GODDARD NEWS

GODDARD SPACE FLIGHT CENTER / GREENBELT, MARYLAND

VOLUME V, NUMBER 8 | THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION | SEPTEMBER 23, 1963

Alouette Marks First Anniversary Saturday

The Alouette topside sounder satellite will mark its first anniversary in space September 28, adding to an imposing list of "firsts" already credited to its account.

This joint U.S.—Canadian venture was the first instance of a satellite being designed and *constructed* by a nation other than the U.S. or U.S.S.R. NASA provided test facilities and the launch vehicle under the international agreement, as well as program coordination, consultative services, tracking and telemetry acquisition.

Canadian Prime Minister John G. Diefenbaker had this to say of the program: ". . . The knowledge gained, which will be used for peaceful purposes, should greatly improve the problem of communication.

"The launching of the Alouette with United States supplying the rocket power is a practical illustration of the cooperation for peaceful purposes which exists between the United States and Canada. . . ."

Another "first" claimed by the 320-pound nearly-oval satellite relates to its launch: It was the first satellite launched by NASA from the Pacific Missile Range (PMR). The launch vehicle was the Goddard-managed Thor-Agena B. All systems aboard the satellite have worked perfectly, and none of the redundant features built into the satellite have had to be used.

Alouette is the first swept-frequency topside sounder satellite to be placed into orbit. Signals from the spacecraft "sweep" over a wide range of frequencies to measure electron densities of the ionosphere. Radio waves of different frequencies make different penetrations into this layer of charged particles. Alouette receives the bounced signal from the layer, and transmits the information to a ground station.

Whenever the satellite is in the vicinity of a ground-based ionospheric sounding station, this station takes a "sounding" of the underside of the ionosphere. In this way, results of probings of both the topside and underside can be compared (see drawing).

Alouette is still functioning well, and transmitting topside conditions to 13 telemetry stations around the world. The satellite has made great contributions to our knowledge of the ionosphere, some of which were discussed at the first colloquium of the fall season.

Goddard's John E. Jackson, planetary ionospheres, is NASA's Alouette project manager. He considers these some of the most important results of the satellite's first year in orbit:

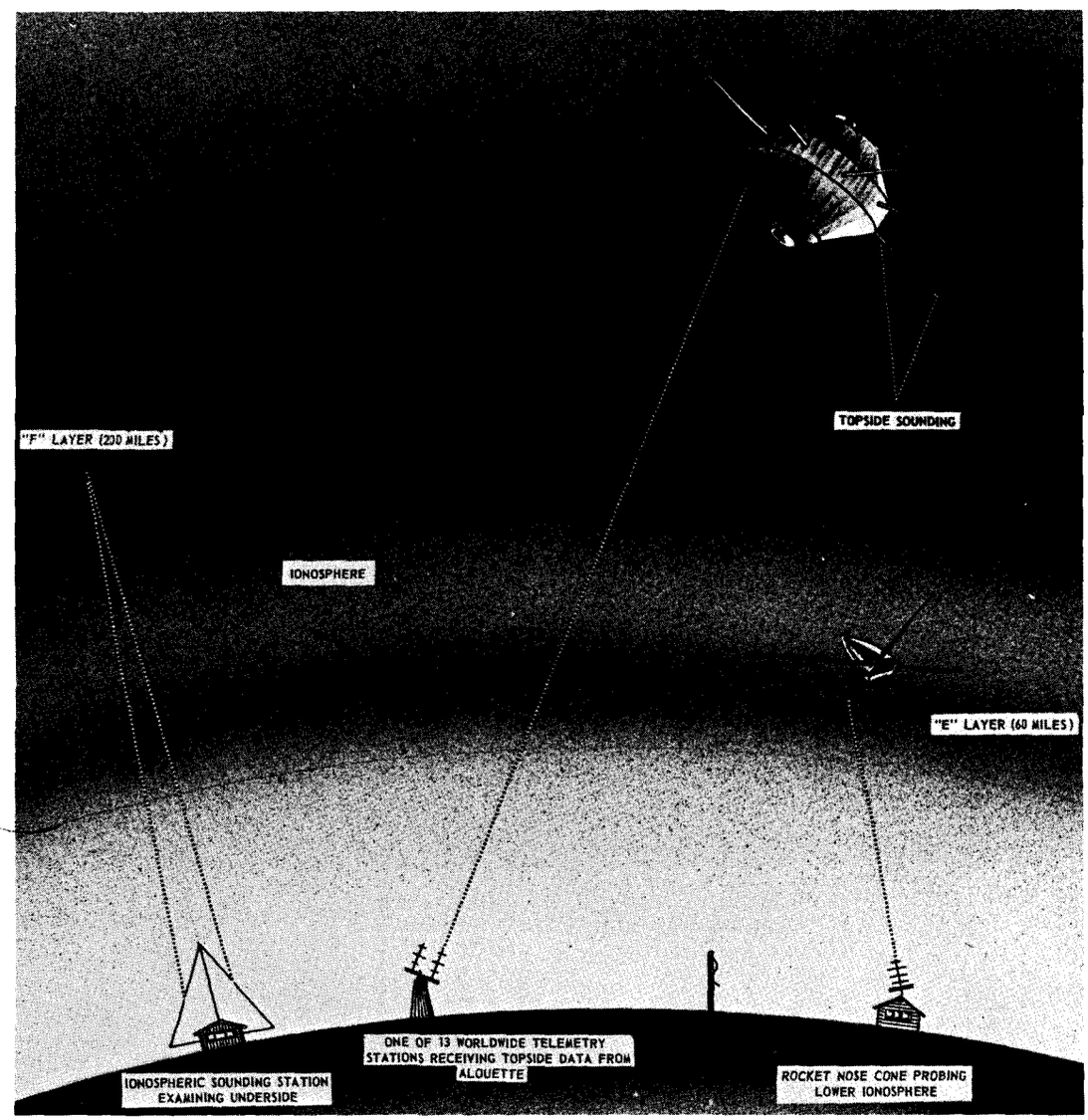
"Approximately 400,000 topside ionograms have been obtained, these are equivalent to the same number of electron density profiles from the satellite's altitude of 1000 km. (620 miles) down to the altitude where the F_2 region reaches the maximum density at approximately 300 km. (185 miles).

"The scope of the investigations which have been conducted with these ionograms range from the investigation of the arctic ionosphere to the study of the equatorial anomaly.

"Local effects (plasma resonances) have yielded information concerning the medium surrounding the satellite, including the intensity of the earth's magnetic field.

"Useful correlations have

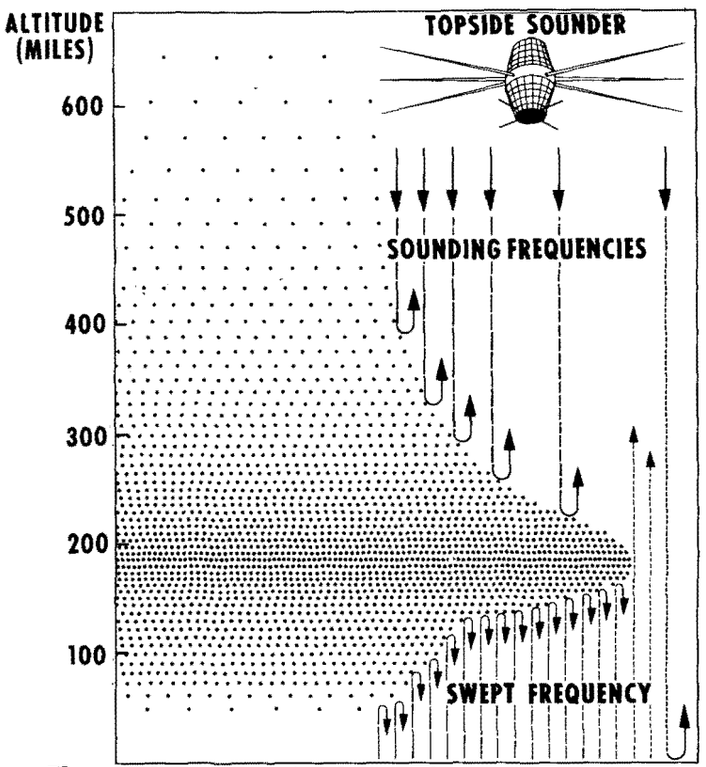
(Cont'd. on p. 2)



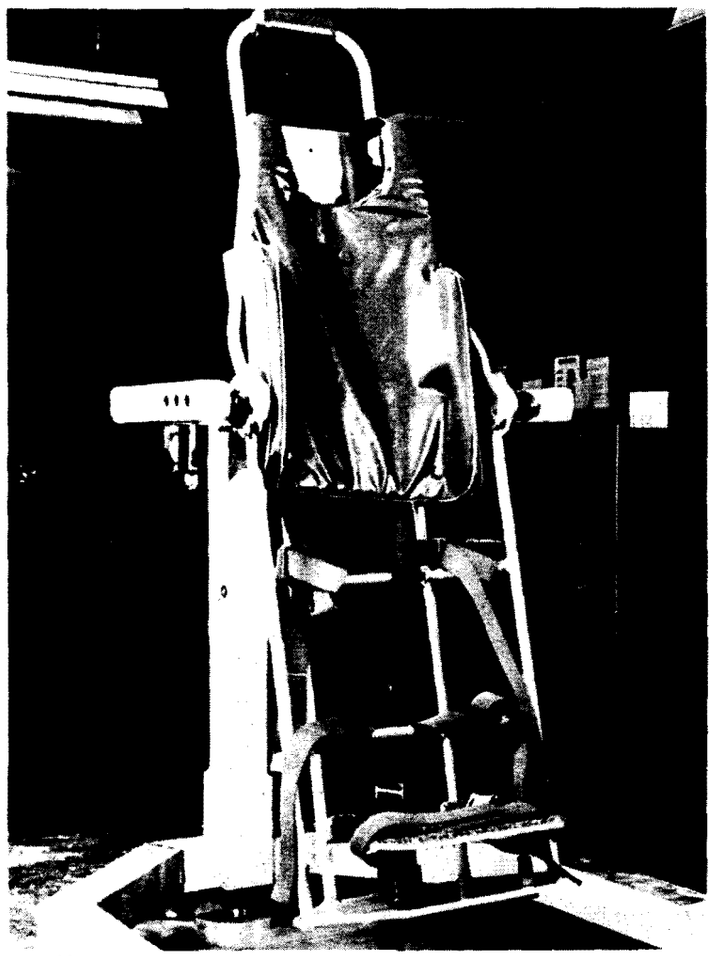
This technical illustration shows how Alouette takes a topside sounding, then telemeters information back to one of 13 ground stations. At left, Canadian Defence Research Telecommunications Establishment ground-based equipment examines the "F" layer of the ionosphere. At the extreme right, an instrumented nose cone is shown telemetering information to a ground station. The three systems support each other in a coordinated study of the ionosphere.

Alouette (from p. 1)

been provided by supporting experiments carried in Alouette, such as the VLF (very low frequency), the cosmic ray study, and the radio noise experiments. One of these, the VLF experiment, was discussed by Dr. R. E. Barrington of the Canadian Defence Research Telecommunications Establishment in last Tuesday's colloquium."



The sounding frequencies depicted here increase in frequency from left to right. As the frequency increases, there is a corresponding increase in the electron density at which the signal will reflect. Finally, complete penetration occurs.



No, it's not a new version of the electric chair. This "space chair" was developed for astronaut reaction studies at Houston. It floats so freely on a cushion of compressed air that the slightest motion of the subject causes simulated weightlessness.

Impetus

Editor's Note: This column of thoughts from various quotable sources will run whenever ideas are available which fit this definition—"comments which give impetus to the creative mind; which stretch and exercise the intellect." Publication does not necessarily imply endorsement.

"Professor Albert A. Michelson, head of the Department of Physics at the University of Chicago since 1892, died in Pasadena, California, on May 9, 1931. . . .

"Professor Michelson had worked since 1926 to perfect a method for measuring the velocity of light in a 3-foot pipe, a mile long, which could be exhausted. This experiment has been successful and the results will soon be ready for publication. He frequently referred to this as his last experiment, and so it has become. But those who knew him best feel sure that it would have been followed by many others if he had lived, even though suffering from desperately bad health.

"The most characteristic thing about his work was that he selected big ideas. He liked to play, and he did play in the laboratory. He has perhaps done more simple experiments and then forgotten all about them and never published them than most men have done. He lost interest in them because he did not think they were big enough. . . . He scorned to publish anything that he regarded as beneath the high standard he set himself. He published about seventy-five papers, all of them classics.

"His point of view toward science is best illustrated by quoting some of the things which he himself wrote; for example: 'It seems to me that scientific research should be regarded as a painter regards his art, a poet his poems, a composer his music. It would be quite as unfair to ask of these an apology for their efforts; and the kind of benefit which I should most appreciate from research in pure science is much more allied to such nonmaterial results, results which help to increase the pleasure of our all too small matter of fact existence, and which help to teach man his true relation to his surroundings—his place in nature.'

"In a somewhat lighter vein he wrote about the ruling engine on which he worked for many years: 'One comes to regard the machine as having a personality—I had almost said a feminine personality—requiring humoring, coaxing, cajoling, even threatening! But finally one realizes that the personality is that of an alert and skillful player in an intricate but fascinating game who will take immediate advantage of the mistakes of his opponent, who "springs" the most disconcerting surprises, who never leaves any result to chance, but who nevertheless plays fair, in strict accordance with the rules of the game. These rules he knows, and makes no allowance if you do not. When you learn them, and play accordingly, the game progresses as it should.'

"And finally: 'Doubtless to the lay mind and certainly to the practical man of affairs, upon whom unfortunately we are dependent for support, the argument of the practical value of scientific research will appeal more powerfully than the true reason for the activities of the investigator—namely, the love of the work for its own sake.'

"When asked why he wanted to do this last experiment on the velocity of light, he made some half-hearted explanation about the value to science, and then he added laughingly, 'But the real reason is because it is such good fun.' "—*Henry G. Gale in the July 1931 issue of The Astrophysical Journal.*

Space Administration Going On Five

October 1 marks the fifth anniversary of the creation of NASA. Goddard personnel, newcomers and veterans alike, can pause and reflect with pride on the rapid advance of the space age — and the important role which Goddard has played in the entry into this exciting period.

Goddard holds prime responsibility within NASA for the management of applications satellite projects, unmanned scientific satellite projects, and worldwide tracking and data acquisition operations.

The majority of NASA's satellites have been launched by the Goddard-managed Delta vehicle.

With these factors in mind, Goddard personnel can glance at the following chronology of NASA achievements with special pride:

NASA Chronology—
Story of Accomplishment

1958

Oct. 1—Dr. T. Keith Glennan on Sept. 30 proclaimed "NASA has been organized and prepared to discharge its duties." Entered in the Federal Register, this proclamation instituted NASA as of Oct. 1, 1958.

Oct. 7—Project Mercury organized to orbit man around Earth.

Oct. 11—Pioneer I, first U.S. space probe, launched from Cape Canaveral.

Dec. 3—Jet Propulsion Laboratory at Pasadena, Calif., transferred to NASA.

1959

Feb. 17—Launch of first NASA earth satellite—Vanguard II.

March 3—Pioneer IV launched; first U.S. spacecraft to orbit sun.

April 2—Seven astronauts selected.

July 1—Chincoteague Naval Air Station, Va., transferred to NASA's Wallops Station.

Aug. 7—"Paddlewheel Satellite" Explorer VI sent back cloud cover photos.

Sept. 17—First X-15 powered flight.

1960

March 11—Pioneer V launched; set communications record of 22.5 million miles in deep space.

April 1—First TIROS weather satellite launched by NASA.

July 1—George C. Marshall Space Flight Center, Huntsville, Ala., with its director, Dr. Wernher von Braun, transferred to NASA from Army.

Aug. 12—Echo communications balloon placed in orbit.

Dec. 19—First successful suborbital flight of unmanned Mercury capsule.

1961

Jan. 31—Chimpanzee Ham sent on suborbital flight in test of Mercury capsule systems.

Feb. 14—James E. Webb sworn in as second NASA administrator.

May 5—Alan B. Shepard, Jr. became first U.S. astronaut to fly in space; recovered at sea after suborbital flight.

July 21—Astronaut Virgil I. Grissom repeated Shepard's suborbital flight.

Oct. 27—First suborbital test flight of first stage of Saturn launch vehicle.

Nov. 29—Chimpanzee Enos recovered safely after two earth orbits that qualified Mercury capsule for manned orbital flight.

1962

Feb. 20—Astronaut John H. Glenn, Jr. circled earth three times in Friendship 7.

March 7—NASA launched OSO I —Orbiting Solar Observatory.

April 23—Ranger IV launched on lunar trajectory. It impacted on moon April 26.

April 26—NASA launched first international satellite, Ariel I, with British instruments.

May 24—Astronaut M. Scott Carpenter completed three earth orbits.

June 27—X-15 set unofficial world's speed record—4,104 mph. Pilot—Joseph A. Walker of NASA.

July 10—NASA launched Telstar communications satellite for AT&T.

July 11—Lunar orbit rendezvous technique selected to accomplish manned lunar landing.

July 17—X-15 set official world altitude record: 314,700 feet, or 59.6 miles. Pilot—Air Force Major Robert M. White.

Aug. 27—Mariner II sent on 180 million mile, four month flight to planet Venus.

Sept. 29—Canadian satellite, Alouette I, launched by NASA to study ionosphere.

Oct. 3—Third successful Mercury orbital flight, with Walter M. Schirra, Jr. piloting Sigma 7.

Dec. 13—NASA's active communications satellite Relay I placed in orbit.

Dec. 14—Mariner II fly-by of planet Venus.

1963

Jan. 3—Last contact with Mariner II, at 54 million miles, set space communications record.

May 7—Launched second Telstar.

May 16—L. Gordon Cooper completes 22 earth orbits in 34-hour flight. Final Mercury flight.

June 19—NASA launches seventh TIROS weather satellite.

July 26—Syncom II communications satellite launched and achieved synchronous earth orbit.

Aug. 1—Mariner II completes first orbit of sun; traveled 540 million miles in year.

Aug. 22—X-15 set unofficial altitude record—351,000 ft. Pilot—Joseph A. Walker of NASA.

Oct. 1—NASA five years old.

News About Space & Aeronautics

● ". . . Our activities in space are dramatic, exciting and they are inspiring, but we are performing neither marvels nor miracles. God in His infinite wisdom created a universe in which these things can be done, and He gave man the intellect to do them. It is the end point of science to study the universe and so determine what are these things that can be done. It is the end point of engineering to do these things for man's betterment.

". . . The future in space is a symbol of the future available to us at all times. It gives an unparalleled opportunity to fulfill life as do all great frontiers—an opportunity to express Mr. Justice Holmes' belief of life and civilization. 'Life is action, the use of one's powers . . . to their height . . .' ."—*Addison M. Rothrock, Associate Director, Plans and Program Evaluation, NASA.*

• • •

● The economics of an entire industry has been revamped due to a new application by NASA for a commonly familiar gas, neon.

Lewis Research Center found a use for liquid neon in the development of a nuclear propulsion system about two years ago. At that time the bulk of the nation's neon supply went into illuminated advertising signs. Since real mass production of neon was non-existent, the rare product sold for approximately $50 a cubic foot.

A Cleveland firm solved the problem of production of neon as a distilled by-product of liquid air production. In the two years since the demand arose, the price has dropped to $1.50 per cubic foot.

The product is converted to a gas for easy transportation, then reconverted to the liquid state by facilities at Lewis. The extremely cold liquid neon is used to cool a new NASA supermagnet which is used to restrain the electrically-charged particles of a fusion reaction.

It is hoped that these particles can be "harnessed" to provide thrust for interplanetary rockets. The low cost of neon? Just a by-product of NASA-stimulated research.

• • •

● "Manmade satellites 'talk' too much and—like the neighborhood gossip—much of what they say is not too important.

"But cutting out the idle chatter is one of the biggest problems facing NASA computer engineers today.

"A really prolific satellite can keep engineers busy almost 24 hours a day recording its voice on magnetic tapes, an expensive process. It gets even more expensive when large computers have to separate meaningful scientific information from a good deal of chaff.

"At Goddard there is a continuing effort to reduce the amount of information requiring to be transmitted from a spacecraft without detracting from the scientific value of the information received on earth.

"The goal is to have small, but efficient, computers placed on board satellites that could do a highly intelligent editing job. In other words, it would give the satellite's radio transmitter only information that departs from certain norms. This would cut down the electrical power needed to transmit information to earth and reduce the amount of information that ground based scientists have to analyze."—*Spaceport News.*

GODDARD NEWS

"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

Bruce Brough, *editor*—Shirley Deremer, *Inside Goddard*

The Department of Agriculture's Research Center—

These two ARC experimenters are working with white rats to discover the effect of fat on the utilization of protein by the body. Kinds and amounts of fat are varied in the diets.

When Goddard Space Flight Center was born, the 550 acres of land for creation of the physical plant were deeded to NASA by the Department of Agriculture from Agricultural Research Center property.

A certain kinship has remained between the two neighboring centers to the present day, as evidenced by the several present and proposed Goddard facilities located on ARC property under revocable lease (see map). ➔

Nearly everyone at Goddard knows of the existence of the ARC, but few perceive the scope and importance of the work done there, or the size of the facilities.

For example, most of the research divisions of the Department of Agriculture's Agricultural Research Service (ARS) are located at the research center. These are:

Agricultural Engineering, Animal Disease and Parasites, Animal Husbandry, Clothing and Housing, Crops, Entomology, Human Nutrition, and Soil and Water Conservation Research Divisions; the Eastern Utilization Research and Development Division; and the control and regulatory divisions of Meat Inspection, Pesticides Regulations, and Plant Pest Control.

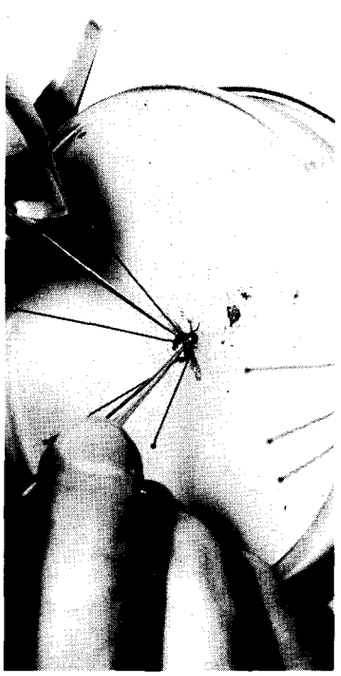
Other Department of Agriculture agencies that carry on research at the center are the Agricultural Marketing Service, Forest Service, and Soil Conservation Service.

ARC Role is Basic Research

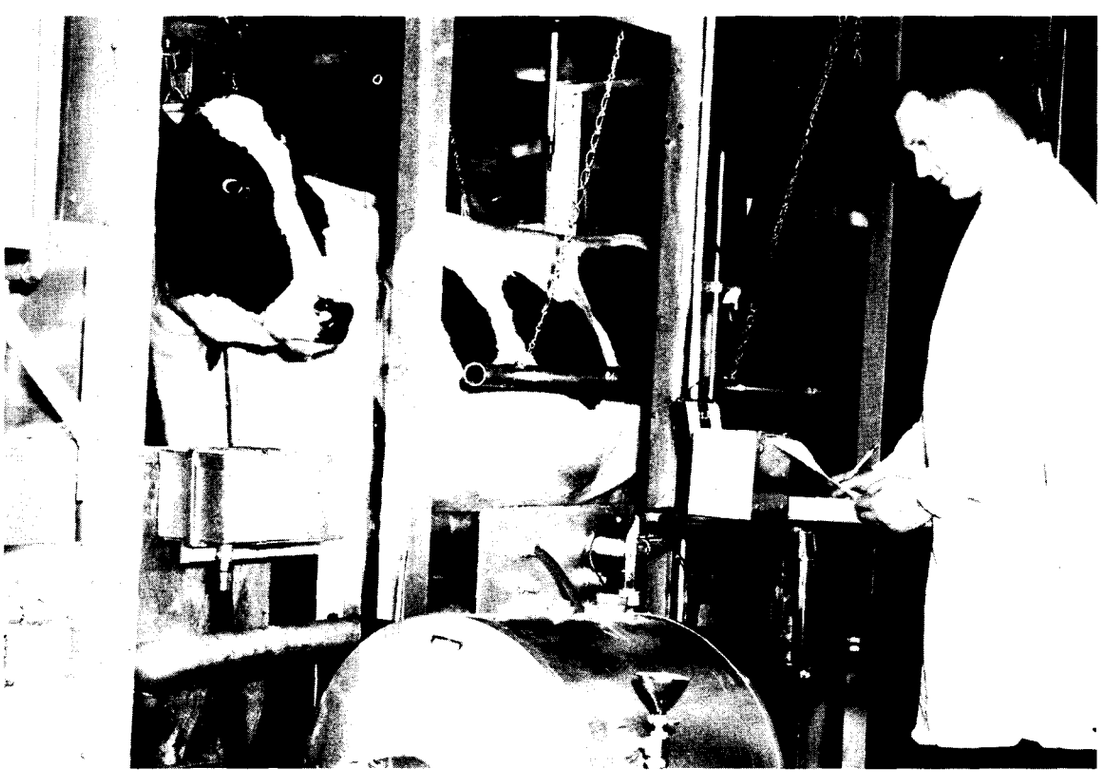
Basic or fundamental research is the major role of the ARC, which aims to accumulate scientific information that can be applied in other places.

Cooperative research between ARC and other agencies or state agricultural experiment stations has led to many discoveries with wide application to American agriculture.

The center covers approximately 10,000 acres, more than 18 times the area of Goddard. The land is divided into experimental pastures, ranges, orchards, gardens, fields for cultivated crops, timber stands, and soil-treatment plots. The center's 1,160 buildings are equipped for special kinds of research and to provide office and laboratory space for approximately 2,800 employees. About half are scientists or technicians. (Cont'd on p. 5)



Insect life processes and development are under study at ARC. Here the organs of an anesthetized fly are removed to study the effect of chemical insecticides. Information from this and other ARC experiments is applied to agricultural problems.



This cow enclosed by glass at the ARC's energy metabolism laboratory is being studied to reveal how she uses feed to make milk. Everything entering and leaving her stall is measured. All her actions are recorded for this study.

New Accident Insurance Offered

Provided 1500 employees participate—NASA will be able to offer travel accident protection during business trips away from home. Your NASA Employees Benefit Association has developed the Travel Accident Group Insurance Plan, and applications for membership are being accepted now. Deadline for enrollment is September 30 . . . with the plan becoming effective October 1, 1963 . . . but *only* if 1500 enroll.

This insurance is underwritten by the Home Life Insurance Company of New York, the same company that underwrites NASA's group life insurance program.

Briefly, here is what the Travel Accident Group Insurance plan offers:

In the event of death resulting from accidental bodily injury sustained during an official business trip, provided death occurs within 180 days after the injury, your beneficiary will receive either $100,000 or $50,000 depending on the amount of insurance you choose.

The insurance applies to "official business trips" only—in other words, to NASA trips for which you have received travel orders or when your destination is at least fifty air miles from your regular post.

NASA's new Travel Accident Insurance will give full coverage 24 hours a day. It makes no difference what mode of transportation you use. Unlike most travel accident policies, NASA's insurance covers you against accidental death occurring during the entire period of your absence, not merely while traveling.

The question most people ask is "how much will this coverage cost?" For $100,000 of protection it will cost you less than a dollar a week—or—$50 a year. For $50,000 of protection you pay only $25 a year.

But remember *only* through the group plan can you buy Travel Accident Insurance at these low rates. You would have to pay far more to get comparable coverage on an individual basis. But *only* if 1500 employees enroll by *September 30,* can we obtain this vital protection at the lowest possible rate.

There is *no* red tape . . . no complicated forms to fill out . . . and no medical examination required. The Travel Accident brochures are available in each division and the employee services branch, building 8, room 118, extension 4757. Now is the time to act. Do not hesitate to take advantage of this additional protection for your family now!

The fire truck wasn't needed after all. What looks like a car on fire in the parking lot of building 8 was only steam escaping from an adjacent steam pit.

OA WILL SWING AGAIN

Be sure you reserve a baby sitter for Friday October 18, for the Office of Administration dinner-dance. Place of action will be at the Ft. Meade Officer's Club. As with last year's party $5.00 a person will cover all expenses. The evening will begin at 7:30 with cocktails followed with dinner at 8:30 and dancing after dinner 'til midnight. Watch for further details.

From Motoring News (England): Sir Robert Watson Watson-Watt, the inventor of radar, was caught in a New York radar speed trap recently and fined $10.00. He has composed a poem about the incident:

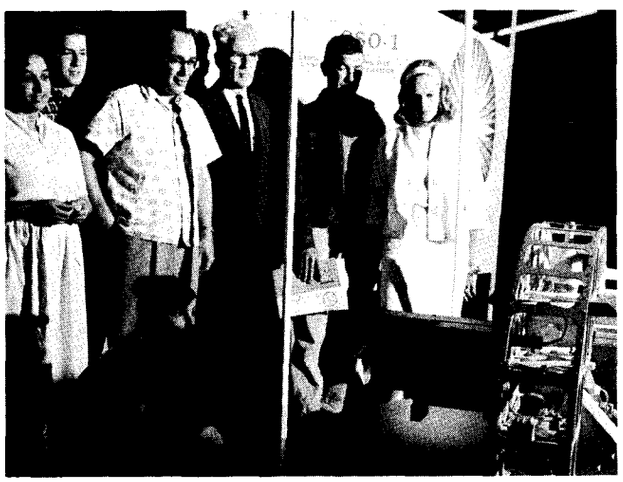
Pity Sir Robert Watson-Watt
Strange target of this radar plot
And thus with others I could mention
The victim of his own invention.

INSIDE GODDARD

GODDARD SPACE FLIGHT CENTER / GREENBELT MARYLAND

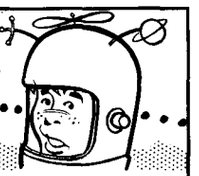
September 23, 1963

SATELLITES AT FAIR



One of the top attractions at the recent Prince Georges County Fair and Showcase at Upper Marlboro was this full scale model of Goddard's OSO-1—the world's first orbiting solar observatory. A five-minute color motion picture along with a series of descriptive panels told the OSO story to thousands of viewers.

FROM "LIL ASTERNERTS"...



Dear Sirs
I would like you to send me some information on different payloads & different missels.
Plus some information on satlites and missels
If you can't fill my request I would appreciate it if you would send me a letter or somthing

thonck you for your time

Pat S

DOWN THE ALLEY

It's that time of the year—open season on bowling. Last week at the Rinaldi bowling alleys in Riverdale, Goddard's bowling enthusiasts started the balls rolling and pins clicking.

Each issue of INSIDE GODDARD will publish the team standings along with stories of bowlers making news.

GODDARD MEN'S TENPIN LEAGUE STANDINGS

Wednesday (As of Sept. 11, 1963)

	W	L
Team No. 12	4	0
Team No. 5	4	0
Outcasts	3½	½
Team No. 1	3	1
El Supremos	3	1
Team No. 9	2	2
Gubaths	2	2
Team No. 2	1	3
Rackets	1	3
Team No. 8	½	3½
Keglers	0	4
Team No. 6	0	4

Thursday (As of Sept. 12, 1963)

	W	L
Team No. 1	4	0
Team No. 12	4	0
Team No. 4	3	1
Team No. 6	3	1
Team No. 15	3	1
Team No. 14	3	1
Team No. 7	3	1
Team No. 10	3	1
Team No. 16	1	3
Team No. 5	1	3
Team No. 3	1	3
Team No. 13	1	3
Team No. 8	1	3
Team No. 9	1	3
Team No. 11	0	4
Team No. 2	0	4

GODDARD MIXED DUCKPIN LEAGUE STANDINGS

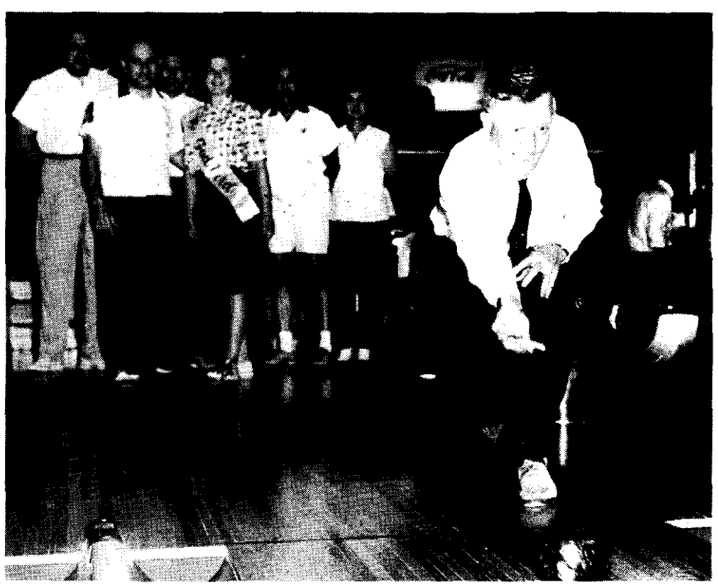
Tuesday (As of Sept. 10, 1963)

	W	L		W	L
Cole's Coolies	3	0	Vagabonds	1	2
Bob Cats	3	0	Toppers	1	2
Ducklings	2	1	Dukes & Duchess	1	2
Alley Catz	2	1	Possibilities	1	2
Bluffers	2	1	Alley Nauts	0	3
Comets	2	1	Stargazers	0	3
Moonshiners	2	1			
Quicksilvers	1	2			

GODDARD MIXED TENPIN LEAGUE STANDINGS

Tuesday (As of Sept. 10, 1963)

	W	L		W	L
Orbiting Elements	4	0	Team No. 16	2	2
Elites	3	1	Zooms	2	2
Imps	3	1	Team No. 17	1½	2½
Full House	3	1	Ichi-Bans	1	3
Team No. 1	3	1	Split-Fits	1	3
Alley Cats	3	1	Scatter Pins	1	3
Team No. 18	2½	1½	Lucky Five	1	3
Twiggits	2	2	No Names	1	3
Morwood	2	2	Spouses	0	4



Eugene Wasielewski, associate director, rolls the first ball of the duckpin season at Rinaldi bowling alley.

Wallops Holds Open House

In observance of NASA's fifth anniversary October 1, Wallops station, Virginia will be open to the general public for a self-guided, "do-it-yourself" tour on September 28-29, from 11 a.m. 'til 6 p.m.

Visitors will be permitted to tour some facilities on the main base as well as the launch sites on Wallops Island. The main base and Wallops Island are about 10 miles apart. To view both places will take two or three hours. Visitors will not be permitted to get out of their cars on the Island.

A number of launch vehicles and models will be on display both at the main base and on Wallops Island. Visitors will also see the control center from which all launches are monitored and controlled, long range tracking radars, launch pads, blockhouses, assembly shops and related facilities.

Medical Training Course Starts Soon

The fourth medical self-help training course is scheduled to start September 30. All Goddard employees and their dependents are welcomed to attend.

The course, given in eight sessions, will cover emergency first aid, emergency child birth, infant and child care, nursing and the effects of nuclear weapons.

The standard American Red Cross certificate and a Medical Self-Help Training certificate will be presented to each person who satisfactorily completes the sequence.

The first session will commence Monday, September 30 in room 231, building 7 from 4:45 to 7 p.m.

To date, more than 40 Goddard employees have completed this course and received their certificates.

Interested persons should call the civil defense planning officer, extension 5420 or 5421.

Goddard Welcomes

Byrd

Ross

Watts

Lampl

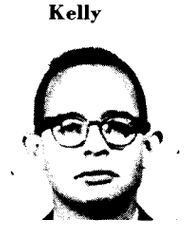
Lawless

Newell

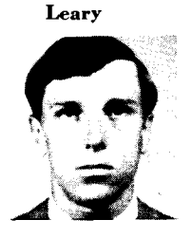
Kelly

Leary

Heber



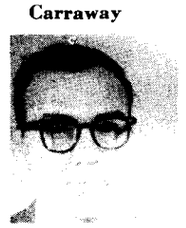
Shelor



Carraway

Jones

Erath

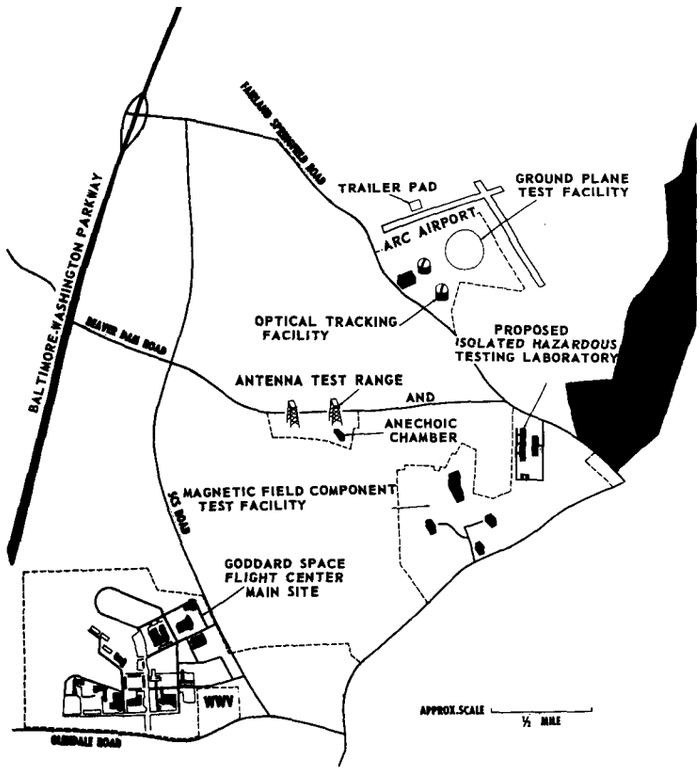


Schnetzler

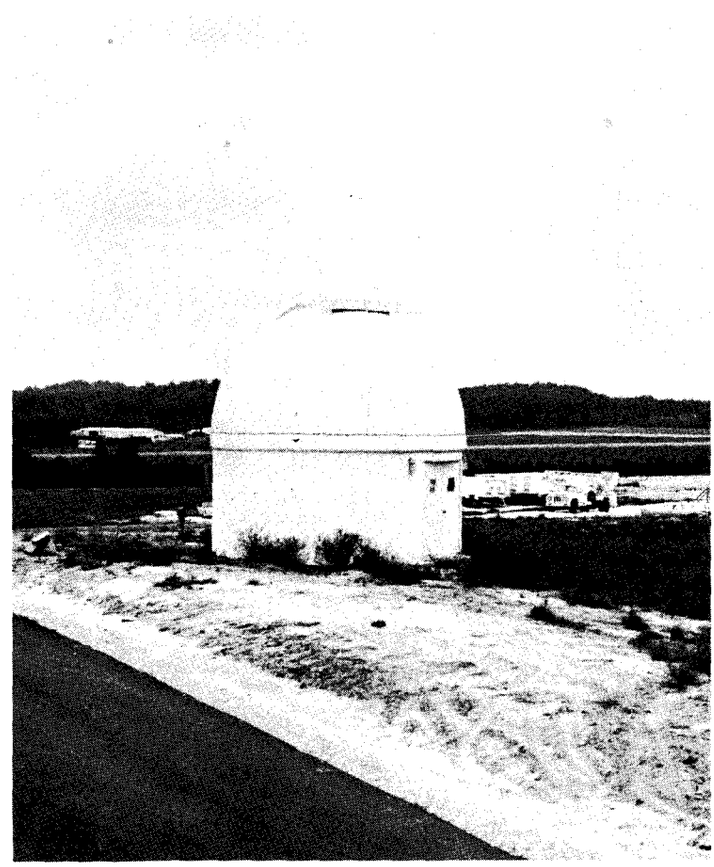
Slater

Emma Byrd, Data Systems Division; *C. V. Ross, Dorothy M. Watts*, Financial Management Division; *Sherman Lampl*, Office of Assistant Director, Tracking and Data; *Edward A. Lawless, George L. Newell, Jr.*, Operations & Support Division; *Robert J. Kelly, Barbara J. Leary*, Organization & Personnel Division; *Frank Heber, Patrick D. Shelor*, Procurement Division; *John B. Carraway, Orbie Jones*, Space Data Acquisition Division; *Charles E. Erath*, Test & Evaluation Division; *Charles C. Schnetzler*, Theoretical Division; *Francis Slater*, Tracking Systems.

Goddard's Good Neighbor



The above sketch gives an outline to the location of Goddard facilities at the neighboring ARC. Other facilities are often put to use there on a short term basis.



The dome in the foreground is part of Goddard's optical tracking system located on Dept. of Agriculture property.

Among the center's buildings are 67 laboratories; 36 greenhouses; 180 storage buildings; and 700 barns, small-animal, and poultry houses. In addition, there are shops; an apiary; a granary; a warehouse; and heating, water-treatment, and sewage-disposal plants.

ARC has nearly 3,800 experimental farm animals, more than 11,000 laying and breeding fowls, and about 3,500 small animals that are used in laboratory tests.

Goddard Facilities at ARC

Four major Goddard installations either completed or under construction on ARC property under lease are the antenna test range, magnetic fields test facility, optical tracking facility, and ground plane test facility.

The antenna test range is located about one mile northeast of Goddard. An existing farm house on the property has been retained and renovated to provide storage, sanitary facilities, and a small shop space. There are essentially two measuring ranges, one horizontal and one vertical, which can be used either independently or in conjunction with each other.

The range provides experimenters with the facility for observing the physical principles underlying the behavior of antennas as well as providing a capability for experimenting with transmission lines, radomes, solid state devices, receivers, transmitters, telemetry systems, coding systems, and other devices or systems used in tracking, telemetry and communicating with artificial satellites and manned spacecraft.

Goddard is also building a magnetic fields component test facility in an area located between the center and the ARC Airport. A permanent structure is now under construction.

The magnetic test facility consists of a large non-magnetic structure to house the required equipment. Located within the structure will be a number of current carrying coils which are very accurately designed and positioned within the facility. Through the use of very carefully controlled electrical currents flowing through the coils, it will be possible to neutralize the effect of the earth's magnetic field and to simulate the magnetic environment of outer space for purposes of testing satellite components.

The ARC site was selected after extensive measurements were made of the background noise. The present site is situated about midway between the Pennsylvania Railroad and the Baltimore-Washington Parkway.

The optical systems branch at Goddard is working on development of unique electro-optical tracking and communication systems to enable ground stations to track and communicate with space vehicles at great distances. One of the most advanced and unique optical tracking laboratories in the United States is now in use by Goddard located on ARC property.

The optical laboratory also houses the Radot System, a prototype real-time automatic digital optical tracker that has the capability of tracking space vehicles in real-time to accuracies once obtainable only by laborious astronomical film data reduction.

The optical tracking laboratory consists of the following permanent structures: (a) Two 20 foot diameter domed observatories whose prime mission is to house special electro-optical devices for specific research and measurement programs. (b) One electro-optical instrumentation trailer which will later enable movement of certain delicate equipment to remote areas to perform experiments which cannot be accomplished at the ARC site. (c) The main building.

A temporary ground plane facility has been operational on a temporary basis pending the completion of a permanent facility.

Grassroots Neighbors, Goddard and ARC

Other more informal activities between the ARC and Goddard personnel include Goddard use of the opportunity to buy eggs and other fresh agricultural produce at the "farm," and joint offers by the welfare associations of the two centers.

The differences between agriculture and space seem infinite, but the scientists of the two centers use the same tools of research for their widely varied fields. Here agriculture and interplanetary space are just a property line apart.

LUNAR FURROWS HAVE EARTHLY COMPARISON

This largest lunar sinuous rille is known as Schroter's Valley. The crater just south (to the right) of the valley is Herodotus. Above the valley is Aristarchus, the brightest spot on the moon. Aristarchus is about 30 miles in diameter. This photograph is reproduced from the Kuiper "Photographic Lunar Atlas."

As the manned space flight program to reach the moon in this decade receives a great deal of public attention and discussion, theoreticians continue to search for clues to what the first "man on the moon" will see. Mrs. Winifred Cameron, an astronomer in the theoretical studies branch, specializes in research on surface areas of the moon. Her report to the Goddard News on an interesting lunar surface feature follows:

The sinuous rilles (furrows) on the moon, numbering about 3 dozen, are quite unlike the thousands of ordinary linear rilles. The sinuous rilles share a number of characteristics that I feel are significant in explaining their origin. These characteristics are:

1) origin in a pear-shaped craterlet, with the rille-side wall often breached; 2) varying width, with the wider end at the craterlet, and tapering off at the other end; 3) the wider, craterlet end is at a higher elevation; 4) composition of arcs of short radii of curvature giving them a zig zag appearance, which is one of the most difficult features to explain; and 5) occurrence in the dark areas of the moon, the maria and the dark, flat-floored craters.

The most famous example of the lunar sinuous rilles is Schroter's Valley (see photo). It is much larger than any of the others and is the least sinuous, but is instead characterized by some rather abrupt changes of direction. It is three miles wide at the widest part, about 120 miles long and about 1200 feet deep at the deepest part. Nearly all the others are only tens of miles long, tens of feet deep, and at most a half mile wide at the widest part. They are most often referred to as looking like dried river beds.

Aqueous erosion, however, is very unlikely to have occurred on the moon under the physical conditions found there. However, there is a terrestrial process that produces sinuous furrows sometimes that seems the most likely one that could also operate on the moon. It is a special kind of volcanic eruption known as a nuée ardente (from the French), which is a relatively dense mass of gas and ash mixture that rushes down the mountain at great speeds (about 60 miles an hour), carrying huge blocks of rock. Sometimes its buoyancy is not so great as at others and the boulders scrape along the

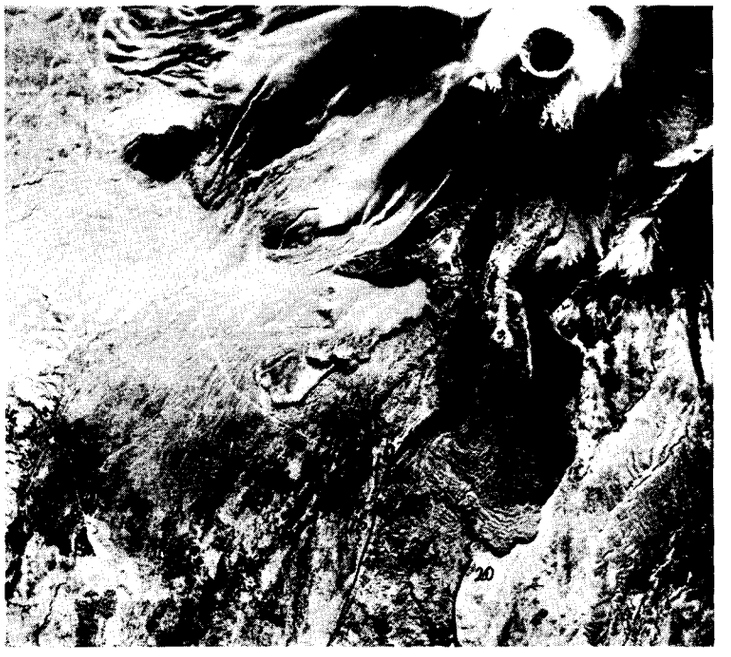
F. A. Perret photographed this nuée ardente issuing from Mt. Pelée on the Island of Martinique during the eruptions that lasted from 1929-1932.

Rilles (from p. 6)

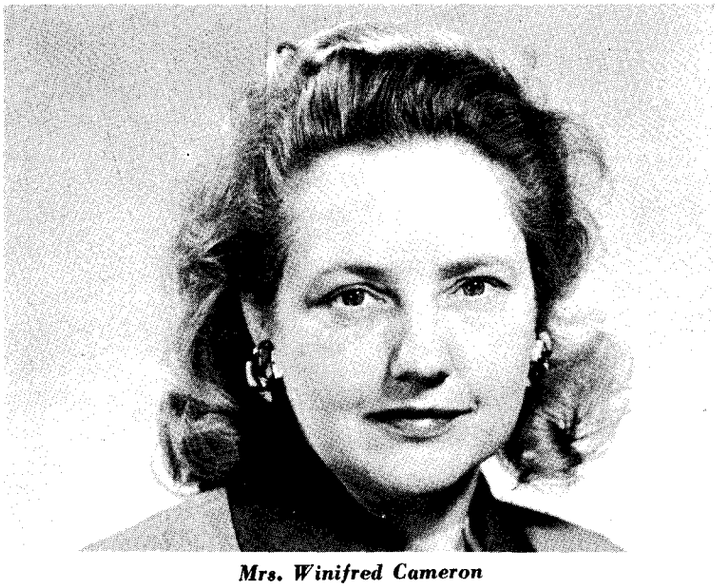
ground digging a furrow. The fiery avalanche follows the lines of least resistance, just as rivers and marine turbidity currents do. Nuées ardentes are very similar in action and nature to the latter. The photo on page 6 shows the advancement of nuée ardente down the slope of Mt. Pelée. It was a similar occurrence that destroyed St. Pierre and its 40,000 inhabitants within ten minutes during the great eruption in 1902.

A similar destructive event occurred in Japan in 1783 by an eruption from Mt. Asama, which is about 75 miles west of Tokyo. One of its eruptions produced a nuée ardente that dug a ditch about 8 miles long, 1½ miles wide at its widest and 120 feet deep at its deepest and part of the path was sinuous. The accompanying aerial photograph shows part of the ditch from the volcano. This furrow might have been longer, but it reached a river, which deflected it and changed its action as it mixed with the river and caused great flooding and devastation for 50 miles down the river. Lava flow has partially filled the furrow.

The characteristics of the lunar sinous rilles and the ditches dug by terrestrial nuée ardentes are quite similar, which causes me to believe that they are produced by the same kind of event.



This isn't the moon. It is Asama volcano in Japan showing part of the sinuous ditch dug by a nuée ardente in 1783. A lava flow immediately filled the upper part.



Mrs. Winifred Cameron

Goddard Speech and Paper Presentations

(Technical presentations approved as of September 17 for period of September 22 through October 6. Requests for copies of speeches and papers should be made directly to the author.)

SPEECHES

T. J. Hennigan, Electrochemical Society, New York, N.Y., September 29-October 3, ***"Applications of Silver Oxide Cadmium and Silver Oxide Zinc Cells on NASA/GSFC Space Programs."***

P. C. Donnelly, Electrochemical Society, New York N.Y., September 29-October 3, ***"NASA/Goddard Satellite Battery Test Programs; NASA/Goddard Battery Evaluation Programs."***

PAPERS

R. W. Rochelle, International Telemetering Conference, London, England, September 23-27, ***"Pulse Frequency Modulation Telemetry."***

N. Kyriakopoulos, Second Annual Symposium on the Physics of Failure in Electronics, Rome Air Development Center and ITT Research Institute, Chicago, Illinois, September 25-26, ***"Failure Modes of Satellite Components."***

M. R. Townsend, 1963 National Symposium on Space Electronics, Miami Beach, Florida, October 1-3, ***"A Medium Data Rate Digital Telemetry System."***

M. S. Maxwell, 1963 National Symposium on Space Electronics, Miami Beach, Florida, October 1-3, ***"An Efficient PCM Error Correction and Synchronization Code."***

R. R. Ziemer, National Symposium on Space Electronics, Miami Beach, Florida, October 1-3, ***"Command Control of the Orbiting Astronomical Observatory."***

Little Joe II Booster Tested

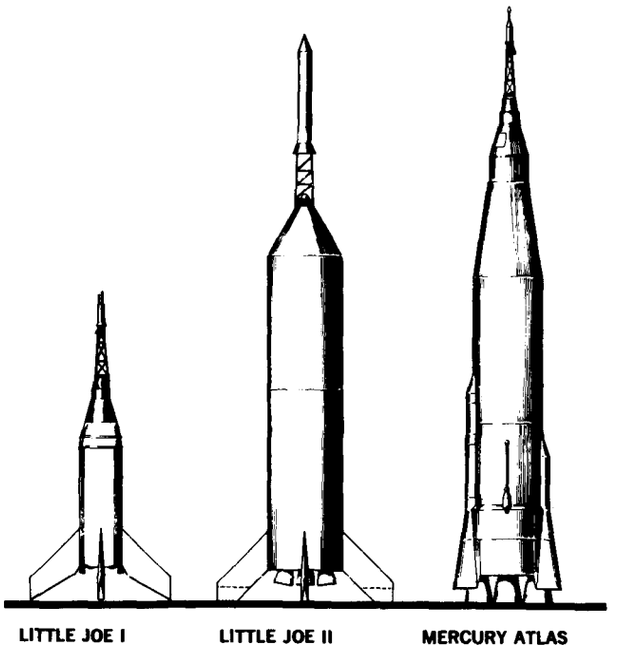
The Apollo program literally "got off the ground" late last month with the flight test of the booster for a dummy Apollo command module, adapter, and escape tower.

The booster, Little Joe II, was tested to demonstrate its capability for simulations of the Apollo launch phase.

The accompanying artist's conception gives a comparison of sizes between Little Joe I, which was used to test the launch phase of the Mercury capsule and the Little Joe II.

The Mercury-Atlas scale drawing at right shows that Little Joe II with payload is approximately the same height as the orbital Mercury launch combination. Little Joe II has a maximum thrust of 720,000 pounds compared to Atlas' 360,000 pounds. Its diameter is greater than Atlas by nearly three feet.

The flight test vehicle attained a maximum height of 24,000 feet and travelled 47,000 feet downrange at White Sands Missile Range in New Mexico.



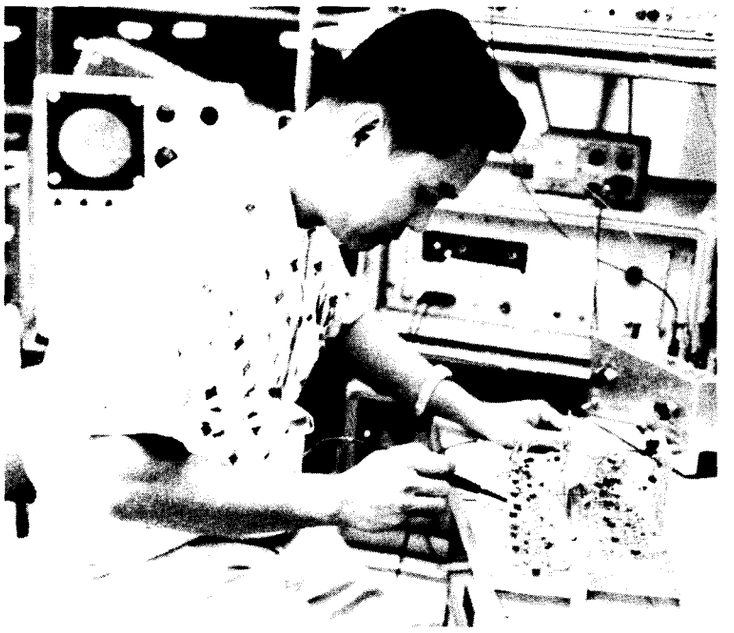
Job Related Training—Patent Award Received by Employees

John Stokes of the quality assurance branch has recently completed two weeks of training at Marshall Space Flight Center's soldering school, which qualifies him as one of two NASA-approved instructor/examiners in the area.

A large number of Goddard personnel are involved in soldering, and consideration is being given to establishing a soldering school at the center.

Stokes' training had two major purposes: To make available to Goddard a fully-qualified examiner to pass judgment on the quality of solder joints produced in-house; and to obtain information on the requirements for establishing such a training program at Goddard.

John Stokes, quality assurance branch, is Goddard's first NASA-approved soldering instructor/examiner.



Henry Doong, energetic particles branch, received a patent award for a new computer concept.

A NASA patent award was recently granted to Henry Doong, energetic particles branch, for the invention of an improved analog to digital converter especially suitable for use in the satellite program due to its simple design, light weight, and low power requirements.

It also has the capability of handling analog input of short duration pulses — another feature which makes it especially applicable to the space program.

Doong received a check for $400 from NASA in recognition for his work.

Recent Technical Publications Authored by Goddard Staff

J. V. Fedor, "The Effect of Solar Radiation Pressure on the Spin of Explorer XII," NASA Technical Note D-1855, August 1963.

Gerald L. Hempfling, Harold E. Evans, Robert C. Baumann, and Richard J. Andryshak, "Arctic Meteorology Photo Probe Polarized Light Experiment (Continuation of Project AMPP)" NASA Technical Note D-1449, August 1963.

Herbert P. Raabe, "Characteristic of Passive Communication Satellites with Lambertian Surfaces," NASA Technical Note D-1841, September 1963.

R. A. Hanel, W. R. Bandeen, and B. J. Conrath, "The Infrared Horizon of the Planet Earth." NASA Technical Note D-1850, September 1963.

Carl L. Wagner, Jr., "Ariel I—Evolution of its Structure," NASA Technical Note D-1903, September 1963.

Bernard J. Saint-Jean, "Theoretical Considerations for a Preliminary Design of a Solar Cell Generator on a Satellite," NASA Technical Note D-1904, September 1963.

Edited by Frank B. McDonald, "Solar Proton Manual," NASA Technical Report R-169, September 1963.

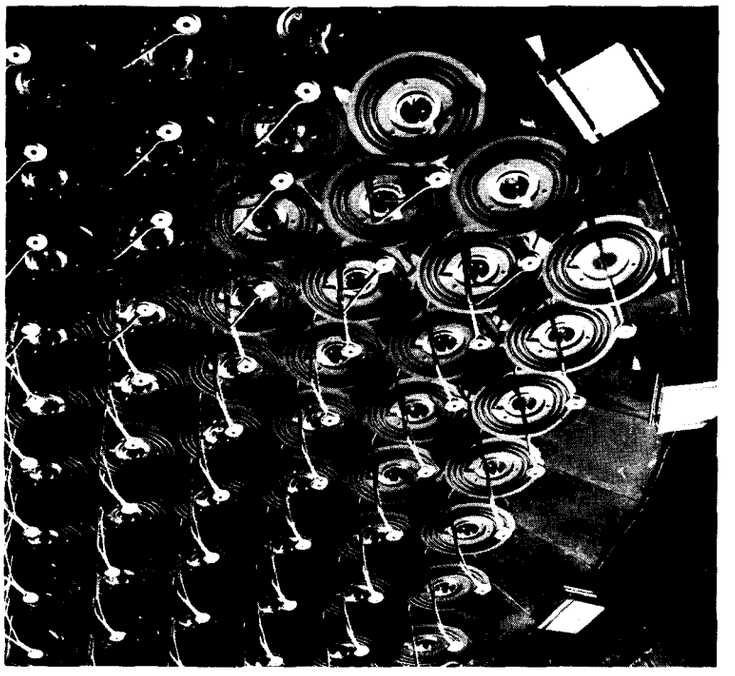
NOT SPRINGS:

Solar Simulator Nears Completion

A squadron of wound-up watch springs? No! This unusual sight is the inside ceiling of the large space simulator in building 10. The spring-like objects along the top of the dome are part of the solar simulator nearing final stages of construction.

The solar simulation capability is scheduled for completion in December. When operational, it will be capable of matching the energy of the sun to 130 watts per square foot—equivalent to the incident solar energy that a spacecraft would encounter in orbit above the earth's atmosphere.

In the center of each of the 127 coils is a relay lens which transmits simulated solar light which is produced by a mercury xenon lamp behind the lens.

The coils which surround each "solar eye" contain liquid nitrogen for conductive cooling. This part of the solar simulation module would otherwise become destroyed due to overheating, according to William Freeborne of the thermal vacuum facilities section.

The solar simulator can be modified to eventually double its capability and produce solar energy equivalent to that encountered in Venus orbit.