization of space.

### At the JSC Exchange Store

- Dean Goss tickets - \$10
- General Cinema tickets - \$2.40
- ABC Theatre tickets - \$2
- Rockets basketball - \$5.50
- Magic Kingdom Cards - free
- Entertainment '79 coupon book - \$15: This book contains 376 two-

for-one coupon offers totalling more than \$4,000 in savings for one full year. Call x4814 for more information.

### DRUG ABUSE

Drug abuse is defined as an effort by individuals to feel "different and/or better" than they ordinarily feel, and applies to street drugs, over-the-counter prescriptions, and alcohol. Everyone pays in one form or another for this social ill. To learn more facts about the escalating problem of drug abuse, plan to attend the next Health Education Program on Jan. 17 at 10 a.m. and again at 1 p.m. in Bldg. 30 Auditorium. Harry Edwards from the Bay Area Committee on Drug Abuse will speak at the program, and a JSC clinic physician will be on hand to answer questions.

### Secretaries' Course

UHCLC is continuing its Certified Professional Secretary review course beginning Feb. 1, and registrations are still being accepted. Although the course is structured to prepare career secretaries for the CPS exam, it is also of benefit to anyone wishing to develop skills as a secretary.

Employee Development may reimburse fees for civil service employees taking the course for the first time. For more information call Cheryl Bouillion at x3087 or 482-2091.

### Computer Conference

UHCLC will host the first annual Conference on Computer Developments on Jan. 25 and 26 in the Bayou Building. Microcomputers and software engineering will be the topic. Registration is \$20 and includes lunch both days and a copy of the conference proceedings. To register, send a check to Anthony A. Lekkos, UHCLC, 2700 Bay Area Blvd., Houston 77058.

## People and Places

The invention of a method to reconstitute asbestos matrix and use the resulting product as an electrolyte holder in alkaline fuel cells has earned Hoyt McBryar \$2,500 and a NASA Certificate of Recognition. McBryar devised the method in 1973, and that year received a \$50 award from the Inventions and Contributions Board. Since that time, Rockwell International has selected an electrical power system using material developed by McBryar as the separator (matrix) between the anode and cathode electrodes for the Shuttle orbiter. McBryar is an aerospace technologist in the Propulsion and Power Division at JSC.

\*\*\*

A new logo that depicts the Girl Scouts as "modern, humanistic, pluralistic, and multi-racial," was a major highlight of the 41st Girl Scouts National Convention, according to Rae Chambers who attended the meeting last fall as a voting delegate. Chambers said she is happy with the new logo, because "scouting has never changed before." Chambers has been active in scouting since 1972 and is currently a cadette troop leader, a senior advisor, and a member of the San Jacinto Girl Scout Council Board of Directors. At JSC she is a contract specialist in Procurement, and she attended the convention with backing from the Federal Women's Program Committee.

\*\*\*

Three more trainees are being phased in as official flight controllers this month. The three are recent new-hires: Cynthia Majors came to NASA from Boeing, Bonnie Dunbar from Rockwell, and Mike Hawes from Notre Dame. The three are "on their own and training five others," said Payload Operations Chief Charles Harlan. He added that Will Fenner recently became a team leader on the flight controllers' staff.

\*\*\*



Rae Chambers



Hoyt McBryar

Bonnie Dunbar has also been active with the FWPC outreach program giving "role model talks" to high school female pre-engineering students. She went to Iowa last fall, Seattle in November, and will make another trip in May. "Nationally, only 3 percent of professional engineers are women," she said, "but today 15 to 20 percent of engineering students are women, almost a 1,000 percent increase." She added that many women go to colleges of engineering to earn second degrees after finding a sparse job market for persons with BA's in Art or History.

## December's Secretary

### 'She returns typed memos and letters within minutes'

Employees in the Astronaut Office think of December's Outstanding Secretary Mae Eubank as the "resident expert" on NASA policies, and as such she is consulted often. She is secretary to the second Shuttle crew and four astronaut candidates, a job that demands tact and firmness dealing with visitors and callers to the office as well as sharp secretarial skills, and Mae Eubank has all those qualities.

"During an average workday, Mrs. Eubank regularly performs her administrative duties and a large volume of typing," said an Astronaut Office spokesman. "She strives for perfection, seldom makes mistakes, and has a reputation for typing and returning completed memorandums and letters within minutes.

"Mrs. Eubank is a skilled writer and often composes letters of response to incoming mail for astronauts. All of the large volume of incoming mail from the public must be answered, and her assist-



Mae Eubank

ance as a writer substantially lessens the burden on crewmen."

Out of appreciation for her dependable skills, Mae Eubank received the December Outstanding Secretary award.

## Advice to ambitious women

### A second degree could mean a job promotion

"Women have nearly doubled their share of earned degrees in the sciences since 1970," said Judith Ramaley, national president of the Association of Women in Science. She was speaking Jan. 4 at the annual AWIS meeting held in conjunction with the AAAS meeting at the Houston Shamrock Hilton.

"Unfortunately, opportunities for employment for women in science have not kept pace with their preparation. In other words, you can train for it, but there may not be a job for you.

"One then asks, what do you do about that?"

"We have an oscillatory supply and demand curve. Someone will wake up one day and realize there aren't enough engineers and they'll immediately crank up and its five or six years before honest-to-goodness engineers come out. By that time, you've made too many

and they all flood out into the market. The binding sites are taken up and there's no place left.

"The graduates often go into a perpetual post-doc pool where they sort of float around and are eventually excreted, as we all know. And they become taxicab drivers.

"In reproductive biology there aren't many jobs. But there are incredible numbers of jobs for people with reproductive biology training who are also toxicologists, or also pharmacologists, or some interfacing combination of fields. If you've got a chance to, develop yourself adequately in one field first, then add on something else that is compatible, and in some way complementary to, what you've already developed. You can leap from experience to experience until you're so educated that you can fit into anything."

## He is highly motivated and an asset to CSD

December's Coop of the Month David Sprague's current assignments include responsibility for an automated oxygen concentration monitoring system for manrated environmental chambers used for Shuttle program life support testing. He also has a test data management task to obtain Shuttle environmental control system thermal data during tests at SAIL.

Sprague's work is diverse and requires a wide range of technical skills. He is highly motivated, a valuable asset

to the Crew Systems Division.

A junior electrical engineering student at the University of New Mexico, Sprague has been a student trainee at JSC since September 1976.

**A LITTLE LUNCH MUSIC—At right, employees gather in Bldg. 14 for lunch-hour country pickin'. From left, clockwise, are Roland Caldwell, Mark Walton, E. T. Dickerson, Bill Seibert, Bart Batson, and Don Eggers.**



Photo by Gary Morrison

## What's cookin' with cafeteria prices?

\$1.95 for the special? \$1.50 for ground sirloin? Employees returning from Christmas break were greeted by higher prices in the JSC cafeteria.

Two factors contribute to the price rise: labor costs and the cost of food. Last year food went up 11 percent and labor 8.75. "Where we could no longer cope with market prices, we went up," said Exchange Operations Manager Roy

Aldridge. Beef and redfish will cost more this year, but milk and coffee prices will stay stable for now.

He added that vending machine prices are not immune to the inflationary spiral. The Rice Vending contract goes into negotiation in April, "and I anticipate candy bar and meat sandwich costs will go up," Aldridge said.

Last year, 1,500 employees signed a

petition to Aldridge demanding that canned soft drink costs be brought back down from 35 cents. He said he has responded by installing machines that dispense soft drinks in paper cups in Building 1 and Building 30. "These are 12-ounce drinks, the same as the cans, for 20 cents," Aldridge said.

Last year, on top of the 10 cent per can price rise, the Environmental Protection Agency wanted JSC to charge a deposit for cans. If the paper cup dispensers are successful, more will be installed.

But savings do not come easy. The Rehabilitation Acts Amendments of 1974 passed by Congress mandate that a certain amount of income from vending machines on federal property must go to the Texas State Agency for the Blind. The cafeteria employees' union contract states that entry level salaries will be 25 cents higher than the minimum wage. The minimum wage went up Jan. 1, it goes up again next Jan. 1, and so do cafeteria costs, Aldridge said.

The two cafeterias have operated at a loss for four years in a row, and the Exchange covers the loss through gift shops, etc. If all goes as planned, next January the Building 3 cafeteria will be modernized to save labor costs by installing a "circle serve" system for sandwiches and a more modern cafeteria line. The Building 11 cafeteria will receive the same overhaul sometime later.

In the meantime, the Exchange will continue to ride the same inflation spiral as everyone else. And don't count on lunchtime alternatives. Brown bags went up 20 percent in grocery stores last year.

## What's cookin' in the JSC cafeteria

### WEEK OF JANUARY 15 - 19

MONDAY: French Onion Soup; Beef Chop Suey; Polish Sausage; German Potato Salad; Breaded Veal Cutlet (Special); Okra & Tomatoes; Green Peas. Standard Daily Items: Roast Beef; Baked Ham; Fried Chicken; Fried Fish; Chopped Sirloin; Selection of Salads, Sandwiches and Pies.

TUESDAY: Split Pea Soup; Shrimp Creole; Salisbury Steak; 8 oz T-Bone Steak; Fried Chicken (Special); Mixed Vegetables; Beets.

WEDNESDAY: Clam Chowder; Fried Catfish w/hush puppies; Braised Beef Ribs; BBQ Plate; Weiners & Beans; Shrimp Salad; Stuffed Bell Pepper (Special); Corn O'Brian; Italian Green Beans; Rice.

THURSDAY: Chicken Noodle Soup; Beef Stroganoff; Turkey & Dressing; BBQ Smoked Link (Special); Lima Beans; Buttered squash; Spanish rice.

FRIDAY: Seafood Gumbo; Broiled Flounder; Liver w/onions; Seafood Platter; Fried Shrimp; Meat Sauce & spaghetti (Special); Green Beans; Buttered Broccoli; Whipped Potatoes.

### WEEK OF JANUARY 22 - 26

MONDAY: Beef & Barley Soup; Beef Chop Suey; Breaded Veal Cutlet w/cream gravy; Grilled Ham Steak; Weiners w/baked beans (Special); Whipped Potatoes, Brussels Sprouts; Buttered Rice. Standard Daily Items: Roast Beef; Baked Ham; Fried Chicken; Fried Fish; Chopped Sirloin. Selection of Salads, Sandwiches & Pies.

TUESDAY: Celery Soup; Frito Pie; Turkey a la King; Port Chop w/applesauce; Chinese Pepper Steak (Special); Au Gratin Potatoes; Breaded Squash; Buttered Spinach.

WEDNESDAY: Clam Chowder; Fried Catfish w/hush puppies; Braised Beef Ribs; Mexican Dinner (Special); Spanish Rice; Ranch Beans; Buttered Peas.

THURSDAY: Green Pea Soup; Corned Beef; w/cabbage; New potatoes; Chicken & Dumplings; Tamales w/chili; Hamburger Steak w/onion gravy (Special); Navy Beans; Buttered Cabbage; Green Beans.

FRIDAY: Seafood Gumbo; Deviled Crabs; Broiled Halibut; Liver & Onions; BBQ Link (Special); Breaded Squash; Green Beans; Lima Beans; New Potatoes.

## START THE NEW YEAR ON THE RIGHT FOOT



BY SENDING YOUR COST REDUCTION REPORT ON JSC FORM 1150 TO:  
**BG-3**  
**COST REDUCTION OFFICE**

### Energy Saver

If in the course of your calculator usage, you are forced to leave your unit on and cleared, you will save 2/3 current drain by punching up "1" rather than sitting on "0". Only two display segments draw power instead of six.

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: Kay Ebeling  
Photographer: A. "Pat" Patnesky

## Roundup Swap Shop

### Cars & Trucks

'78 Ford Granada, auto, A/C power steering & brakes, 302 V8, AM/FM Stereo, less than 3000 miles. Mary 488-0768.

'70 Chevy PU, w/camper shell, AC, built-in cabinets. \$900. 947-9196.

'75 Allegro Motorhome, 29' rear bath dual roof A/C self contained, good mechanical cond. \$14,950. V. Bailey 337-2855.

Utility Trailer, 16' Gooseneck Tandem axles, electric brakes, 3-ton capacity. \$895. V. Bailey 337-2855.

'74 Plymouth Barracuda, V8, air, automatic, PS/PB, rally wheels, 30,000 mi, new tires, \$2350. Ellis 466-5127.

### Miscellaneous

Bay Area Racquet club family membership, must sell, bargain price. J. Lacy 488-6948.

For Sale: Set of 4 13-inch custom wheels for Toyota or similar small car with 4 lugs. \$60. 334-3019.

12 Volt power supply 2-3 amp. T. Ward 488-5445.

For Sale: Tire, ER78x14 radial, steel belted, never on the ground. \$45. Barbara 944-2380.

2 50' garden hoses — \$5, 2 new diston power grass shears — \$15 each, new Mr. Coffee — \$20, GE mixer w/beaters — \$5, various framed pictures & spanish wall decorations — \$5 to \$40, lady Remington Electric shaver & Schick elec facial kit \$12 each. Call Sam x2551.

Tires: Snow or off road, 2 14-inch, 2 13-inch, 1 15-inch, like new. \$10 each. 466-5127 Ellis.

### Household Articles

For sale: Used Kenmore washer \$50. Call Lois 941-7169.

1 Early Amer. 3-cushion, recovered couch. \$150. 2 green Early Amer. wing chairs. \$50 each. 331-8665.

King size mattress and 2 box springs, Sears 920 coil. Very good cond. very firm. \$150, Hamilton 472-2118 after 5.

### Cameras & Stereos

For Sale: In-dash pioneer AM/FM Stereo Cassette, 20 watts/chan., super tuner. Inc.

Ads should be under 20 words and include home phone number. Typed or printed ad copy, a separate sheet for each ad, must be in the *Roundup* office AP/3 by Wednesday the week prior to publication. Swap Shop advertising is open to JSC federal and on-site contractor employees for non-commercial personal ads. Goods or services must be offered as advertised, without regard to race, religion, sex or national origin.

PWR AMP plus filters. 8 months old. No speakers. \$150 Model KPX9000. 861-5278 after 6.

### Pets

Standard poodle puppies \$50 no papers. Born 11/24/78, 5 females, 2 males, 6 black, 1 blonde. Burdsal 482-2873.

### Lost & Found

Found: Ring of Keys in Bldg. 37. Call x4264, Marv or Jackie for return.

### Wanted

Tire chains for H78-15LT. 474-4885 after 5.

Rider to join carpool leaving Meyerland at 7:20 am for the 8 am to 4:30 pm shift. Contact Russ x4871, Carl x4871 or Cathey x6387.

Slide projector. 474-2081.

Volunteers, Boy or Girl Scouts, members other groups, individuals-to work on maintenance of Lone Star hiking trail. Bob Lewis 488-2801.

### Property & Rentals

Lease Home: Brand-new 3-2-2 all brick atrium-type for lease. 488-6412.

Rent: Ninth floor apartment with Gulf view in high rise condominium on the Seawall in Galveston. Winter Rates 488-4276.

For Sale or Lease: Sagemont, 4-2-2 both formals, large den with cathedral ceiling, fenced, drapes, central air and heat. \$410 plus deposit 585-2142.

For Lease: 3-1 1/2-1, brick home in the country, carpeted, family room. \$175 + deposit. 585-2142.

Wanted: a conscientious person to share a furnished 3 bd house in Friendswood, 6 miles from NASA. \$150 month. 482-5393 after 5 pm or weekends.

Sale/Lease: Middlebrook II, 4-2-2, drapes, landscaped, fireplace, wet bar, patio, available now. \$475 month 488-4487.

### Cycles

Girls 20-inch bike with basket, good cond., \$24. Gerlach 482-5825.

## A New Year's look to the future

# Center scientists are developing hardware to support life on long-term space missions

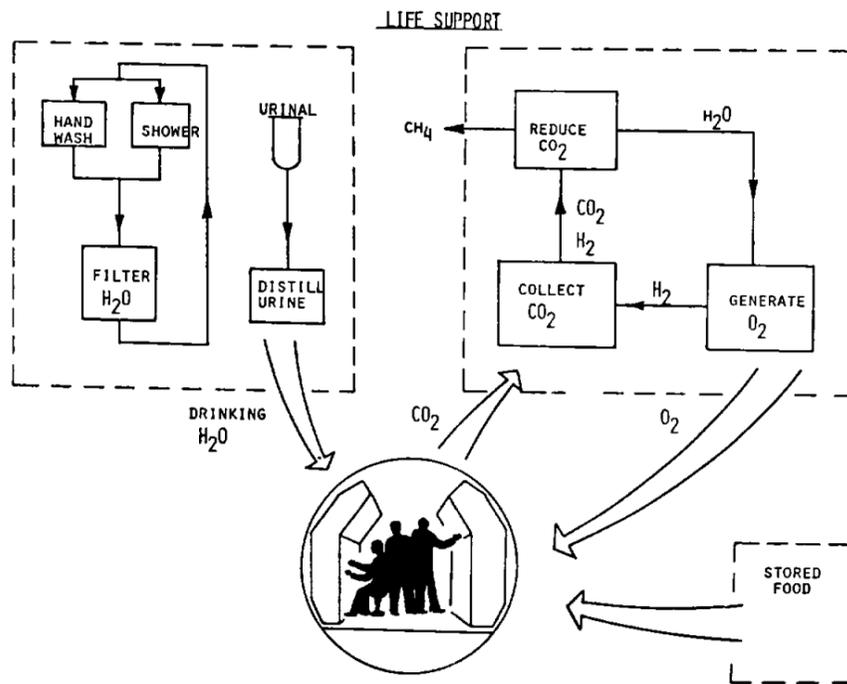
On a year-long mission in space, carrying oxygen and water for the crew would be cumbersome and unwieldy. With ideas for future manned interplanetary missions and a permanent manned space station, NASA has faced the task of providing air and water by setting up the Regenerative Life Support Evaluation, work being done by a group of scientists and engineers in Building 7A.

There, flanked by man-sized machines and tanks, the scientists are testing pre-prototype versions of water and air loops that will someday leave for space. "When they say space station, we're ready," said Nick Lance, an engineer on the air side.

For drinking water, squeamishness is set aside. The crew's urine is mixed with flush water, treated with iodine to prevent ammonia formation, then fed into a zero-g storage tank. From there it is fed into "the still," a distillation unit designed for use at zero-g. The liquid cycles through the still until 96 percent evaporates. Solids come out as a gel, concentrated and kept in a tank to be dumped into space later, though there is talk of someday removing the salts and using it as fertilizer.

"Right now, they're carrying two tanks on Orbiter just to store urine," said Dot Fricks, chemist on the water side. "We're concentrating the waste down into one small package and using the water over again."

She adds that the system uses little energy. "We are able to boil the water at about 80 degrees by evacuating the shell to a low pressure, around 20 mm of mercury. That way the motor that turns the still provides enough heat to evaporate the water."



Fricks herself has never drunk the water, but she asserts it is chemically more pure than that from a tap. "Here at JSC, we don't post-treat it, and it

wouldn't even think about it."

Tests in October showed that the drinking water system is cost-effective if a flight is 30 days or longer.

*On a spacecraft, everything depends on saving power and weight. Regenerative Life Support takes everything a person gives off and puts it to use.*

would have too much acid to drink. A later version will have ion exchange resin beds to control pH and an iodine system downstream that will work the way a commercial system uses chlorine."

She adds that "probably once you were used to it, after a day or two, you

On the air side, again, equipment is in pre-prototype stages, meaning the next edition will be prototype, then flight hardware. A water electrolysis subsystem, first of three major components in the air loop, produces hydrogen and oxygen. Oxygen is sent to the crew cabin, hydrogen passes to the

next subsystem—the carbon-dioxide concentrator.

Carbon dioxide and oxygen enter the second subsystem from the cabin. In the concentrator are a number of cells, each cell made up of two electrodes and an absorbent matrix. Carbon dioxide and oxygen blow over the electrodes, reacting and generating power. In the cell, the carbon dioxide becomes a charged molecule, a carbonate ion, which passes through the electrode membrane and reacts. At the second electrode, it comes out carbon dioxide again, only transferred from the air to a stainless steel line. Meanwhile, air minus the CO<sub>2</sub> has gone back to the cabin.

Next, carbon dioxide and hydrogen pass to the third subsystem, a reactor which combines them— $4H_2 + CO_2 = CH_4 + 2H_2O$ —creating methane and water. The methane, at this time, is dumped into space, though there is talk of someday using it as a propulsive fuel.

Water leaves the CO<sub>2</sub> reduction subsystem and returns to the first step, to be used in electrolysis, closing the loop.

The first air subsystem arrived at JSC in the fall, and has been tested with good results. The second unit arrived in December and still sits, unpacked, in boxes. Lance's work for the next months will be studying how to test the equipment, how to keep conditions right for later tests.

The entire closed life support system will make little noise, comparable to a pump room, or an air conditioning unit operating unnoticed in a home. On a spacecraft, everything depends on saving power and saving weight. Regenerative Life Support is designed to take everything that a person gives off and put it to use.

## Think Tank

Once again Roundup is going to activate your brain cells with a Think Tank puzzle. This time a carpet in a 9 X 12 room has a 1 X 8 hole in the center to accommodate a hot air register. How can it be cut into just two pieces which, when joined together, will fit a 10 X 10 room?

Submit your solution to AP3/Puzzle Editor. The first correct one will be recognized in the next issue.



## How to grow food in a closed system

*Editor's Note: The following are excerpts from a paper delivered by John M. Phillips, University of Arizona, at the American Astronautical Society Conference last October.*

"Looking at long-term mission scenarios, we see a gradually closing life-support system. When we have food production in space, we will have to have closed systems, controlled eco-systems.

"The basic problem is minimizing launch weight. With a closed system, we increase the initial launch weight, but reduce the weight of re-supply.

"Looking at a candidate system for future total closed life support, simply for discussion, the habitat should be designed with Earth-normal conditions—Earth-normal atmosphere and protections against space radiation; species diversity so you're not relying on a handful of crops; and redundant recycling pathways.

"The human diet will determine agricultural requirements. For vegetables, we'll want to intensify production by tiering, and trellising the crops. Basic foods, such as grains, would require mechanization, day-

length control, and temperature control in order to get flowering.

"In our studies, we have included aquatic and marine organisms. They may perform dual functions: they act as an aquatic recycling system for sodium chloride, and they will produce biomass as food.

"Other features include a soil-less culture, cause it reduces mass and allows control over the nutrient environment; modular environments; computerized environmental control; multiple cropping, inter-cropping; and pest disease control using thermal-sterilization."

## Launches slated for '79

Continued from Page 1

Westar-C, a communications satellite, will be launched from Cape Canaveral on a Delta in July and another communications satellite, Intelsat V-A, will be launched in August from Cape Canaveral on an Atlas Centaur for Comsat Corp.

One of NASA's scientific satellites, High Energy Astronomy Observatory-C (HEAO-C), will be launched in September on an Atlas Centaur from Cape

Canaveral. Another NASA satellite, this one in the applications area, Magsat-A, a magnetic field satellite, is also scheduled for September from Vandenberg on a Scout.

The Solar Maximum Mission (SMM-A), a NASA scientific mission, is scheduled for October on a Delta from Cape Canaveral and Navy 21, on a Scout, from Vandenberg.

In November, another communica-

tions satellite, Intelsat V-B, will be launched for Comsat Corp., on an Atlas Centaur from Cape Canaveral.

The year will close out with two launches in December: a weather satellite, NOAA-B, for the National Oceanic and Atmospheric Administration on an Atlas-F from Vandenberg; and RCA-C, a domestic communications satellite for RCA on a Delta from Cape Canaveral.