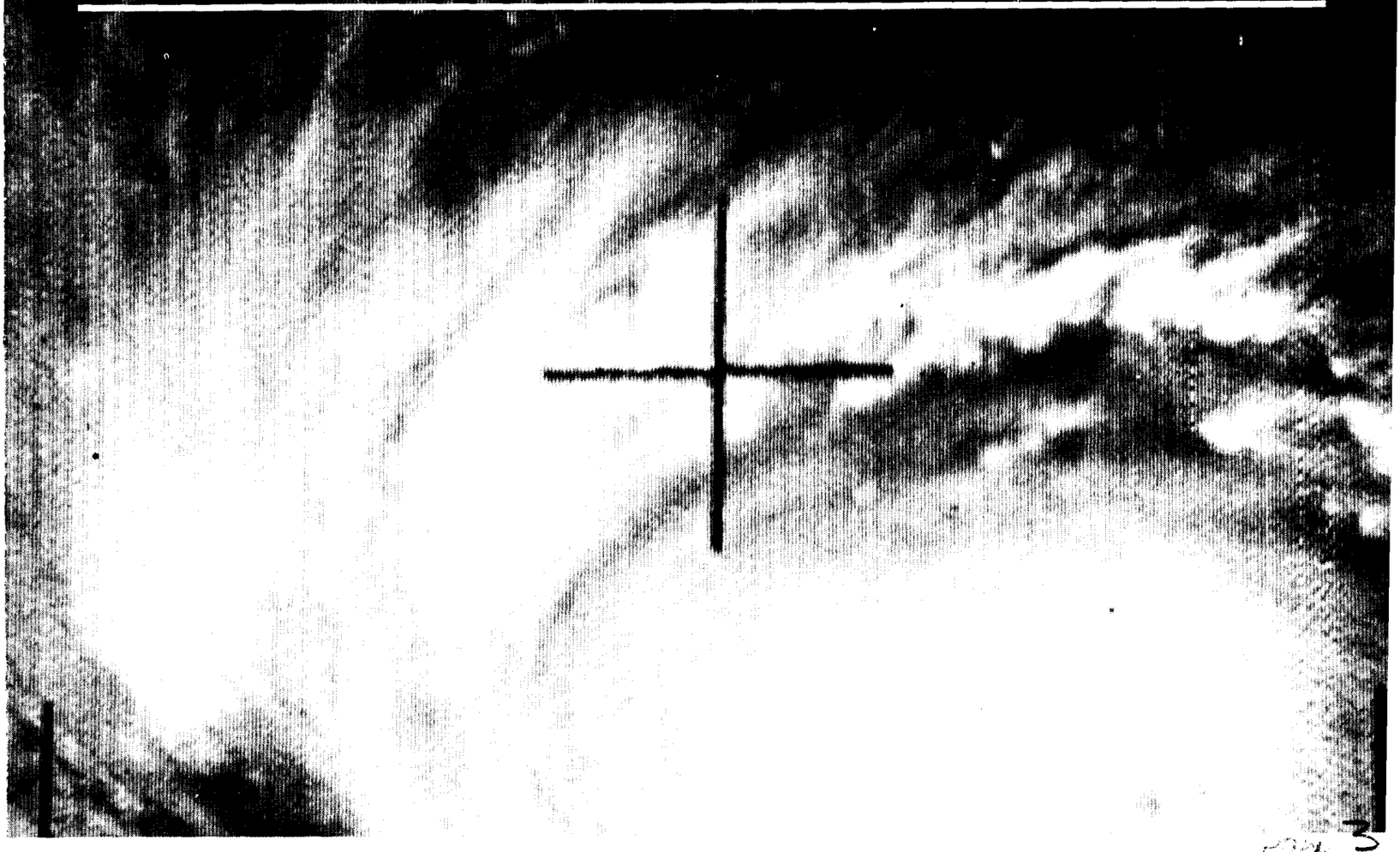
GODDARD NEWS

GODDARD SPACE FLIGHT CENTER / GREENBELT, MARYLAND

VOLUME VIII, NUMBER 1 THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION NOVEMBER 16, 1964



Hurricane Hilda, 360 miles south of New Orleans, photographed by TIROS VII, October 1, 1964.

TIROS VII Still 'Snapping' Space Portraits of World After 518 Days

Some water from Ponce de Leon's fabled "Fountain of Youth" must have splashed on Pad 19 at the time TIROS VII was launched from Cape Kennedy, Florida, June 19, 1963.

At the launching, engineers hopefully predicted a life-span of six months to one year at the most.

Now, after 17 months of 'snapping' some 89,000 space portraits of the world, the 300-pound storm tracker appears to be as young and fresh as that June morning it headed for space.

Although TIROS VII is the sixth youngest in its family of eight, it certainly has traveled the farthest and done the most as an operating weather satellite.

"The satellite is working just as good today as the day it was launched," said Robert M. Rados, TIROS project manager. "Everybody in the project is happy with its performance."

The "tale of the tape" for TIROS VII is a long one. It has operated at peak efficiency for more than 7,000 orbits, traveling a total of over 175-million miles. While streaking through space, it sent back some 81-thousand usable pictures and spotted 52 hurricanes and typhoons.

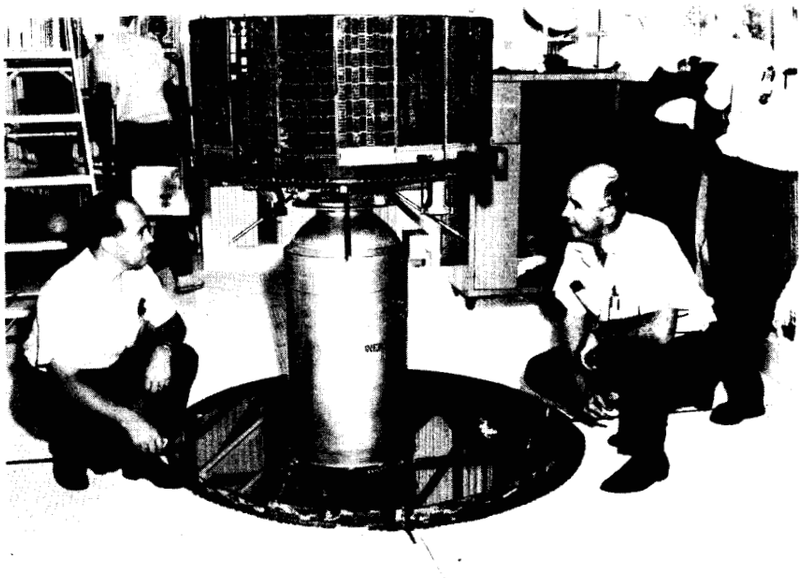
TIROS VII is the first and only weather satellite to operate during two hurricane seasons. From the vital data it collected, the U. S. Weather Bureau issued 513 storm bulletins and 3,164 nephanalyses.

TIROS VIII, the "youngest" satellite in the "weather-eye-in-space" family, will be one-year old this December 21. With one TV camera continuing to provide excellent quality pictures, TIROS VIII has completed over 4600 orbits, sent back some 54,000 pictures, and supplied data for 585 storm bulletins and 2,111 nephanalyses.

TIROS VIII was the first of its clan to carry a special camera called APT for Automatic Picture Transmission, which transmitted pictures on the slow-scan principle, similar to that used to send radio photographs.

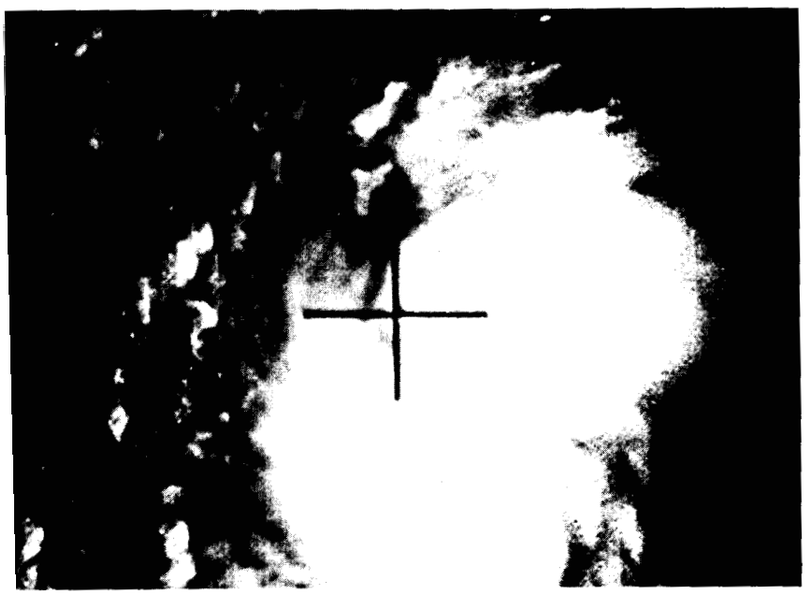
At the ground stations, which are located at Wallops Island, Virginia, Pt. Mugu, Calif., and Fairbanks, Alaska, the TIROS TV pictures are flashed on special kinescopes and photographed by 35-mm cameras. Meteorologists analyze the photographic data almost immediately.

(Cont'd on Page 2)

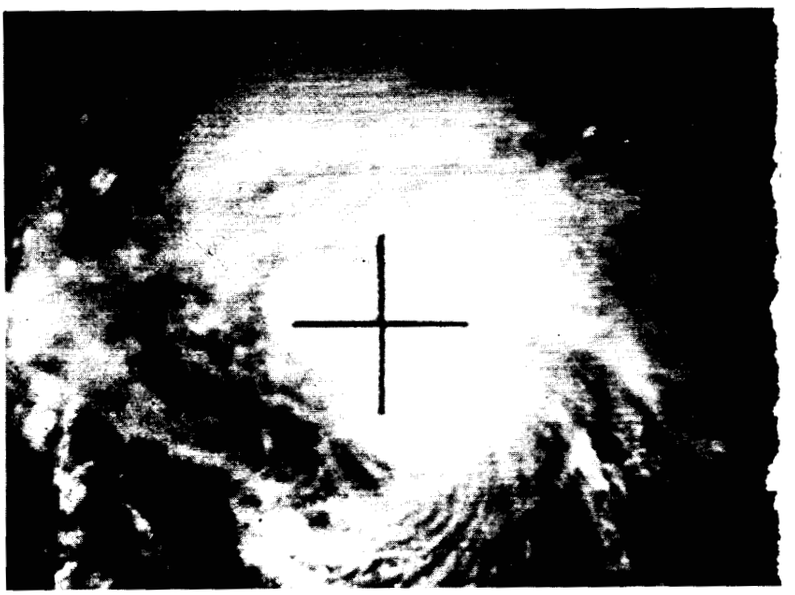


TIROS VII is mated to the third stage of the Delta launch vehicle prior to liftoff, June 19, 1963. In foreground are Ernie Powers (left), Manager, TIROS Technical Control Center, and Robert R. Golden, Aeronomy & Meteorology Division.

LAND-MASS PHOTO BY TIROS VII, September 1964, showing eastern U. S., including Long Island, N.Y., Chesapeake Bay and Delmarva Peninsula.



HURRICANE CLEO BY TIROS VII, August 26, 1964, with Florida visible.



HURRICANE GLADYS, 850 miles east of Puerto Rico, photographed by TIROS VII, Sept. 14, 1964.

(From Page 1)

TIROS VII STILL 'SNAPPING'

The infra-red experiments carried by TIROS—from which the weather satellites get their name: Television Infra-Red Observation Satellite— are designed to make measurements of reflected solar and terrestrial radiation over selected spectrum ranges.

The primary purpose of these experiments is to learn how much solar energy is absorbed and reflected and how much infra-red radiation is emitted by the earth and its atmosphere, as well as to continue development of techniques for infra-red night-time cloud-cover maps which supplement the daytime TV picture data.

"To provide top camera coverage during the hurricane season, August-October," said Ernie Powers, TIROS project coordinator, "the TIROS cameras are 'optimized' by use of the Magnetic Attitude Control subsystem. This procedure keeps the cameras directed toward the hurricane-spawning regions."

The Magnetic Attitude Control is handled by A. Gerald Johnson and his group in the Data Systems Division, Theory & Analysis Office, headed by Dr. Joseph W. Siry.

Robert Rados reports, "The next TIROS, which will be launched shortly, will be in the 'wheel mode of operation,' meaning its cameras will be directed at the earth on each revolution of the satellite. This is to provide coverage of the complete sunlit portion of the earth once per day. TIROS IX will be the forerunner of TOS, the NASA-Weather Bureau operational system."

Goddard is charged with the overall technical direction of the TIROS program. This includes tracking the spacecrafts, programming, and TIROS data acquisition.

TIROS VII LOOKS at the northeastern U.S. shorelines, Sept. 26, 1964.

Dr. Waddel Wins Award

A paper by Dr. Ramond C. Waddel, Spacecraft Technology consultant at Goddard, has been selected as one of the two most outstanding papers of the 1964 IEEE/GNS Nuclear Radiation Effects Conference. Its title is "Radiation Damage to Solar Cells on Relay I and Relay II."

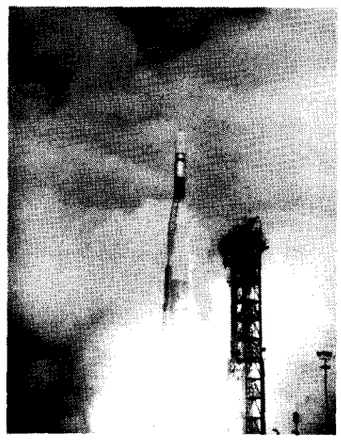
The other paper so honored was jointly written by C. A. Goben and F. M. Smits of the Sandia Corporation on "Anomalous Base Current Component in Neutron Irradiated Transistors."

Selection of the papers was based on scientific value, originality, and clarity in organization and presentation. The paper by Dr. Waddel represents the most comprehensive report to date on radiation effects actually measured *in situ* in the space environment, reported the Radiation Effects Committee.

Dr. Waddel reported that by exposing a combination of different types of solar cells with varying thicknesses of transparent shielding, valuable information was obtained on solar cell lifetimes, comparative performances of the different type cells, the relative importance of the heavily damaging low energy protons in space, and the validity of procedures for prediction of radiation damage in space when based on extrapolation from laboratory irradiation data.

Goben and Smits in their paper describe a technique by which the several components of base current in transistors may be resolved and separately studied.

Dr. Ramond C. Waddel



MARS MARINER LIFTOFF from Cape Kennedy, Nov. 5, 1964 at 2:22 p.m. EST.

Satellites Relay Election News to Europe and Asia

Three Goddard-developed satellites, Relay I, Relay II, and Syncom II, were used extensively throughout election week to broadcast previews and results to the European and Asian continents.

Relay II bore the brunt of the transmissions to Europe, as its talents were called upon seven times, while Relay I was used only once. Syncom II was solely responsible for transmission to Asia.

Total broadcast time for the Relay satellites amounted to slightly less than two hours. A preview of the election was broadcast Monday, Nov. 2. On Tuesday, Nov. 3 and Wednesday, Nov. 4, four broadcasts were made each day.

In the meantime, Syncom II, a synchronous communications satellite, was used by the Voice of America for nearly eight hours on Nov. 3 and Nov. 4.

Relay telecasts were beamed from the COMAND station in Andover, Maine, through the satellites, and received at COMBOD station in Pleumeur-Bodou, France. From here the broadcasts were sent to different networks throughout Europe and finally channeled into the homes of many European viewers. The whole process takes only a fraction of a second.

Meet Our People

This is another in a series of articles on Goddard personalities

Ernest F. Sorgnit

Ernest F. Sorgnit, Head, Flight Performance Section (SI&SR), has won wide recognition for his work in missiles and sounding rocket research and development.

Before coming to Goddard in June 1959, he was recommended for the Arthur S. Flemming Award at the Air Force Missile Development Center, New Mexico, and for three straight years there, was awarded the ARDC (Air Research and Development Command) Certificate of Accomplishment for sustained superior performance.

At Goddard he is responsible for sounding rocket development and evaluation of flight results. He was Project Scientist on the IRIS, Nike Apache and Astrobee 1500.

Mr. Sorgnit was an Air Force major and pilot, 1942-1947. He received his B. A. degree from Oklahoma State in 1950 and M. S. from Texas A. & M. in 1952, and completed the University of Washington's Advanced Management Seminar in 1958.

He lives at 8401 Fremont Street, Hyattsville, Md., with his wife, Eugenia, and two children: Erna, 16, and Stephen, 13.

***POLAROID PICTURE** of TV monitor showing television reception relayed to Europe and Asia by communication satellites.*

In the Old World tradition of craftsmanship—

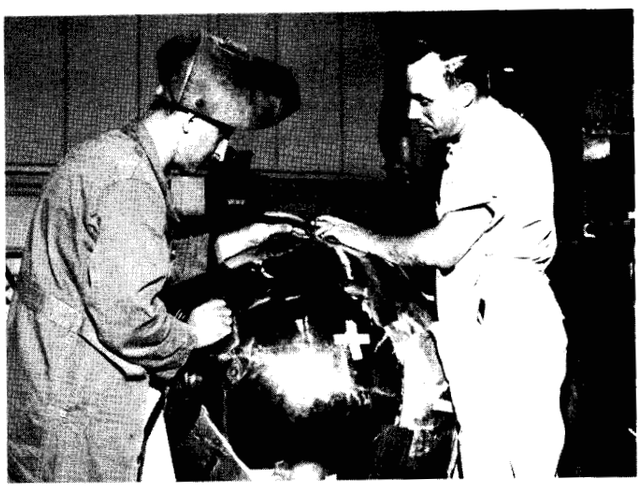
SKILLED ARTISANS AT GODDARD PERFORM VITAL TASKS IN THE NATION'S SPACE PROGRAM

Far from being members of a vanishing breed, the artisans at Goddard, who total one-hundred and twenty in the Fabrication Division, have not only proved their importance to the nation's space effort, but also have won recognition for being among the busiest workers at the Center.

They handle a staggering number of work requests. Fabrication Chief Maurice Levinsohn said, "Each week they turn out an average of 439 'quickie' jobs, while at the same time, they fill completely about 100 formal work requests for jobs of longer duration."

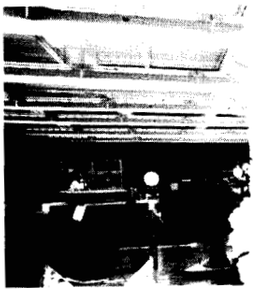
William Peed, aviation sheetmetal worker, installs a door on the nose cone of a sounding rocket.

Wiley Jenkins, metal fabricator supervisor in the Sheetmetal Branch, is heat-treating steel in the oil quench tank, a procedure reminiscent of the blacksmithing art.

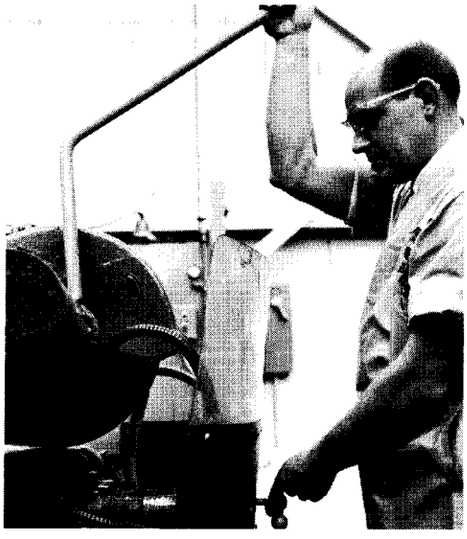


Anthony Votta (left) welder, and Joseph Rogers, metalsmith in the Sheetmetal Branch, are attaching solar cell stand-offs and brackets on a satellite.

Charles L. Davis, in the Optical Shop, is polishing the F1.0 cylindrical parabola of the new airglow spectograph on a shaper which has been ingeniously modified for this use.

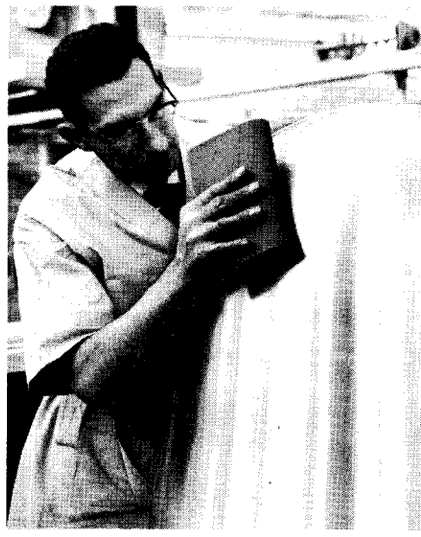


Optical shop personnel

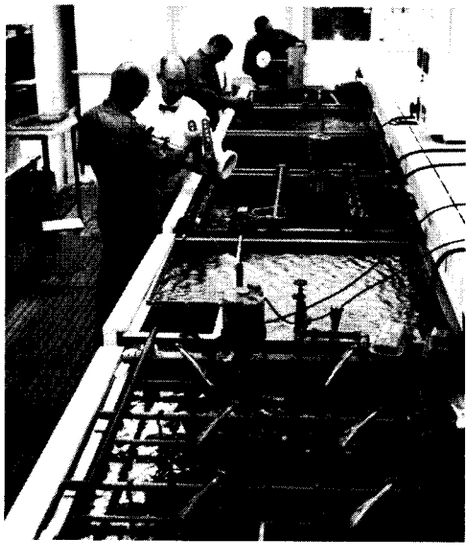


George Glunt, in the Sheetmetal Branch, is using the abrasive cutoff machine.

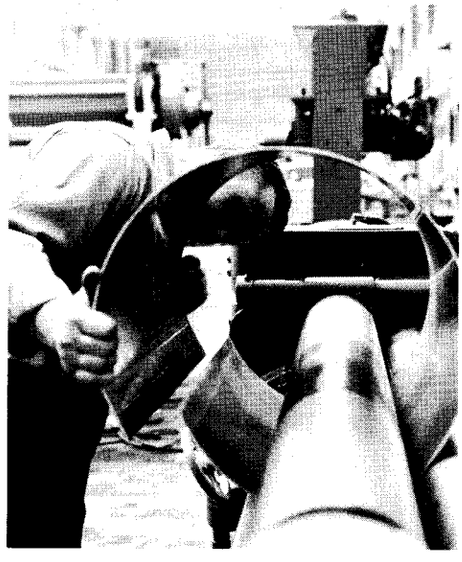
Bob Hessler, of the Machine Branch, is checking the alignment of the stellar spectrometer bases in a rocket's payload frame.



Donald Voelker, aviation metalsmith, is polishing a spun nose cone.



Space-age alchemists at work in the Electro-Chemical Processing room.



Burton Kelbaugh, aviation metalsmith, forms a 20-inch diameter aluminum cylinder on the metal rolling machine.

William R. Gotthardt, machinist, drills a hole measuring one-quarter the breadth of a human hair in part of an ultra-precision spectograph.

at work at their instruments.

Electronic technicians at work on telemetry circuitry.

NEW COMPUTER SYSTEM AIDS ENGINEERS IN PARTS SEARCH

Up to now Goddard engineers had to spend hours pouring through piles of manuals, catalogs and "spec" sheets in order to select the best electronic component for each different circuit they designed.

No longer is this necessary. The same work can be done in minutes, and perhaps more accurately—thanks to a Goddard developed Semiconductor Data Storage and Retrieval System now being set up for the Failure Analysis Section.

The new system, which should be in full operation by next January, provides complete information on electrical and mechanical characteristics, applicable specifications, manufacturers, and reliability reports on all semiconductors made in the U.S. All of this information is contained on a single tape reel. There are part-number listings for 25,000 different types of transistors and diodes.

Russell E. Dorrell, Head, Quality Assurance Branch, said: "This data retrieval system enables circuit designers and reliability engineers to search and compare all known sources of semiconductors and their characteristics more rapidly and accurately than ever before possible.

"Devices may be searched for and selected by the system according to electrical parameter ranges, reliability test data, as well as procurement specifications and sources of supply."

George N. Kambouris, Head, Failure Analysis Section, said: "The versatility of the system, I think, is one of its major attributes. It will allow circuit designers and others to search for a specific device with as definitive or as loose criteria as he desires."

NEW SYSTEM FOR SEMICONDUCTOR-SELECTION IN ACTION! At the computer are James P. Mitchell (sitting), Quality Assurance engineer, facing (from left); George N. Kambouris, Head, Failure Analysis Section; and Russell E. Dorrell, Head, Quality Assurance Branch.

JOHN K. STECKEL inspects an antenna on a scientific satellite in Goddard's new Vertical Test Range for Antenna Radiation Measurements. The pyramid-shaped projections on the wall are electromagnetic radiation absorbers.

NEW TEST RANGE FOR SPACECRAFT ANTENNAS

An unique full-scale spacecraft antenna test range designed to operate in a frequency region *as low as 100 megacycles* has been completed and put into operation here at Goddard.

The new facility is called the Vertical Test Range for Antenna Radiation Measurements. It is used to measure and calibrate the radiation patterns of spacecraft antenna systems under controlled conditions.

The new facility is designed to operate in the frequency spread of 100 megacycles to 10,000 megacycles. Goddard is particularly interested in the 136 megacycle area which is the frequency region used by orbiting spacecraft to transmit telemetry data as well as beacon signals for tracking purposes.

The new vertical range consists of an echo-free room lined with large electro-magnetic absorbers and covered with a radome roof. Within the 26-square-foot room is a movable arm on which spacecraft can be rotated and tilted to simulate angles of flight. Suspended over the roof of the room is a receiving antenna.

The range is designed so that electro-magnetic radiation from an antenna system being tested inside the echo-free room reaches the overhead antenna without reflection interferrence. This is to simulate the conditions under which the antenna system must operate in echo-free space.

The new test range is unique in that it is the only full-scale vertical facility designed for use in the low frequency range. Conventional anechoic chambers designed for operation in this frequency area are scaled down facilities in which miniature versions of the spacecraft antenna under test are used at a loss of much meaningful data.

Only scaled down low freguency antenna test facilities have been built in the past due to the expense of using large electromagnetic absorbers as well as the difficulty in suspending them vertically from the walls of the necessarily long chamber required.

New Colloquia Series Initiated

The Goddard Electronics Colloquia Series was recently initiated by the Employee Development Branch, with the purpose of keeping our electrical engineers abreast of the latest developments in their field by exposing them to recognized leaders in the electronics profession from throughout the country.

This series of lectures is in accord with Goddard management's interests in keeping its professions aware of new developments in technology. The approach appears to have merit as a means of providing stimulation and motivation for meeting this goal. Mr. Charles A. Jones is the program coordinator.

The series began on Wednesday, Sept. 23, 1964, with Dr. Lawrence Rauch of the University of Michigan, speaking on "Demodulation Processes or Making the Best Bet." Dr. Rauch was introduced by Dr. Goett who expressed his interest in the program. The next lecture was given by Dr. Howard Tompkins of the University of Maryland. His topic was "Structure for Scientific and Technical Information Retrieval."

The next session will be held on Wednesday, Nov. 25, at 3 p.m. in the auditorium of Building 3. At this time Dr. William Edson of the Electromagnetic Technology Corporation will speak on, "The Design of Oscillators and Concept of Frequency Stability."

Speakers and topic selection for the series is the responsibility of a committee of key Goddard electrical engineers. The seven members of the committee are: Harold J. Peake, Co-chairman, Thomas Lynch, Co-chairman, Dr. Robert Rochelle, Dr. George Ludwig, Allen Franta, Victor Simas, Ed Habib, and Al Ferris.

Department of Physics and Astronomy University of Maryland, College Park, Maryland

PHYSICS AND ASTRONOMY DEPARTMENT COLLOQUIA AND OTHER MEETINGS

November 1964

PHYSICS COLLOQUIA are held on Tuesdays, 4:30 p.m., Room C-130

Nov. 17 Dr. D. Scalapino, University of Pennsylvania; "Josephson Tunnelling."

Nov. 24 Dr. M. Greenberg, Rennsselaer Polytechnic Institute; "Recent Advances in Interstellar Grains."

QUANTUM FIELD THEORY SEMINARS are held on Mondays, 3:30 p.m., Room Z-115

Nov. 16 Dr. A. Jaffee, Princeton University; "Interpretation of Energy Density in Quantum Field Theory."

Nov. 23 to be announced

Nov. 30 to be announced

ELEMENTARY PARTICLE PHYSICS SEMINARS are held on Wednesday, 2:00 p.m., Room Z-115

Nov. 18 Dr. Giovanni Puppi, University of Bologna; subject to be announced.

Nov. 20 Special Seminar: Dr. Gordon Shaw, Stanford University; "Absorptive Corrections to High Energy Production Processes."

Nov. 25 Dr. Edgar Beall, University of Maryland; "Instrumentation Techniques in High Energy Physics."

ASTRONOMY SEMINARS are held on Wednesday, 4:30 p.m., Room C-132 to be announced weekly in the University Calendar of Events. (If you wish to have your name put on the Astronomy mailing list, please call 927-3800 Ext. 620).

PHYSICS JOURNAL CLUB will meet every Thursday at 4:30 p.m., Room C-132

Topics to be announced

AFTERNOON TEA will continue to be served at 4:00 p.m., Physics Lobby

Recent Technical Publications Authored by Goddard Staff

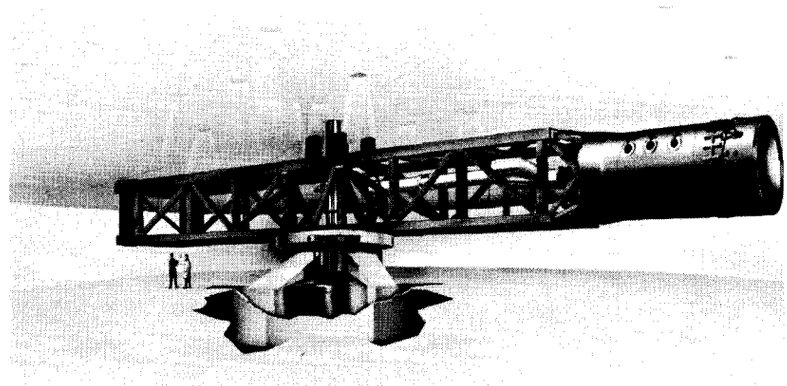
J. A. Sciulli, "Theory of Operation and Operating Instructions for the Digital Tape Recorder Analyzer," NASA Technical Note D-1863, October 1964.

J. Semyan, "Digital Ohmeter," NASA Technical Note D-2003, October, 1964.

Goddard Coming Events

Goddard Colloquium Lectures:

- **November 19, 4 p.m., Goddard Institute for Space Studies, 475 Riverside Drive, N. Y., N. Y.—Dr. Heinz G. Fortak, Institut fur Theoretische Meteorologie, Der Freien Universitat Berlin, Germany, "Long Period Oscillations in the Stratosphere."**



NEW LAUNCH PHASE SIMULATOR, which will give spacecraft exactly the kind of shaking up they would get in the five-minute blastoff from launching pad to orbit, is being constructed in Building 15 here at Goddard.

The structural-steel monster, which has girder members 90-feet long weighing nearly half a million pounds, is due to start operations early in 1966. It will be mounted on a ring-gear setup, powered by 1250 horsepower motors, arranged in tandem.

The simulator will be able to handle spacecraft up to 10 feet in diameter and 15 feet long, weighing as much as two tons. Its own vacuum pumps will create conditions of altitudes up to about 35 miles.

At the present time, spacecraft have to be subjected to one launching condition at a time. With the new simulator, they will be able to undergo simultaneous testing for vibrations, noise, acceleration up to 30 times the force of gravity, plus partial vacuum for periods of up to five minutes.

If the spacecraft can pass these ground tests, it will have no trouble getting off the pad and into orbit, Goddard scientists believe.

EXPERIMENTS FOR IMP SATELLITES ANNOUNCED

Scientific experiments have been selected for two unmanned Goddard-developed satellites that will be put in orbit around the Moon and for two similar spacecraft that will travel in highly eccentric Earth orbits during 1966-67.

The Moon-anchored satellites will be Interplanetary Monitoring Platforms (IMP–D and IMP–E). The Earth-orbiters will be IMP–F and IMP–G. All will be designed to study interplanetary phenomena and the Earth-Sun relationship in the region extending from the Earth to the Moon.

Eight experiments selected for IMP–D and IMP–E are designed mainly to measure magnetic fields, solar plasma, micrometeoroids and energetic particles in the vicinity of the Moon.

Orbiting the two IMPs around the Moon will permit collection of data once every 28 days on both the Sun side and the shadow side of the Earth as compared with one such data-collecting run per year with standard Earth-orbiting IMPs such as the first IMP (Explorer XVIII) launched Nov. 27, 1963.

This also means that the Earth's interplanetary wake, as outlined by the flow of the solar wind, can be studied from a lunar distance 13 times a year instead of once. This is an area of space affected by the Earth's magnetosphere that is of prime interest to scientists and is presently unmapped.

The solar wind is a variable stream of energetic particles (electrons and protons) ejected from the Sun and radiated outward through space. The Earth's magnetosphere (the interplane-

(Cont'd on Page 8)

(From Page 7)

IMP EXPERIMENTS

tary region in which the Earth's magnetic field is dominant) acts like a rock in this stream, diverting the particles out and around the Earth and leaving a long wake on the side away from the Sun.

The Interplanetary Explorer project is managed by Goddard under the direction of NASA's Office of Space Science and Applications. It consists of a series of spacecraft designed primarily to monitor radiation in the vicinity of the Earth and Moon.

The mission can be accomplished by satellites in highly eccentric Earth orbits or Moon-anchored orbits. The different orbits sweep out different interplanetary regions.

The 140-pound IMPs F and G are planned for elliptical Earth orbits in 1966 and 1967 ranging from 200 miles altitude to 185,000 miles. They will be launched from Cape Kennedy by Delta vehicles.

The lunar-anchored IMPs would be aimed at the Moon and slowed down by an apogee kick motor (retro-rocket) so as to be captured by the Moon's gravity field. The launch vehicle will be a three-stage Thrust Augmented Delta (TAD) fired from Cape Kennedy. IMPs D and E are expected to be launched in 1966 and 1967.

The anticipated lunar orbit is expected to have a lifetime of six months or more with an apolune (high point) ranging 2,000 to 6,000 miles from the Moon and a perilune (low point) ranging from 300 to 900 miles. Time to complete an orbit could range from five to 16 hours.

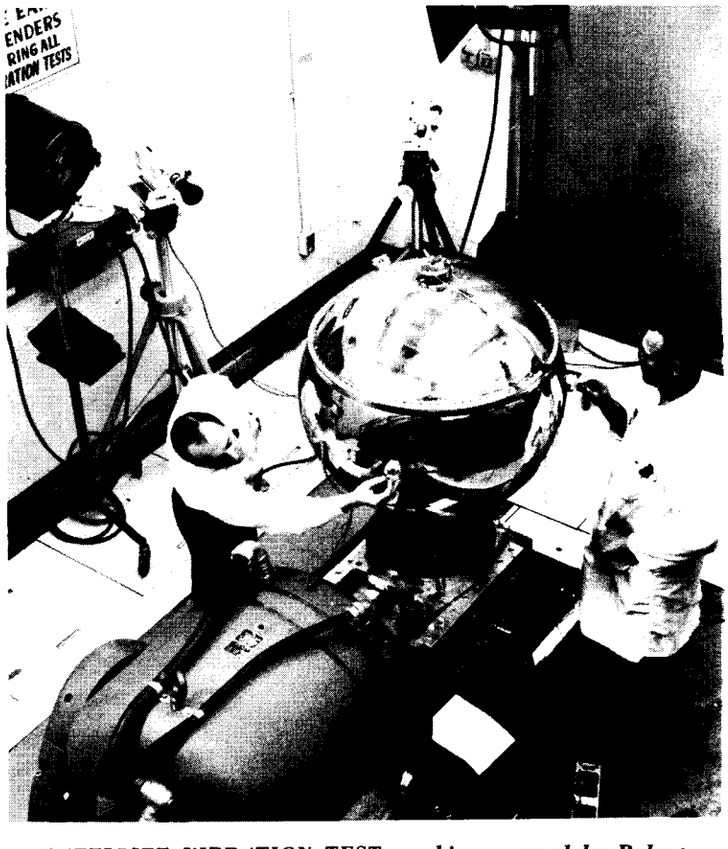
The basic anchored IMP will weigh about 130 pounds and be similar to Explorer XVIII. The major new item, the apogee kick motor, will bring the total weight to about 215 pounds.

Simultaneous measurements by the IMPs and other spacecraft will provide data on the propagation of solar disturbances in interplanetary space.

Scientific investigations selected for lunar-anchored D and E include:

Energetic Particles Flux (ionization chamber and two Geiger counters)—Kinsey A. Anderson, University of California, Berkeley.

Electrons and Protons (Geiger tubes and solid state detectors)—James A. Van Allen, State University of Iowa, Iowa City.



***SATELLITE VIBRATION TEST** machine manned by Robert White (left) and Walter Behrens, Test and Evaluation Division. The satellite is the AE-D (S-6A).*

GODDARD NEWS

NOVEMBER 16, 1964

"It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow."
—DR. ROBERT H. GODDARD

The Goddard News is a bi-weekly publication of the National Aeronautics and Space Administration's Goddard Space Flight Center, Greenbelt, Md., suburban Washington, D. C. Phone—Ext. 4141 or 4142

Photography by Goddard's photo branch

Jerry Stark, *Editor* Shirley Deremer, *Inside Goddard*

**Press date precedes publication date by approximately seven days.*

Science Bureau Distinguished Lecture Series 1964-65

Again this year the Science Bureau Distinguished Lecture Series is presented to the people of Washington by its universities and its science industry, working through the Metropolitan Washington Science Bureau—an association of 75 R&D organizations. A cordial invitation is extended to attend any or all of these lectures:

AMERICAN UNIVERSITY, Glover Hall, December 11, 1964, 8:00 p.m.
Speaker: Dr. G. Bentley Glass, Professor of Biology, The Johns Hopkins University
Subject: Human Heredity, Today and Tomorrow
Response: Dr. William R. Menyhert, Drug Detection & Development Organisation, Inc.

GEORGETOWN UNIVERSITY, Gaston Hall, January, 1965, 8:00 p.m. (Date to be announced)
Speaker: Dr. Paul M. Fye, Director, Woods Hole Oceamographic Institution
Subject: Oceanography
Response: Dr. David C. Miller, American Machine & Foundry Company

HOWARD UNIVERSITY, Biology Auditorium, February 17, 1965, 8:00 p.m.
Speaker: Dr. Nicholas M. Smith, Jr., Chief, Advanced Research Division, Research Analysis Corporation
Subject: Foundations of the Prescriptive Sciences.
Response: Dr. John M. Brewster, Department of Agriculture

CATHOLIC UNIVERSITY, Nursing Building Auditorium, March 24, 1965, 8:00 p.m.
Speaker: Dr. Joseph V. Charyk, President, Communication Satellite Corporation
Subject: The Role of Satellites in the World of Communication
Response: Dr. Henry H. Armsby, Capital Institute of Technology

TRINITY COLLEGE, Noter Dame Auditorium, April 28, 1965, 8:00 p.m.
Speaker: Dr. Mary I. Bunting, Commissioner, Atomic Energy Commission
Subject: The Education of Women in Science, Let's Experiment
Response: Dr. Michael Markels, Jr., Atlantic Research Corporation

* Respondents in the Science Bureau Lecture Series will describe individual efforts to apply advanced concepts in each field to practical needs.

Goddard Speech and Paper Presentations

(Technical presentations approved as of November 16, 1964, for period through November 29. Requests for copies of speeches and papers should be made directly to the author.)

Dr. F. B. McDonald, University of Rochester, November 19-22, 1964, Ithaca, New York, ***"Cosmic Rays."***

Henry Mauer, Jr., BIS and SEE Symposium on Space Environment Simulators, November 17, 1964, London, England, ***"Space Environment Simulators For Spacecraft Testing at GSFC."***

Paul Butler, Western Electric Company Symposium, November 17, 1964, Burlington, North Carolina, ***"IMP Satellites."***

Dr. Paul D. Lowman, Jr., Third International Symposium on Bio-astronautics Expl. of Space, November 16-18, 1964, San Antonio, Texas, ***"Photographic Exploration of the Earth from Orbital Distances."***

James E. A. John and ***William F. Hardgrove,*** Space Simulation Testing Conference, American Institute of Aeronautics and Astronautics, November 16-18, 1964, Pasadena, California, ***"Simulating the Space Vacuum Environment."***