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GODDARD NEWS

GODDARD SPACE FLIGHT CENTER / GREENBELT, MARYLAND

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S-6 Successfully Begins Atmospheric Research Mission

Goddard's atmospheric structure satellite (S-6) commenced its important and eagerly awaited mission of atmospheric research on April 2.

The 410-pound spacecraft with a 35-inch diameter and a stainless steel shell 25/1000ths of an inch thick was launched in near perfect fashion from Cape Canaveral into an orbit of 920 kilometers (780 miles) apogee, and 255 kilometers (215 miles) perigee, with a 57½-degree inclination.

The two-day count down was nearly "flawless—there wasn't a hold," said N. W. Spencer, project manager.

The launch was performed by the highly successful Goddard Delta launch vehicle (Goddard News, March 18), which recorded its 16th straight success.

Aboard the spacecraft, all systems are functioning properly Mr. Spencer said. Experiments to measure the density, composition, pressure and temperature of the atmosphere are providing extensive data over geographical areas of the earth never before probed. Similar U.S. atmospheric measurements in the past have been conducted by sounding rockets and confined primarily to limited areas over Wallops Station, Fort Churchill, Canada, and White Sands, N. M.

Two Read-Outs Daily

Immediately after launch, Goddard experimenters were receiving the first atmospheric findings in real-time as the spacecraft sped over the Blossom Point, Md., satellite tracking station.

An average of 2 daily passes of the satellite over Blossom Point are read-out and the data transmitted via microwave link to the project's digital computer operation in building 2. There decomutation and print out is performed in rapid fashion and the scientific data made available to Goddard scientists without delay.

In the first 6 days, the spacecraft was commanded on 75 times for an estimated 4 minutes per pass, compiling a record 5 hours of total read-out in the process.

There are two principal advantages to real-time read-out, in the opinion of Mr. Spencer. One is that it enables project personnel to make an early and continuing evalution of the spacecraft's performance. The other is that it provides scientific data to Goddard experimenters quickly.

Eight primary detectors are on S-6. They consist of

- two neutral mass spectrometers to count electrically neutral particles;
- four vacuum gages to determine atmospheric pressure along the satellite orbit, and
- two electrostatic probes to gauge the temperature of electrons and the density of positive ions along the orbit route.

Atmospheric constituents have been measured during the past four years by sounding rockets, Sputnik III, Explorer VIII and NASA 8.23. Explorer VIII provided, through ion energy measurements, the first indication of the presence of helium.

Javelin 8.23 positively identified helium and hydrogen ions in the atmosphere.

Measurements of the diurnal variations of neutral particle density were recently made by a Discoverer satellite. These data showed a factor of four variation in density on the "day" side of the earth as compared with the "night side," Mr. Spencer said.

He said S-6 will provide even more precise information concerning high altitude regions. S-6 carries an aspect systems to determine the orientation of its spin axis against a reference plane. This system is designed to use either the sun, moon or earth as references.

In addition, the craft contains a solid-state pulse code modulation telemetry system with a power output of 500 milliwatts. It is capable of supplying 45 different channels of information in digital form.

Launch was performed at night, during a 3-hour launch window to optimize the spacecraft orientation for aspect measurement.

A sensor aboard "locked on" the moon and later switched onto the sun to provide earth-sun or earth-moon two-point references for correlating the scientific data.

First results of data transmitted by S-6 will be made known during the upcoming meeting of the American Geophysical Union. The conference is scheduled for Washington, D.C., April 17-20.

S-6 experimenters Dick Horowitz of NASA headquarters and Larry Brace and George Newton of the physics branch study first real-time data. Not pictured are Carl Reber and project manager N. W. Spencer, the other experimenters.

Additional pictures on page 3.

Eleanor Pressly Chosen One of 6 Award Winners

Eleanor C. Pressly, head of the vehicles section of Goddard's spacecraft integration and sounding rocket division, has been chosen as one of the six outstanding women in government service to receive the third annual Federal Woman's Award.

Winners were chosen for their contributions to the quality and efficiency of the career service of the federal government, for their influence on major programs, and for personal qualities of leadership, judgment, integrity and dedication.

Miss Pressly was cited for her pioneer work in the development of sounding rockets and her demonstrated organizational ability in scheduling and coordinating launchings of sounding rocket vehicles in support of upper atmospheric research. She transferred to NASA from the Naval Research Laboratory in 1958, and was promoted in 1962 to her present position at Goddard.

Miss Pressly developed the Aerobee Jr. sounding rocket, co-developed the Aerobee-Hi 150, and directed improvement of the Aerobee-Hi 150A, which were extensively used during the International Geophysical Year.

As head of the vehicles section, she manages Goddard's operations for sounding rockets. She initiates procurement of the ten types of vehicles in current use, manages a budget of approximately $3 million annually, and coordinates the entire program.

From Moon, Earth Will Be a 'Magnificent Spectacle'

Dr. John A. O'Keefe is assistant chief of Goddard's theoretical division. A graduate of Harvard with an A.B. and the University of Chicago with a Ph.D., he served as a mathematician with the Army Corps of Engineers from 1942 to 1958. Dr. O'Keefe has been a leading exponent of the theory that tektites come from the moon, and is the author of an upcoming book on tektites. He also is responsible for several significant "firsts" in the fields of astronomy and geodesy—first use of star occultations to measure long distances over the earth; first measurement of the flattening of the earth from the satellites and first measurement of the odd harmonies in the earth's gravitational field. Highlights of an interview with Dr. O'Keefe featuring his observations on topics of current interest concerning the moon are presented here.

Do fairy castles exist on the moon?

Yes, I think the suggestion by Bruce Hapke that small particles falling under lunar conditions would build themselves into a fairy castle structure is very likely to be correct. It explains why the peculiar photometric properties are observed under such a wide variety of circumstances both in the level areas and in the mountainous areas. It suggests at least to me that some of the deposition took place from a gas, and I think that perhaps the idea of Mrs. Cameron and mine that ignimbrites have played an important role in lunar history may be relevant here. An ignimbrite is a deposit of volcanic ash which is formed by the process of fluidization when a small amount of residual gas cushions the particles from each other and allows a mass of ash to flow like a watery liquid.

Is it possible that temperatue extremes on certain parts of the moon are less intense than on other parts?

The temperature extremes will be very unimportant at a distance of a few inches under the surface. A nearly stable temperature regime of about minus 30° F will be found a few feet down. In addition, it appears quite possible to me that the temperature extremes in the polar regions will be much less important than elsewhere. Unfortunately the average temperature also will be lower.

An area 700 miles northeast of the moon's South pole is shown on this recent telescope view of the moon's surface. The area shown is near the eastern edge of the side of the moon facing the earth.

Where did the moon come from?

The moon may once have been a part of the earth's mantle. This is suggested by the fact that there is a strong chemical resemblance between tektites and the crust of the earth. If so, it is possible that the moon separated from the earth under the influence of centrifugal force caused by rapid rotation of the earth. This must have happened after the formation of the core, if it is really true that the core is composed of heavier elements than the crust. Conceivably some of the stresses in the deep interior of the earth are survivors from this period of time.

What will the earth look like from the moon?

From the moon the earth will have a disc which will be 4 times the size and 16 times the area of the moon. It will be about 10 times as bright per unit area as the moon. It will be largely blue and will be clearly a magnificent spectacle. The earth as seen from the moon will display phases like those of the moon. When the moon as seen from the earth is full, then the earth as seen from the moon will be new, i.e., nearly dark. Around the dark side of the earth, the airglow will be visible; the lights of major cities also will be observable. On the day side, cloud formations will be the most important features. Here and there will be glimpses of land areas, chiefly deserts.

Our first astronauts may land on the moon at night, explore by "earthshine." What advantages are there in this procedure?

On the moon it is extremely difficult to get rid of the heat which is generated by engines or by life processes in people. The air is not there to cool, water cannot be expended, and the ground is like a blanket which stops the movement of heat. It is believed that at night when the ground is quite cold and when there is no problem caused by heat radiated by the sun, it may be possible to keep objects cool. The problem is one of the most acute of those which face explorers of the moon.

About all that scientists agree on is the moon's surface is not made of green cheese. What theory about the surface do you find most acceptable?

I think that the surface of the moon is chemically much like the surface of the earth, being essentially an acid-igneous rock chemically like a terrestrial granite. I think that the maria will be found to be ignimbrites, i.e., ash deposits which are loose at the surface, then punky and sintered and finally welded at the depth of a few hundred feet. Obviously it will be pock marked with craters. On the other hand, the radar information makes it clear that the pock marks will cover only a minority of the total surface. Owing to the fairy castle structures and possibly also to the presence of small glass beads, optical phenomena will be produced at the moon's surface which means that each astronaut will see a private aureole or halo around the shadow of his own head.

What will be the greatest danger man will face on the lunar surface?

I think the greatest danger that man will face on the lunar surface will be carelessness or ignorance. A vacuum environment is a hostile and unforgiving environment. Carelessness with air locks or rashness in moving about the surface can lead to disaster. I do not think that there are any insuperable dangers.

In your opinion, is life present on the moon?

The extremely hostile environment present on the moon precludes, in my opinion, finding life in any form.

Would a landing on Mars be of more value than a landing on the moon?

I do not think that a landing on Mars would be of more value than a landing on the moon. The nearness of the moon will make it of great importance to us on earth for a long time to come, partly because of the role which the moon must have played in the earth's early history, partly because of its increased accessibility and partly because in a given unit of time it is possible to send approximately 10,000 times as much information from the moon as from Mars. Baltimore may not be as important a city as London but it is much important to us here in Washington, as a quick glance at the paper will show.

Why is the study of the moon of interest to us?

I think that the study of the moon will be important to us on the earth because it will afford us a chance to see how geologic processes operate in a medium which is different from that of the earth. We may study the processes which are involved in the formation of impact craters. These craters are probably quite abundant on the earth but so far we have recognized only a few. Perhaps studies of the moon will show us how to recognize more. Finally we can hope that the process by which the moon was formed may have left some mark on the earth. Conceivably some of the distortions in the lower mantle of the earth to which various people have drawn attention are in some way related to the formation of the moon.

Radar Astronomy Provides New Method for Exploring Universe

Dr. Gordon H. Pettengill has been associated with the Lincoln Laboratory Millstone Hill radar facility since its inception in 1957. With an interest in many aspects of radio physics, this facility has been used for several investigations of the moon as well as a radar study of the planet Venus in 1961. Dr. Pettengill is a native of the Boston area, having attended the Massachusetts Institute of Technology as an undergraduate. He received his Ph.D. in physics from the University of California at Berkeley in 1955. Dr. Pettengill spoke on Radar Investigations of Lunar and Planetary Surfaces at Goddard's weekly colloquium on Friday.

What are the aims of a radar investigation of the moon and planets?

Radar astronomy is a very young, still small, but rapidly growing science. Although it dates from the first detection of lunar echoes in 1946, it was not until the development of more powerful radars in the 1950's that important information was gained on the radio-scattering properties of the moon. First echoes were obtained from the sun in 1958, from the planet Venus in 1961, from Mercury in 1962, and from Mars in February of this year.

Radar astronomy requires somewhat more sophistication, in certain technical respects, than radio astronomy. But because the investigator has control over or full knowledge of the outgoing waveform, he may obtain a great deal of information from a study of the received echo signals.

The measurement objectives of a radar investigation would include determination of the distance of the echoing body by the time elapsed between transmission and reception of the signals and its radial motion from the frequency or doppler shift of the returned carrier wave. Furthermore, a careful study of the time and spectrum spreading of the echo gives clues as to the size, surface roughness and rotation rate of the target. Finally, by the use of two simultaneous signals of widely separated frequencies, a determination of the electron content along the propagation path is possible. These measurement possibilities are very different from those available to purely optical approaches (excepting LASER studies) and in almost every case yield new information.

What have radar observations found out about the flatness of the moon's surface?

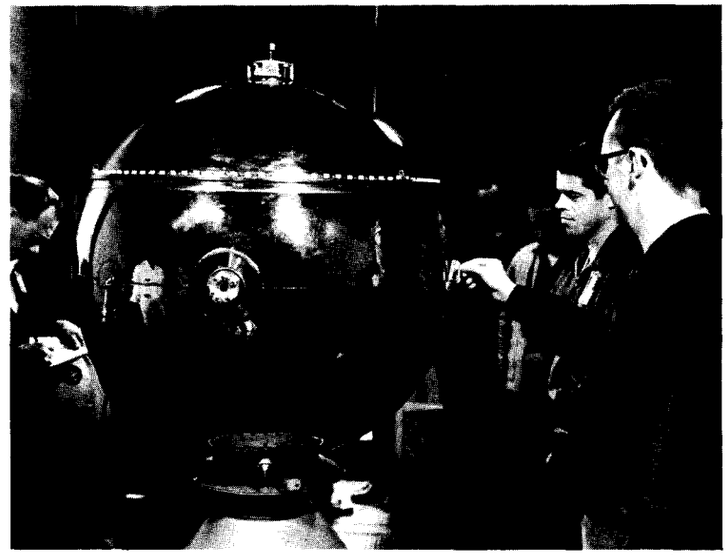
One of the biggest surprises to come out of the early serious radar studies was the comparative smoothness of the moon's surface at radio wavelengths, i.e., at a scale of a few feet. This behavior yields an intense highlight in the center of the lunar disc where the surface is nearly at right angles to the incident radio waves and can reflect the energy directly back to the observer. The situation at optical wavelengths, however, is in marked contrast, as anyone can verify by looking at the disc of the full moon. Apparently the surface is very rough on a small scale, much as is freshly fallen snow or beach sand, while appearing quite smooth to an observer who cannot make out the individual flakes or grains. The mean lunar slope varies slightly with the wavelength used to measure it, but is approximately 6 to 10 degrees from horizontal.

What is the current situation concerning our knowledge of the orbits of the planets?

Astronomers have studied the motions of the planets around the sun for many hundreds of years, and have accumulated a great body of precise angular observational data. By fitting these data to the gravitational theories of Newton and Einstein, relatively precise orbits could be obtained for the planets in terms of an internal "astronomical" unit. While these orbits yielded values for the separation of the planets one from another at any given instant of time with high relative precision in this unit—approaching a few parts per million—the absolute separation in terms of terrestrial units such as the mile or kilometer was relatively poorly known—with errors approaching one in several thousand.

Radar measurements of the distance and velocity of Venus made in 1961 and 1962 have now permitted the absolute distances to be specified as accurately as the planetary orbits—or in some cases the velocity of light—are themselves known. In fact, it is certain that the recent series of radar measurements will prove helpful in further improving the planetary elements.

Picture Highlights of S-6 . . .



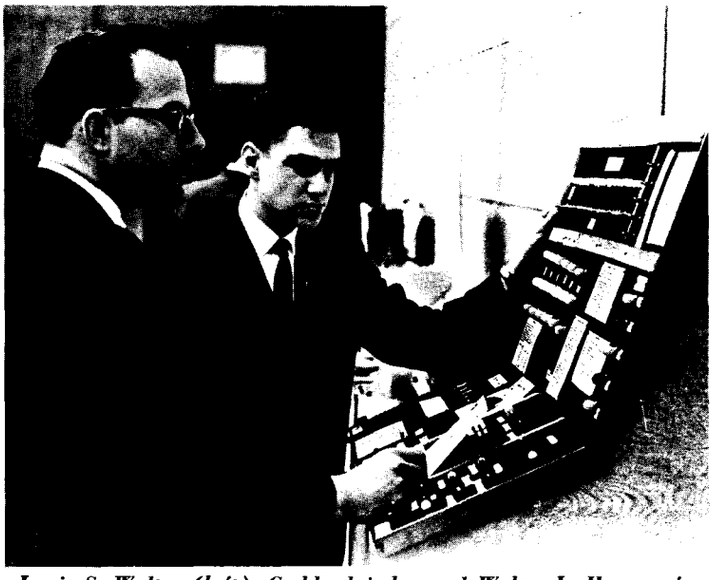
Mating of the S-6 satellite to the second stage of the Delta rocket is supervised, on the left, by Truman Aehle of the mechanical systems branch and, on the right, by Jim Cooley, physics branch, and John Webb, mechanical systems branch. Two Douglas aircraft personnel are in the background. Location of the picture was atop the gantry at pad 17 at Cape Canaveral.

At Goddard S-6 project personnel discuss computer programming being used in real-time processing of S-6 telemetered data received from the Blossom Point, Md., tracking station. Shown are Chris Stephanides, in charge of payload integration, Bill Stewart, electronics development technician and McLean Grant, engineer, of the systems integration branch.

Goddard's S-6 Team

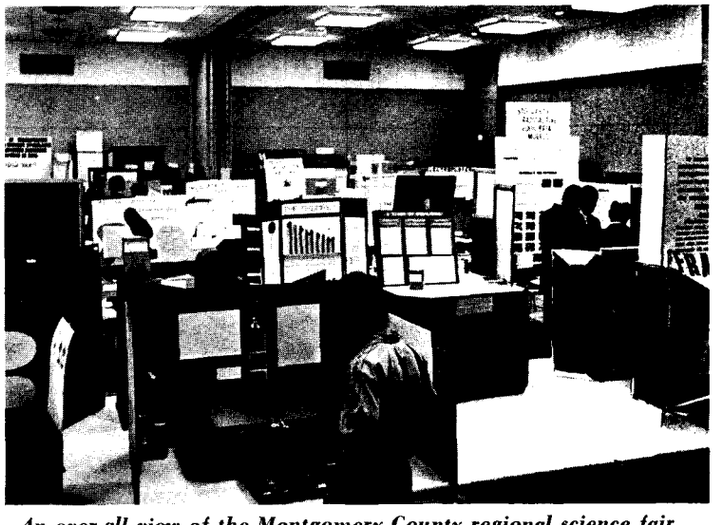
Nelson Spencer	project manager and electrostatic probe experimenter
J. E. Cooley	project coordinator
Carl Reber	mass spectrometer experimenter
George Newton	pressure gauge experimenter
Virginia Zanner	machine data analysis
Larry Brace	electrostatic probe experimenter
Richard Horowitz	(NASA HQ) pressure gage experimenter
Donald Fitzpatrick	shell and mechanical assembly
Robert Kidwell	thermal control
Paul Donnelly	power supply
James Albus	aspect system
Ronald Muller	telemetry
Joseph Corrigan	ground support systems
John Libby	control and electronics systems
Chris Stephanides	payload integration
William Hoggard	environmental test and evaluation
Anthony Brozena	delta liaison
William Schindler	delta project manager

Today's Scientists Judge Tom



Lewis S. Walter (left), Goddard judge and Walter L. Hagen of Gaithersburg High School examine Hagen's display—a computer which beat the judge in a game of "21".

Joe Maskasky (right) from DuVal High School was winner of the Grand Award from Prince George's County as well as the NASA award being presented here by John P. Hennes. Young Maskasky's father is a Goddard employee.



An over-all view of the Montgomery County regional science fair, which was held in Rockville's Educational Services Center. Five NASA awards went to Montgomery County students.

Where will America turn for trained scientists and technicians as we enter the middle laps of the space race? The curve of projected need continues to rise—yet the nation's colleges and universities report that the growing enrollments in space-related subject are not keeping pace with the mushrooming need.

"Already space is an industry nearly the size of automobiles. In eight years it may be a $20- billion-plus business . . ." according to an article in a recent issue of *Fortune*. In other words, by 1970, the space effort will involve an industry more than twice the size of 1963's largest industry; and the need for young scientists and engineers will certainly increase tremendously.

A beginning is being made to help resolve this enigma, and is concentrated on the high school level. The science fair program places special focus on the emerging imagination and ingenuity which often comes to the surface for the first time when the adolescent is challenged and motivated by the laboratory situation during late junior high and high school courses in physics, chemistry, and biology.

NASA has offered special awards at the national level for several years, geared to recognize exhibits which are of exceptional quality, and which apply directly to space research and development technology. This year, for the first time, NASA has offered awards at the state and regional level in six catagories: Aerodynamics, Space Vehicle, Space Flight and Propulsion, Space Life Sciences, Space Physical Sciences, and Space Electronics and Communications.

More than 60 Goddard scientists and engineers volunteered to act as judges for the area regional science fairs, which have included Prince George's Area, Montgomery county, Frederick county, nothern Virginia, and the District of Columbia. The judging was in all instances done on a Saturday, and demanded a large part of the day. In many instances, the Goddard judges were on hand for the Sunday presentation of awards. The most recent area fairs were held on the weekends of March 30-31 and April 6-7.

Prince George's Area

The Prince George's Area Science Fair was held March 30-31 at Cole field house, University of Maryland. Judges from Goddard were David H. Suddeth, spacecraft systems and projects division, chief judge; Warren R. Crockett, spacecraft technology division; and John P. Hennes, space sciences division.

Award certificates of outstanding achievement were announced in five of the six NASA categories, these being:

- ***Space Physical Sciences***—Joe Maskasky of DuVal high school in Glenn Dale for building his own VandeGraff accelerator for use in chemistry studies of effects of radiation on long-chained molecules. Maskasky is the son of John A. Maskasky, of Goddard's aeronomy and meteorology division.
- ***Space Life Sciences***—Hilda Salamy of Northwestern high school, Hyattsville, for a display which studied the radiation effects on barley including mutation rates, germination percentages, size of plant, and other factors out to the third generation.
- ***Space Flight and Propulsion***—Terry Dawson of Suitland high school, for work with rocket fuels and nozzles. He tested existing fuels and made new fuels of his own, and cast engine housings and motor nozzles. He then test fired (static) his own motors.
- ***Space Vehicles***—Mary Catherine Garner of Regina high school, Hyattsville, for a test of the effects of dilute acids, bases and salts on eight different metals.
- ***Aerodynamics***—John A. Bunce, of Ryken high school, Leonardtown, for a wind tunnel which he built, and tested various air foils with strain gauges to measure forces and stalling angles.

Montgomery County

The Montgomery County Science Fair was held April 6-8 at the Educational Services Center in Rockville. Judges from Goddard were Louis S. Walter, theoretical division, chief judge; Joseph R. Schulman, spacecraft systems and projects division; and Janis Bebris, aeronomy and meteorology division. Award certificates were announced in five of the six NASA catagories:

- ***Space Physical Sciences***—Martin Levin of Bethesda-Chevy Chase high school for a display in which the kinetic theory of

heat was illustrated by the determination of the velocity of emission of volatile elements from high temperature sources in a vacuum.

• ***Space Life Sciences***—Dorian Weiss and Maury M. Silverman of Bethesda-Chevy Chase high school for a demonstration of one technique for converting urine into potable water.

• ***Space Flight and Propulsion***—Cheryl A. Endo and L. Michael Sweeny of Einstein high school, Silver Spring, for a graphic demonstration of a typical fuel cell showing the principles of operation, and an operating fuel cell built by the exhibitors which powered a transistor radio which they had also constructed.

• ***Aerodynamics***—John D. Weston of Einstein high school for an exhibit demonstrating and measuring aerodynamic drag on various geometric shapes.

• ***Space Electronics and Communications***—Walter L. Hagen of Gaithersburg high school for constructing a series of circuits showing some basic digital computer principles. The display included a machine vs. operator game of "21", which the machine won against the judge every time he played it (see photo).

Frederick County

The Frederick County Science-Math Fair was held in Frederick April 6-7. Judges from Goddard were Wilfred B. Hillstrom, tracking and data systems directorate, chief judge; and Lloyd Salisbury, Bureau of Standards consultant to Goddard. Mr. Hillstrom announced award certificates in four of the NASA categories:

• ***Space Physical Sciences***—Donna Stine of Frederick high school for experiments in column chromatography. She worked out a technique of her own and the superior results were displayed.

• ***Space Life Sciences***—Robert Wickless of Middletown high school for placing an electrical potential between a plant and the soil as an experiment with electrical plant stimulus.

• ***Aerodynamics***—Harold W. Cunningham of Lignore high school for his display of a smoke trail wind tunnel and photographs made of airfoils and airstreams obtained with use of his tunnel.

• ***Space Electronics and Communications***—Dewey Dykstra, Jr., of Frederick high school for an exhibit of an automatically tracking solar furnace.

Northern Virginia

The latest of two northern Virigina Science Fairs covered Fairfax and Prince William Counties, and was held April 6-7. Roland L. VanAllen, spacecraft technology division represented Goddard as chief judge for this affair. Awards were presented in all six NASA categories as follows:

• ***Space Vehicles***—Richard Dunn of Annandale high school for a display featuring a lunar surface exploration vehicle.

• ***Space Physical Sciences***—Richard T. Kouzes of W. T. Woodson high school for a display of X-ray, diffraction by crystals.

• ***Space Life Sciences***—John Crossan of James Madison high school for a display featuring revealed symbiosis in a lichen.

• ***Space Flight and Propulsion***—Andres Cassard Polit of Jeb Stuart high school for his presentation of "Rocket Research Vehicle A-1."

• ***Space Electronics and Communications***—Steven LaBerge of Annandale high school for microwave transceiver demonstrating doppler shift.

• ***Aerodynamics***—Lucy Lynch of McLean high school for using matrix algebra to solve symbolic logic.

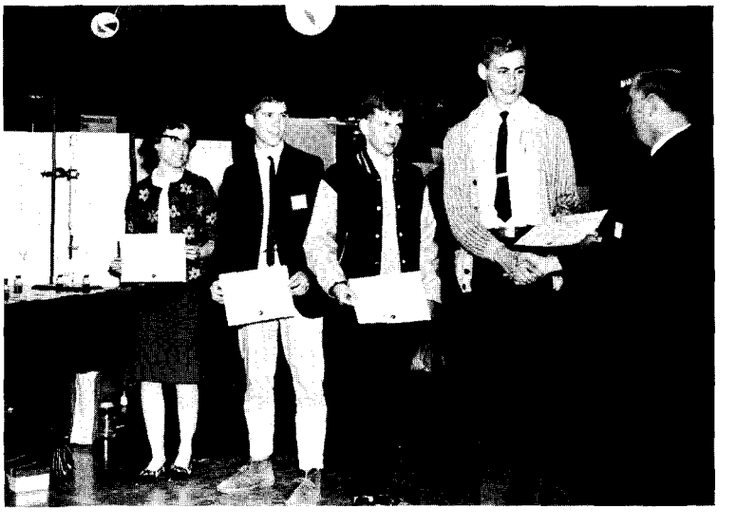
District of Columbia

The District of Columbia Science Fair was held at the auditorium of Georgetown University April 6-8. Judges from Goddard who participated were Dr. Kazen Omidvar, theoretical division, chief judge; and Lawrence L. Cook, test and evaluation division. Certificates were awarded in three of the six NASA catagories:

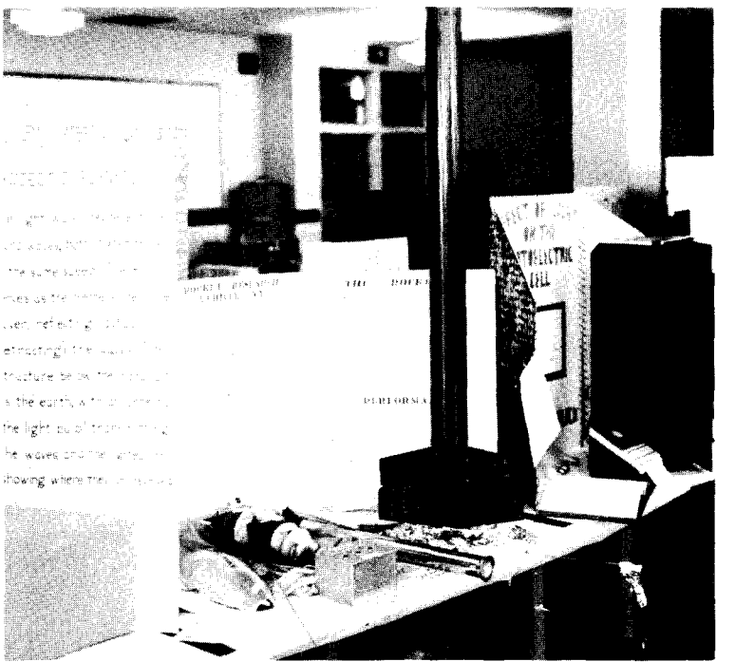
• ***Space Physical Sciences***—Karl H. Miller of Woodward Prep for a display on measurement of electron spins in solids by pragmatic resonance techniques.

• ***Space Life Sciences***—Sheila D. Minor of McKinley high school for studying the effect of breathing of compressed air by frogs.

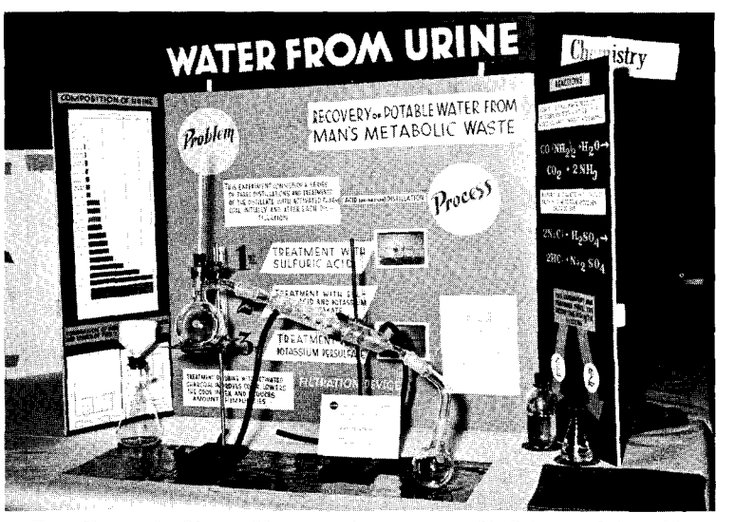
• ***Aerodynamics***—Marshall M. Curtis of Woodrow Wilson high school for a display dealing with properties of flight.



Shown, from left to right, are the winners of NASA awards from the Frederick County event: Donna Stein, Dewey Dykstra, Jr., Robert Wickless, Harold Cunningham and Wilfred B. Hillstrom, judge, representing Goddard.



Andres Cassard Polit of Jeb Stuart High School in Virginia built this flyable rocket, with parachute and instruments.



Two Bethesda-Chevy Chase students won a NASA award for this display in the "Space Life Sciences" category.

Dr. Goett Compares Space Race With Columbus' Age of Discovery

The space race can be compared in many ways with the maritime exploration of the late fifteenth century—including the area of national prestige. Dr. Harry J. Goett, Goddard director, drew this comparison in a speech before more than 700 North Carolina business and political leaders in Raleigh recently.

"Columbus, as I recall, spent quite a bit of time and effort on trying to get national support for his ideas and plans," Dr. Goett told the 21st annual meeting of the North Carolina Citizen's association. ". . . And the space budget is the equivalent of Queen Isabella's jewels. I leave it to your judgment as to who had the tougher job."

Goddard's director asserted that he would consider the space budget as money well spent if it can produce the intellectual ferment and interest of the scientific revolution in combination with the politcal and social advances initiated by the early sea explorations.

Columbus Analogy

"I am sure Columbus must have urged the Queen that it was important to find a sea route to India before the English did — and that this would not only be to the commercial advantage of Spain, but it would also command the respect of her sister nations, and be a proof of Spain's strength and leadership," he continued. "The analogy with our present case is so obvious I am sure I do not have to dwell on it."

Comparing these factors to our current stated goals, Dr. Goett recalled objectives set forth in the 1958 National Aeronautics and Space Administration Act:

- To conduct the scientific exploration of space;
- To conduct manned exploration of space;
- To apply space sciences and technology to the development of earth satellites for peaceful purposes and to promote human welfare; and
- To develop space science and technology in the interest of national defense.

He expressed the need for leadership in these words: "In many ways the viability of representative government and the free enterprise system is being tested in space."

After outlining some of the less spectacular "bread and butter" space projects which seldom receive adequate attention in the public press (unless they fail), Dr. Goett moved back to the discussion of the close relationship between the space effort and our national prestige as he summarized:

"I would like to get out of my immediate field, which is that of space science and technology, to discuss briefly the requirements which national prestige place upon us as Americans in the exploration of space.

". . . It is possibly true, that, from a purely scientific point of view it may matter little how quickly we come to understand sun-earth relationship . . . or whether we land a man on the moon during this decade or the next. But . . . continued superiority in science and technology is indeed essential to our leadership of the Free World and our prestige among the uncommitted nations. . . .

"Therefore, our efforts in the scientific satellite area, weather and communications satellites, and in the manned exploration of the moon demand that we develop a time table competitive with the capabilities of other nations, and this implies a budget of the magnitude that is currently being requested by the President to support our space efforts.

Our Challenge

"This nation has never been satisfied with any goal less than pre-eminence, nor with any effort less than the challenge demanded. We have been challenged in a vital area of scientific and technological endeavor. Looking at the practicalities in the world today, can we afford to be outstripped by any nation?". . .

Goddard News

The Goddard News is an official biweekly publication of the Goddard Space Flight Center, Greenbelt, Md.

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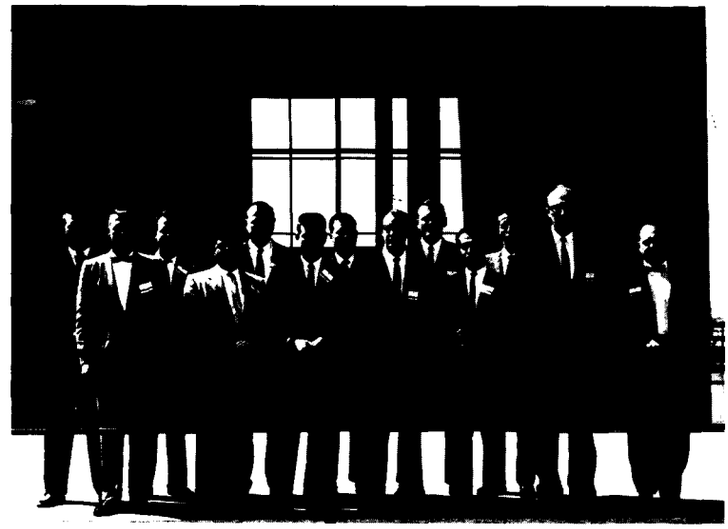

Attending from Goddard's field projects branch, AMR, were, left to right, F. R. Searle, systems engineer; S. B. Brandt, assistant operations manager, Centaur; S. E. Poteat, guidance and controls; H. Zweigbaum, manager/Atlas-Agena; John D. Gossett, chief engineer, Centaur; Lester E. Rudy, trajectory and range safety; Harry O'Dell, propulsion; F. C. Jones, systems engineer; F. A. Knauer, instrumentation; Jerry Tritto, Sr., propulsion engineer; Frederick G. Thorne, systems engineer; George C. Gentry, systems engineer; and M. R. Comer, Jr., staff engineer.

Agena, Centaur Training Begins

Attending from the field projects branch at PMR, were Paul Yasaki, left, and F. E. Richards.

Goddard personnel from the Atlantic Missile Range (above), and Pacific Missile Range (left) recently attended a three-day Atlas space launch vehicle course at the astronautics branch of General Dynamics corporation in San Diego, Calif. The course provided a detailed technical description of the Atlas launch vehicle and its associated subsystems. Goddard was recently assigned the launch responsibilities for NASA's Agena and Centaur vehicle programs, and the training in San Diego is part of the preparation for this new responsibility.

Recent Technical Publications Authored by Goddard Staff

R. V. Borchers, "A Satellite Orbit Computation Program for Izsak's Second-Order Solution of Vinti's Dynamical Problem," NASA Technical Note D-1539, March 1963.

F. G. Cunningham, "Power Input to a Small Flat Plate From a Diffusely Radiating Sphere With Application to Earth Satellites II. The Spinning Plate," D-1545, March 1963.

A. M. Lenchek, "On the Anomalous Component of Low-Energy Geomagnetically Trapped Protons," D-1679, March 1963.

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J. E. Jackson, R. W. Knecht, and S. Russell, "First Topside Soundings of the Ionosphere," D-1538, April 1963.

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S. J. Bauer, "Note on the Thickness of the Helium Ion Layer," D-1686, April 1963.

W. Nordberg, and W. S. Smith, "Preliminary Measurements of Temperatures and Winds Above 50km Over Wallops Island, Virginia," D-1694, April 1963.

R. Jenkins, "Nike Apache Performance Handbook," D-1699, April 1963.

News About Space & Aeronautics

Langley scientists are developing a blunt body to take direct measurements of the intense heat which will surround a returning lunar spacecraft as it re-enters the earth's atmosphere.

The research effort is appropriately known as Project Fire.

It consists of a model re-entry package mounted in Langley's thermal structures tunnel on a special support motorized to spin the package as if it were in flight.

Temperature readings will be taken by three special calorimeters, which are made of beryllium and instrumented with thermocouples. The calorimeters will take temperature reading during three periods of the re-entry heat pulse as individual layers of heat shield sections are jettisoned from the package.

Success of the experiment will depend on the mechanism for jettisoning the heat shields. The mechanism is a pyrotechnic device fired at precise instants to release a latch and allow springs to eject the heat shield segments.

The tests are made in a large blow-down wind tunnel at Mach 3, simulating the air pressures Fire will experience in flight.

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MA-9 Astronaut L. Gordon Cooper and backup pilot Alan Shepard took turns in their Mercury spacecraft in a series of hangar simulated flights in the hangar S white room at Cape Canaveral. They each "rode" 4½ hours in tests for lift-off, separation, turn around, orbit mode, retro-firing, re-entry, deployment of parachutes and landing bags and impact. MA-9 is scheduled for mid-May.

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A water piping system large enough to supply 40 cities the size of Huntsville, Ala., is being built at the Marshall Space Flight Center. The 250-pounds-pressure industrial water system—which has huge pipes up to eight feet in diameter and 25 feet around—is being constructed in the west area of the Center's test division. Pumping capacity of the system will be 270,000 gallons a minute. Millions of gallons of water will be forced by this system into flame deflectors at two test area static test stands now being built. These stands will be used to test the giant Saturn V booster and its F-1 engine.

The Jet Propulsion Laboratory has developed a method for sterilizing solid propellant rockets to prevent microscopic life from contaminating other planets. While heat is the easiest way of sterilization, it could lessen the reliability of the rocket, says Lawrence Montgomery, JPL senior research engineer. So a sterilant—ethylene oxide—is added to the rocket propellant prior to moulding and hardening in the rocket casing. The oxide kills all viable organisms in the propellant mixture and then evaporates. The program was undertaken to assure that there would be only 1 chance in 10,000 that a living organism could be carried to another planet.

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NASA is considering a new family of "practical" satellites to collect data from remote parts of the earth.

One of the promising new uses is in data collection from floating buoys distributed over the ocean surface. Sensors in the buoys could measure both sea and air temperatures at the surface, wave height and a variety of readings at various depths. As the satellite passed anywhere above the horizon, it would interrogate each buoy by means of a code and store the information on magnetic tape. The satellite would then transmit the information to the ground for distribution to oceanographers and other users.

Analysis of the data collected on a world-wide basis would result in a better knowledge of the sea, more effective weather routing of ships, reduction of weather damage and improvement in the economics of ship operations.

A similar application would allow the satellite to track icebergs or pack ice and relay the information to the international ice patrol and other services.

Meteorologists are interested in data from the ocean and from various heights above the surface. A network of small balloons floating at a constant pressure altitude might carry sensors and transponders to provide simultaneous weather data over wide areas. Automatic weather stations in remote areas and aboard ships at sea would provide additional coverage.

Dr. Klein, left, receives the Honorary Fellow award of the Institute of Environmental Sciences from Dr. Harry Goett, Goddard director. Looking on are P. W. Espenschade, president of the local I. E. S. chapter, and John New, head of the test and evaluation division.

Goddard Speech and Paper Presentations

(Technical presentations approved as of April 10 for period of April 15 thru April 28.)

PAPERS

Dana S. Cope, Institute of Environmental Sciences, April 17-19, Los Angeles, "Problems in the Construction of a Space Environment Simulator"; ***A. R. Timmins,*** "Experiment in Thermal-Vacuum Testing Earth Satellites at Goddard"; ***John New,*** "Achieving Satellite Reliability Through Environmental Testing."

W. M. Kaula, American Geophysical Union, April 17-20, Washington, D.C. "Tesseral Harmonics from Satellite Orbits," "Tidal Dissipation in the Moon," "The Gravity Field and the Mantle"; ***Masahisa Sugiura,*** "Pearl Type Micropulsations in the Auroral Zones: Polarization and Magnetic Conjugacy"; ***Barbara Shute,*** "Dynamical Behavior of Ejecta From the Moon"; ***Gilbert D. Mead,*** "The Geomagnetic Field Near the Magnetopause"; ***M. P. Nakada,*** "Study of Synchrotron Radiation From the Artificial Radiation Belt"; ***J. C. Cain,*** "Automatic Mapping of the Geomagnetic Field"; ***T. Neil Davis,*** "Negative Correlation Between Polar Cap Visual Aurora and Magnetic Activity"; ***A. Konradi,*** "Study of the Outer Region of the Trapped Radiation"; ***T. L. Cline,*** "Election to Positive Ratio at Low Energies in the Cosmic Radiation"; ***M. E. Lipschutz,*** "The Al^{26} and Ti^{44} Content of Some Iron Meteorites, and Their Exposure Age"; ***B. Donn,*** "Geological and Astrophysical Inferences from the Oldest Rocks"; ***K. J. Frost,*** "Low Energy Gamma Ray Flux, Spectrum and Spatial Distribution Observed at 3.5 GMS Residual Atmosphere Over Minneapolis"; ***W. E. Behring,*** "The Solar Spectrum From 50A to 400A"; ***Kenneth Hallam,*** "Solar Hydrogen Lyman Alpha Radiation"; ***C. D. Schrader,*** "OSO-1 Observation of Starfish Electrons"; ***L. E. Peterson,*** "Gamma Rays from OSO-1"; ***W. A. White,*** "Solar X-Ray Emission 1-10A"; ***K. J. Frost,*** "Search for Solar Gamma Rays in the Region 20 Kev-1 Mev"; ***S. J. Bauer,*** "The Diurnal Variation of the Topside Ionosphere at Mid-Latitudes"; ***W. N. Hess,*** "Search for Solar Neutrons" and "Injection and Loss Problems."

W. M. Neupert, American Astronomical Society, April 17-20, Tucson, Ariz. "Emission of Extreme Ultraviolet Line Radiation From Solar Centers of Activity"; ***W. S. Cameron,*** "A Possible Interpretation of Shroter's Valley and Other Sinuous Rilles"; ***Shinko Aoki,*** "A Contribution to the Theory of Critical Inclination of Close Earth Satellites 2, Asymmetrical Case"; ***Jaylee Burley,*** "Neutral Hydrogen in NGC 6822," and "The Velocity Field of O-B5 Stars in the Vicinity of the Sun"; ***John O'Keefe,*** "Significance of Tektite Sculpturing."

C. E. Fichtel, American Physical Society, April 22-25, Washington, D.C. "Energy Spectrum of Cosmic Ray Protons at Fort Churchill on July 28, 1962"; ***K. A. Neelakantan,*** "Intensities of Multiply Charged Nuclei in the Primary Cosmic Rays Over Texas in March 1962"; ***U. D. Desai,*** "Solar Protrons Observed by Explorers 12 and 14"; ***D. A. Bryant,*** "Low Energy Primary Cosmic Ray Study"; ***Aaron Temkin,*** "Nonadiabatic Theory of H_2"; ***S. L. Malukar,*** "Criterion of Hydromagnetic Instalibility in Top Heavy Layers of Fluids"; ***Robert L. W. Chun,*** "Steady-State Escape of an Atmosphere and Exospheric Transport."

SPEECHES

Robert J. Coates, Data Processing Management Association, April 18, Racine, Wisc. ***"Electronic Computers in Space Data Acquisition."***

R. A. Stampfl, Society of Motion Picture and Television Engineers, April 21-26, Atlantic City, N.J. ***"Automatic Picture Transmission from Nimbus."***

Myron Lecar, Pomfret School, April 24, Promfret, Conn. ***"Science as a Liberal Art."***

J. M. Sherfey, Electrochemical Society, April 25, Washington, D.C. ***"The Nickel-Cadium Cell as a Spacecraft Component."***

Henry C. Hoffman, Institute of Environmental Sciences, April 29, Philadelphia. ***"Satellite Stabilization and Control in a Space Environment."***

New Tracking Sites Are Scheduled for Australia

NASA in agreement with the Australian government will establish a manned space flight and scientific satellite tracking station at Carnarvon in Western Australia, a smaller data acquisition station at Darwin, and an 85-foot data acquisition facility about 11 miles southwest of Canberra.

The Carnarvon site will be concerned with project Gemini as well as the Eccentric Geophysical Observatory (EGO) and the Orbiting Astronomical Observatory (OAO). The Darwin site will support the injection phase of the EGO launch.

Wes Bodin, head of the systems development branch, said the selection of Carnarvon was made to "optimize the need for a site to handle the second ignition of the Agena vehicle," which will carry EGO and OAO, and to "track the first few orbits of future manned space flights."

Range and Range Rate

Goddard's range and range rate system (Goddard News, Feb. 25) will be used at the Carnarvon site in tracking EGO during the injection phase and throughout its normal orbital life.

The Darwin mobile facility will provide essential command and telemetry facilities for EGO, according to Chris Maskaleris, project manager for implementation of the Darwin facility. This site will observe and monitor the injection, opening of the spacecraft from its "folded" configuration, and initial orbit. This involves a sequence of about 120 seconds which occurs after the spacecraft separation from the Agena.

"This interval plus the long second burn and delay before separation from the vehicle requires coverage from Darwin in addition to Carnarvon," Mr. Maskaleris explained.

Mr. Bodin emphasized that while the facilities at Carnarvon or Canberra will be more suitable than the Darwin facility from the standpoint of logistics and staffing, they are not geographically situated to provide the required initial coverage.

From the standpoint of manned space flights, the Carnarvon site will be the first station implemented from the start for support of project Gemini. Other sites are undergoing modifications to existing facilities to support the project.

Phase into Apollo

Lyle Bonney, head of the implementation section, network engineering branch, said that "in all probability, the new site also will phase into the Apollo project."

Major instrumentation going into the sites includes two radar systems, two acquisition aid systems, digital command systems, four consoles, 136 and 400-megacycle telemetry equipment with antennas and receivers and equipment for real-time data processing.

The Canberra data acquisition facility will consist of an 85-foot diameter parabolic antenna, associate equipment for the control of the antenna, and electronic equipment for the transmission, reception and processing of radio signals to and from spacecraft. The station in addition to the Carnarvon and Darwin sites, will be operated by the Australians under contract with NASA.

The antenna will be similar to the 85-foot antennas installed at Fairbanks, Alaska, and Rosman, N. C., (Goddard News, Dec. 31), according to Lloyd Hightower, consultant to the tracking systems division.

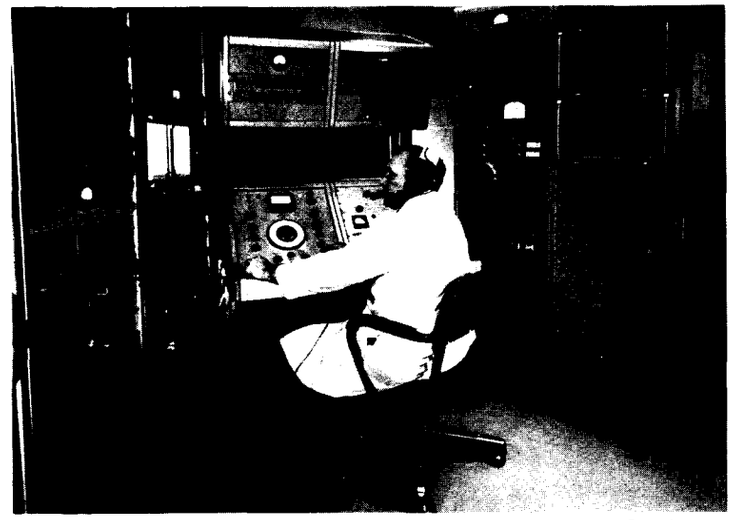
The Valley in which the antenna will be located forms a natural amphitheater bounded at one end by mountains. Formation of the terrain will effectively shield the station from radio interference from Canberra City.

NASA is particularly appreciative of the cooperation given by the Australian authorities in selecting the sites.

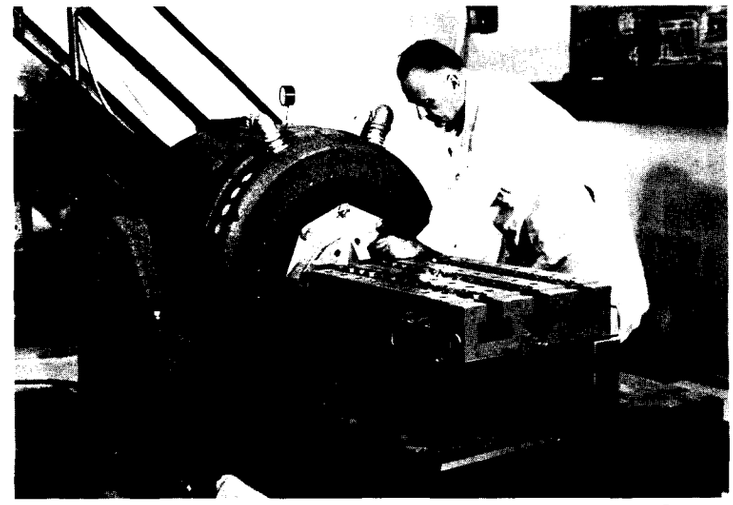
Goddard Team Effort

Site selection, facility design and construction are the responsibility of the field facilities branch under Larry E. Brown. Mr. Brown and his facilities group have travelled throughout Australia working closely with their Australian counterparts on all aspects of the sites.

The Carnarvon station will be operated by the manned space flight support division. The Darwin site and Canberra data acquisition facility will be operated by the operations and support division.



Wayne Traylor operates the controls of the automatic vibration exciter console during a test.



Charles Van Dercook connects the C-125B 10,000-pound vibration exciter for lateral vibration tests.

Vibration Test Capabilities Increased

In the last month, vibration facilities of the test and evaluation division under the supervision of Ed Kirchman, head, structural dynamics branch, and Bill Forlifer, head, vibration section, have been expanded to provide better and more efficient environmental testing.

The latest addition is a "switching cabinet." According to vibration facilities engineer Larry Cook this will make possible the operation of the two 10,000 pound-force C-125 vibration exciters by using a common control console and common amplifiers. Both of these shakers make use of hydrostatic bearing tables for the lateral vibration exposures.

In a vibration test, as explained by Ali Arman, laboratory floor manager, "the most time consuming operation is the setting-up of monitoring equipment, the mounting of the test specimen on the exciter, the installation of necessary instrumentation and the pre-test check-out." When this happens, that whole system is tied up for an indeterminate period of time.

With the addition of a "switching cabinet," while one test item is being vibrated on one of the shakers, the necessary pre-test checkout activities can be conducted on the sister exciter, Mr. Arman explained. Thus when one test is completed, with the push of a button, the second test can be gotten underway. "This makes for a much more efficient operation as well as a shorter total testing period," he said.