

NASA invention applies heat to cancers

RF applicator used in treatment at St. Joseph Hospital

Cancer research has shown that heat treatments can destroy cancer cells without harm to adjacent healthy tissue. Methods for producing heat have grown steadily in sophistication—starting in 1893 when doctors induced fever in cancer patients to today's techniques such as ultrasound, radiated microwave, and blood perfusion.

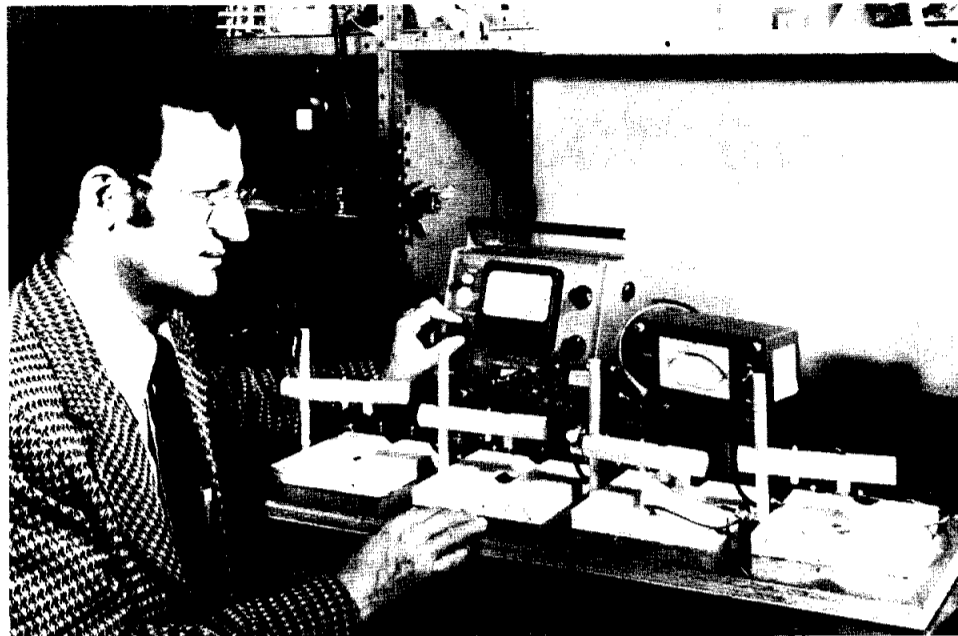
In mid-1978 LBJ Space Center signed a Memorandum of Understanding with the Stehlin Foundation for Cancer Research at St. Joseph Hospital in Houston, saying the space center will provide technical support for the foundation's work with heat, or hyperthermia, treatment of cancer.

Tumors will heat faster than healthy tissue, perhaps because they hold more fluid to contain the heat and fewer blood cells to carry the heat away. Tumors have restricted blood flow. So, heat concentrated on a cancerous area can destroy cancer cells without harming healthy tissue nearby.

The challenge for JSC engineers was to improve radio frequency (RF) heating techniques being used at the Stehlin Foundation. First step was to develop a machine for treatment of small animals.

Then after a year of tests on mice, JSC scientists developed an advanced RF hyperthermia system for treatment of humans.

"The human RF system has performed



Krishen with small animal device—finding optimum frequency

successfully on several cancer patients," said Kumar Krishen of JSC's Experiment Systems Division. Dr. Krishen is technical coordinator of the project.

"Developing the advanced human RF hyperthermia system involved acute concerns about safe and reliable performance."

For work on the machine to be used on humans, Dr. Krishen's team called for assistance from JSC's Safety, Reliability,

and Quality Assurance Directorates. SR&QA monitored and reviewed the overall design and performance of the equipment.

In January 1980 the team delivered an experimental human treatment system to St. Joseph Hospital.

"The RF system for human treatment uses a gradual buildup of power to its preselected value," Dr. Krishen said. "Two pairs of sequentially driven

electrodes provide more concentration of RF power at the tumor and disperse heat at the skin."

The team also developed a feedback control which allows regulation of temperatures within a specific area to an accuracy of 0.2 degrees Centigrade.

One area of concern was heating of the skin below the electrodes which in some cases causes burns. "Our approach was to circulate temperature-controlled water through metal tubing soldered onto the back of flexible electrodes," Krishen said. "This scheme has been found to be very useful."

A data printer added to the system records temperatures and power levels as a function of time.

"The small animal experimental system we first designed yielded very valuable data," Dr. Krishen said. After trying different combinations, the ESD team came up with an optimum size and shape for the applicator. They determined the maximum heat the animal's body could tolerate, 41 degrees Centigrade, and gave the applicator a convex shape to keep "hot spots" from coming into contact with the skin.

"A notable feature of the small animal system is the ability to apply up to 50 watts at five frequencies from three MHz to 30," Dr. Krishen said. "This helps us to indicate the advantages, if there are any,

Please turn to Page 2

Women in Aerospace...

Today women pilot high performance jet aircraft in the military. Women are engineers in Mission Control Center and they fly commercial jets with major air lines. Only five years ago, these occupations were for men only—women have made remarkable progress building careers in the aerospace industry.

March 12 and 13 JSC is hosting a symposium, "Women in Aviation and Space," to examine women's advancements in these professions—both to applaud the progress and to locate and discuss any remaining roadblocks.

The Aviation/Space Writers Association and the American Institute of Aeronautics and Astronautics are sponsoring the symposium, with support from the Federal Women's Program Committee at JSC.

Some of the sessions may ignite heated debate. For instance, one member of the "Women in the Cockpit" panel is convinced that women are physically incapable of piloting commercial aircraft. With him on that panel will be female pilots from Continental and Frontier Air Lines.

Another panel, "Transition: You Can Change Careers," will feature women who broke from tradition mid-career: a former nurse who is now studying engineering; a former secretary who is now a NASA Contract Specialist.

The symposium opens Wednesday, March 12, at 1 p.m. with a series of speakers and presentations in the Building Two Auditorium. Thon Griffith, International President of the Ninety-Nines, Inc., will give the keynote address. (The Ninety-Nines is a professional organization for women pilots founded in 1929 by Amelia Earheart.)

Among the women speaking will be a T-37 instructor who is an Air Force Cap-

tain, Carolyn Huntoon who is Deputy for Personnel Development in the Astronaut Office, a Director of Consumer Affairs with United Air Lines, and the president of an aviation firm in Houston.

The two panels will take place Thursday the 13th in Building Two Auditorium from 9 a.m. to noon. Further information is circulating to employees through in-house announcements.

20 more to JSC next week competing for astronaut slots

The second group of 20 astronaut applicants will report to JSC March 10 for a week of physical exams and interviews.

Those among the 20 who are currently working at the space center are: Marsha Ivins of the Spacecraft Design Division

and Capt. Jerry L. Ross who is with the U.S. Air Force at the space center.

Applicants selected from those screened will begin a year's training as astronaut candidates in July of this year.

Space Shuttle Status

Main engines passing tests; new target November

November 1980 is the current target for the first Shuttle launch date, and all working schedules are geared for that month, according to John Yardley, Associate Administrator for STS Acquisition.

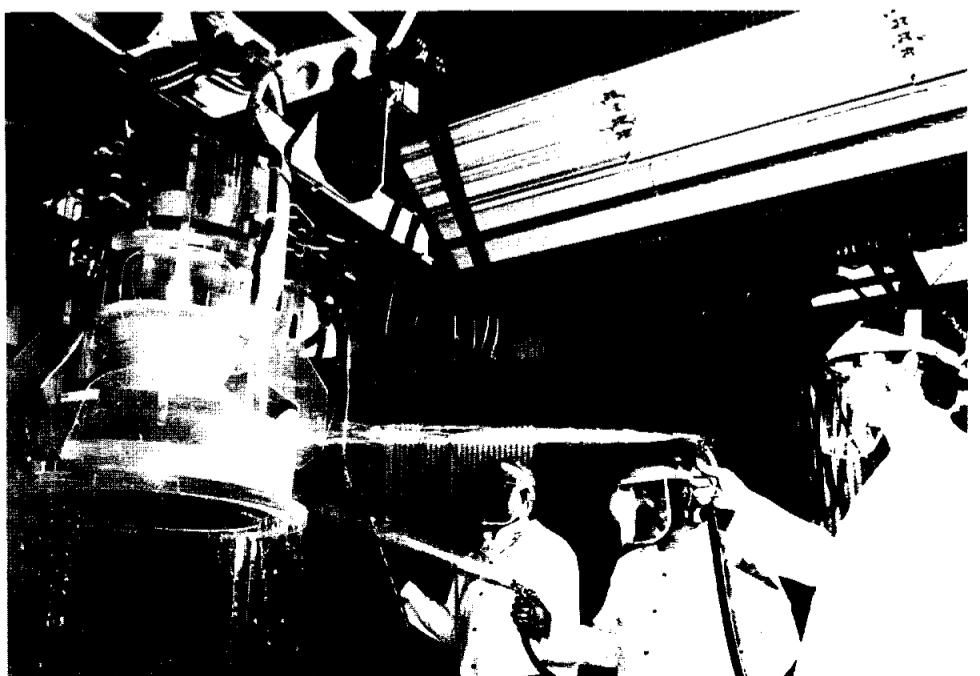
He added that the actual projection for the launch date is between November 1980 and March 1981.

Mr. Yardley was speaking at a press conference at the Cape February 20.

More recently, main engine testing has reached a "milestone." A second full duration test firing of the three main engines went a full 551-seconds, meeting all test objectives. At least five more firings of the main engine cluster are required before the first orbital flight of the Shuttle.

July 31 is the target date for moving *Columbia* out of the Orbiter Processing Facility and into the Vehicle Assembly Building. The date for mating the Solid Rocket Boosters and the External Tank to the Orbiter is no earlier than June.

The SRBs are ready for mating, but the ET is undergoing some minor "tune up" work.



Rocketdyne employees in California hose down Shuttle main engine thrust chamber liner. They are between cycles of applying layers of nickel to protect liner from pressure and heat. (Rockwell photo)



The audience at Black History Program February 15

The Sports Scene at JSC

Golf tournaments in heated competition; tennis club on courts, open for members

The JSC Golf Association held its warm-up tournament on a cold Washington's birthday at Willowisp Country Club. This was a team event using Stableford scoring.

Our hottest shooters were the first place team of **Milt Heflin, Reggan Redman, Vic Zuber, and Bert van Wagoner**. The next teams (both missing players) were (second) **Wakie Dunham, Daryl Gress, Betty Gabel,**

and (third), **Joe Nick Villarreal and Tom Dennis**. Fourth place consisted of **Ted Breezy, John Jones, Al Ligrani, and Jim Hoffman**.

Closest to the hole on par-threes were **Bob Ross, John Jones, and Wakie Dunham**. **Jerry Shinkle** won a ball by being the only person to hit the green on a par three set up at about 220 yards.

JSCGA's competitive schedule of monthly tournaments begins in March at Goose Creek. Other tournaments will be played at Tejas, Wortham, Brock Park, Newport, Lake Houston, Texas City Bayou, and Atascocita. A mid-summer fun tournament will be at Woodlands.

New members are still being accepted. Anyone interested should contact JSCGA president Mike Gremillion at 3753.

And on the courts...

The JSC Tennis Club held its first tournament of the 1980 season on February 22, 23, and 24 at the Friendswood Racket Club. The results of the tournament were **Hugh Burris** defeating **Bill Stetzer** 6-3, 7-6 in Men's Championship; **John Norris** over **Fred Hermann** 6-1, 6-3 in Men's A; **Homer Ahr** over **Abhijit Gadgil** 6-3, 6-2 in Men's B; and **Mike Tracy** over **Bill Schoolmeyer** 6-1, 5-7, 6-3 in Men's C.

In the Women's division it was **Ann Williams** over **Ruth Damoff** 6-4, 6-4 in Women's Championship; **Leona Kain** over **Dianna Manner** 3-6, 6-4, 6-4 in Women's A; **Lambert** over **Lana Highland** 6-1, 6-3 in Women's B, and **Linda Cassetti** over **Carolyn Knight** 6-2, 6-1 in Women's C.

For Tennis Club membership information contact Lyle White at 483-2686.

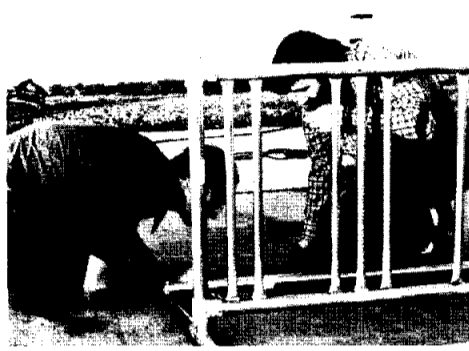
Attention All Coops, Come to a Party

Come meet your fellow coops and join in the celebration of St. Pat's. The fun begins at 9 p.m. on March 14 in Clear Lake Forest. Contact Judy Gast, x3681, for more party details. Remember—wear green.

Bulletin Board

"We Need Your Support" —JSC Bike Club

The JSC Bike Club is small, but growing every week. We need people who are interested in making cycling safe—even if you don't cycle right now. Safe cycling in the Bay Area means change: road striping, bike paths, bicycle racks (a new one has just been installed at the JSC Credit Union), but most of all, public involvement. Together, we can do it. Don't forget our first Bike Ride on March 9. We will meet at 9 a.m. (not 10 as previously stated here) at JK's Cycle Shop for a ride to Morgan's Point and return. Membership is free to all. Call Brian Morris at x-5293, or Sheldon Tucker at x4107.



Sheldon Tucker and David Rainey installing new bike rack at C.U.

As the Skies Get Bluer it's Time To Set Sail in the Bay

Basic and Intermediate Sailing Courses sponsored by the Clear Lake Sailing Club, the Lake Houston Sailing Club, and Lido Fleet 40 will be offered for the 13th year this spring. BASIC SAILING will be presented in two series: the Friday night series will be on March 28, April 4, and April 11—7 p.m. to 9:30 the Saturday series will be March 29, April 5, and April 12—9:30 a.m. to noon. INTERMEDIATE SAILING will be held on Saturdays April 26, May 10, 17, 24, 31, and June 14—9:30 a.m. to noon. Classes will be at the Clear Lake Park Building at Harris County Park on Clear Lake, and included are on-the-water demonstrations. Cost is \$15 for a family (up to four) for Basic, and \$25 for Intermediate. For further information, call 488-3921.

Where and When is

The Easter Egg Hunt This Year?

The JSC EAA Easter Egg Hunt will be Saturday, March 29 at 10 a.m. at the Gilruth Center, for children two to eight years of age. Each child is to bring his own basket. Tickets will be \$1 each, and will go on sale on or about March 10.

On Sale at the JSC Exchange Store

(Store hours 10 a.m. to 2 p.m.)

Dean Goss tickets: \$10 single, \$20 couple (regular \$14.50)

ABC Theatre Tickets: \$2 ea.

General Cinema Tickets: \$2.40 ea.

Astroworld: Free coupon for \$2.50 discount on Astroworld tickets. (Coupon good from March 8 to April 6.)

Williams, 3/20

"A Geologist's View of Lunar Resource Utilization" or "Mining the Moon" will be the topic of an AIAA joint meeting with Sigma XI, Thursday, March 20 at the Holiday Inn on NASA Road One.

Richard J. Williams, Manager of JSC's Geochemistry Branch, is guest speaker. The program begins at 8 p.m. For those who attend the dinner at 7, reservations must be made by March 17. Call Edith Todd at x4121. Social hour starts at 6.

El-Baz, 3/18

Tuesday March 18 Farouk El-Baz of the Smithsonian Institute will deliver a lecture, "Journey Into Northern China," in the Building Two Auditorium at 8 p.m. The speech will be based on a trip he made with the National Geographic Society last July into China to study land forms of the deserts and to lecture on applying remote sensing to desert research.

Dr. El-Baz is Research Director of the Center for Earth and Planetary Studies at the National Air and Space Museum. He will be in Houston for the 11th Annual Lunar and Planetary Science Conference.

Treatments From Page 1

of treating various cancer types at a specific frequency."

The small animal system is used currently to establish human protocols and to study the effects of hyperthermia at the cell level.

"The challenge now is to deliver the heat with minimized side effects," Dr. Krishen said. "We are investigating the possibility of transmitting the radio waves through the patient with electrodes that do not come in contact with the skin. They will function somewhat like antennae."

This assignment was a particular challenge for Dr. Krishen and his co-workers, since their specialty is observing the Earth's weather, soil conditions, and agriculture using microwave data from aircraft and satellites.

Dr. Krishen's team coordinated its work with JSC's Medical Sciences Division, who interfaced with physicians at the Stehlin Foundation.

Jim Witter dies

Jim Witter, Assistant Cafeteria Manager in Building Three, passed away February 16, 1980. Jim had served JSC employees and visitors in that capacity since 1973. He also served as a Navy gunner in the Pacific aboard several ships during WWII. Jim will be missed by co-workers and the other JSC employees.

Swap Shop, from Page 3

Miscellaneous

Attention Oiler fans - 1980 Columbia Blue Cartoon Calendar, \$4.95. For more information call Tim Allen x3031 or 332-2279 after 6.

Tool box for wide bed pickup, \$75. Fiberglass canoe, \$115. Kayak, \$145. 334-1983 after 6.

Sears 48 Car battery 12V size 24C 6 7/8W X 10 1/4L X 5/8H. Purchased Jan 1979, cost \$49.99 sell \$30. 488-1550

Vinyl motorcycle cover, fits large motor cycle with fairing and saddle bags, \$35. Ken x3229 or 944-6450.

Firewood, Oak, you haul it, \$35 per pickup load or will sell in larger quantities. Dave Saucier 585-5816.

On any other day in Weedeaters...

On any other day of the year if a person were to go to Foley's at Alameda Mall to look for a Weedeater, he would find them on the second floor across from Housewares next to the lawnmowers; but on February 23 in place of the Weedeaters was the Bay Area Refuse Firm Chili Team, and the ContraBand from the Electrical, Mechanical, and Environmental Systems Branch of Flight Control Division.

The chili team, still cooking after the untimely departure of chilihead Sy Liebergot, was invited by Foley's to be one of several teams making appearances at stores in and around Houston as part of its Go Texas Week celebration. Rookie chilihead, Conley

Perry, debuted a new recipe at the event. Cooking began at 10 a.m., and free samples were served to anyone unfortunate enough to be in the Housewares area at 1 p.m.

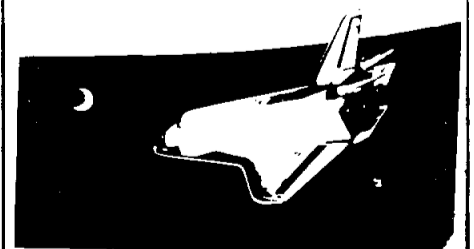
The activities of the day began at 11 a.m. on the east side of Foley's with a flag raising ceremony conducted by the 12-member ContraBand, the chili team's semi-all-purpose entertainment troupe. The band then set up to serenade unsuspecting passers-by in the Weedeater section. A smaller strolling group of musicians wandered the aisles of the department store attempting to lure the innocent and ignorant to the simmering cooking-pot upstairs.

Queried about the significance of the Foley's event EMESB Chief Rod Loe

groaned, "It's the first time I've had to eat our chili without a beer. I'm lucky to be alive." Trombonist Milt Heflin was looking to the future, however: "ContraBand views Foley's as a stepping stone. Our long range goal is to play the Lingerie Department of Nieman-Marcus."

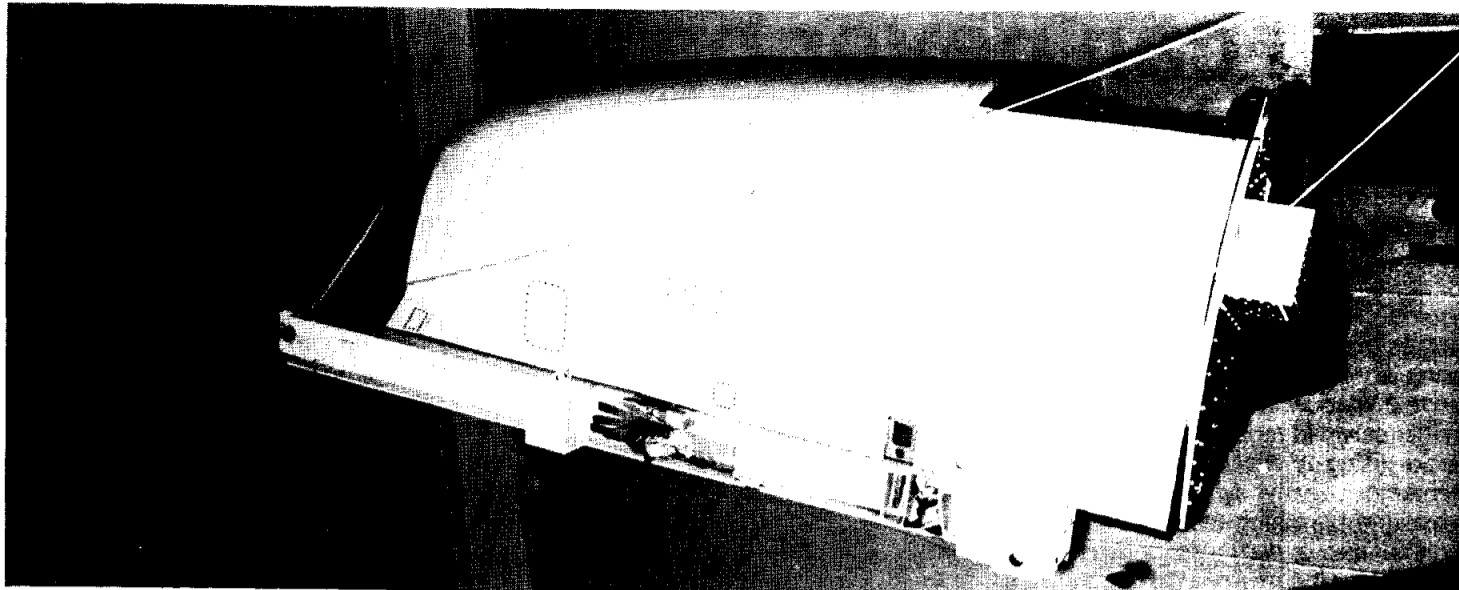
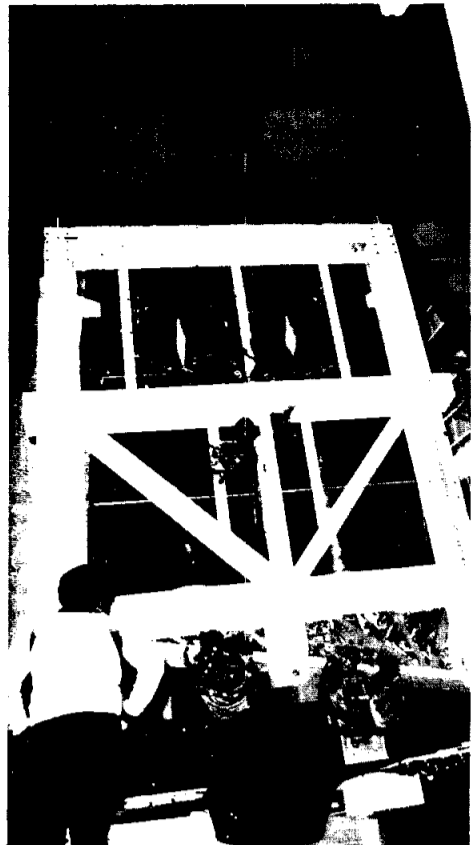
In the near term, both the chili team and ContraBand will participate in the Second Annual FOD Chili Cookoff on March 22 at the Gilruth Center. People with weak stomachs are warned to stay clear of the area.

Roundup deadline is the first Wednesday after publication.



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 all Space Center employees.

Editor Kay Ebeling



OMS Pod test article is installed in Building 49 for acoustics testing

You think your neighbor's stereo is loud...

Photos by
Ralph Payne
and Jack Jacob

by Karen Johnson

TEST CONDUCTOR: "Bring up master gain."

POWER AMPLIFIER CONTROL: "Master gain is up."

T.C.: "Cycle up to holding level."

DATA: "TC, all instrumentation is ranged."

T.C.: "Roger, go to full modulation."

COMPUTER CONTROL: "Showing modulation now."

The massive building quivers slightly and a muffled rumble can be heard from below the control room. The test team, engineers, technicians, and observers all seem to hold their breath for the duration of the test run. Weeks of preparing the test article and facility culminate in these few minutes, when an acoustic test in the Vibration and Acoustics Test Facility, Building 49, begins.

Before the Shuttle can fly in space, it must be certified through an extensive program which includes acoustic testing.

Under the Orbital Structural Fatigue Test Program, these runs simulate the acoustically-induced loads that the Shuttle Orbiter experiences during launch and ascent. These loads can cause such failures as structural fatigue, tile damage, broken rivets, or propellant leaks.

A test article, a representative portion of the Orbiter which is built to flight configuration, is subjected to the launch and flight acoustic environment in a large reverberant chamber. The runs last from a few minutes to half an hour. After each sequence, the article is inspected for any structural or configuration changes.

By the end of a typical test, the article will have experienced an approximate accumulation of stress from 500 missions.

A typical sound pressure level produced for these tests is 160 decibels, which is orders of magnitude greater than the most powerful rock concert sound system. To produce the environment, two compressors of 4000 and 4500 hor-

sepower supply air at 21,000 to 27,000 cubic feet per minute and 28 to 32 pounds per square inch to air modulators which are connected to acoustic horns.

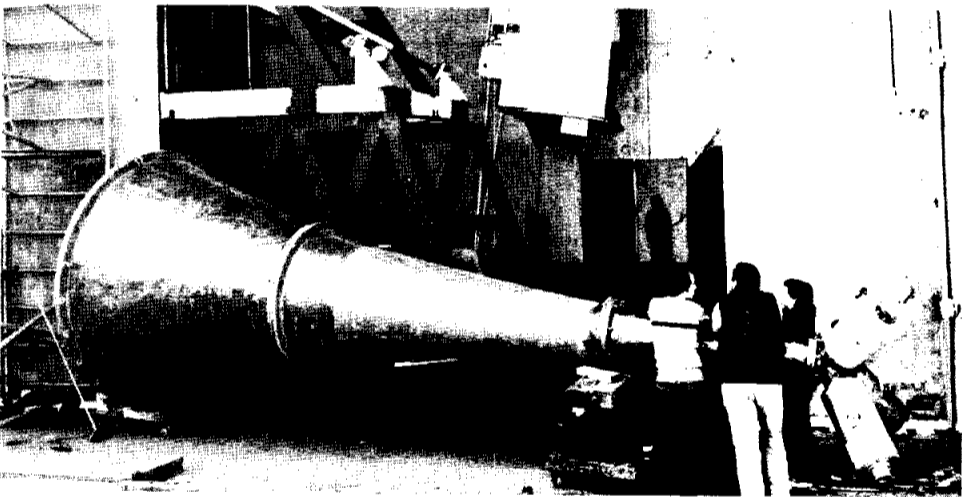
It takes a great deal of power to "fire up" this facility. In fact, during summer months, runs take place only on the night shift to avoid interference with center electrical demands during normal work hours.

Presently being prepared for testing is the OMS Pod (Orbital Maneuvering Subsystem). This test article differs significantly from recent ones such as the Nose Cap or Wing Leading Edge. For example,

the OMS Pod test article will contain 2000 gallons of propellant simulants (alcohol and freon) and it will be pressurized at 100 to 4600 pounds per square inch depending on the system or component. Also, in order to produce localized acoustic fields, two "hot spot" horns will be suspended to within a few inches of the article.

Testing begins in March and is to continue for three weeks.

After Orbiter testing is complete, other acoustic tests in support of the Shuttle program will include anomaly investigations and payload dynamic testing.



Scientists to analyze new planetary data

Lunar Planetary Conference to cover year's encounters, more lunar samples

The Year of the Planets will be the theme for the 11th annual Lunar and Planetary Science Conference March 17 through 21 at JSC. Concurrent sessions in the Visitor Center Auditorium and two halls at Gilruth Center will cover results from the numerous planetary encounters that took place in 1978-79.

The science sessions, during the day, will cover recent reports from data on the Jupiter moons obtained by Voyager, new data from Pioneer Venus, recent analyses of data from the Viking orbiter and lander which is still transmitting from Mars, and details on meteorites recently collected from the Antarctic.

Two evening sessions will cover topics of interest to the general public. Monday at 8:30 p.m. a panel will discuss "Application of Remote Sensing Techniques" in Room 104 of Gilruth Center. Wednesday at 8 p.m. there will be public lectures on the Galilean satellites, the planets, and "Hunting for Meteorites in Antarctica"—in the Building Two Auditorium.

The United Nations' "Draft Agreement Governing the Activities of States on the Moon and Other Celestial Bodies" will also be a topic at the Wednesday evening session.

Two groups of lunar samples are being given special attention at this year's conference: complex fragmental rock (breccias) from the light-colored lunar highlands are being examined to understand the early history of the Moon and the Earth. Long cores of "lunar soil," the

powdery rubble that covers the mare's surface, are being carefully dissected to trace the history of the Sun—a history written by tiny solar atomic particles that have been trapped in the lunar soil for millions of years.

New theoretical, experimental, and analytical studies of the Moon, based on lunar sample analyses and on continued Apollo data analysis, will be the topics of several conference sessions. Detailed models of the Moon's interior structure

and composition are being developed for comparison to Earth and other planets.

The conferences, begun in 1970, were originally used to share the knowledge gained from the lunar samples returned by Apollo missions. The first six Lunar Science Conferences were almost entirely devoted to lunar studies.

More recently, lunar research has become increasingly important for helping to understand the other planets of the solar system, and the last three con-

ferences included much more information about comparative studies of such other bodies as Mercury, Venus, Mars, and the asteroids.

The name of the conference has been changed to "Lunar and Planetary" to reflect the continuing trend for combined studies in planetary exploration.

This year, "poster sessions," in which authors of papers will use graphic displays to discuss their work informally during breaks in the schedule, will be featured for the first time. The posters will be displayed in the Rec Center gym.

More than 700 scientists from all over the world are expected to attend this year's conference.



Apollo 17 photo

AAS passes hat

The Viking landers can continue sending weekly bursts of data and pictures from Mars until 1987. In order to assure funding, and to show public support for the project, The American Astronautical Society, San Francisco Section, is taking contributions to "The Viking Fund." Their goal is to raise \$1 million by July. Contributors (minimum \$1) will receive an open invitation to the presentation of the Fund to NASA in Washington on or before July 20, 1980, the fourth anniversary of Viking's Mars landing. Send to The Viking Fund, P. O. Box 7205, Menlo Park, CA 94025.