GODDARD NEWS

GODDARD SPACE FLIGHT CENTER / GREENBELT, MARYLAND

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Goddard to Host Optical Conference

An estimated 70 persons representing NASA's field centers and installations will come to Goddard Feb. 5-6 for the first intra-agency technical conference on optical communications and tracking.

Dr. Henry Plotkin, head of the optical systems branch, and Charles Boyle, Goddard public affairs officer, co-chairmen of the event, said the conference is being conducted to provide:

- An exchange of technical information on and review of NASA personnel with related facilities and activities at all centers.
- An opportunity to acquaint NASA personnel with related facilities and activities at the centers.

Scheduled to make special presentations during the two-day event are Roland Chase, NASA headquarters; S. J. DeFrance, D. M. Hegarty, F. A. Pauli, J. R. Swain, and T. M. Walsh, Ames Research Center; T. J. Ferguson, Flight Research Center; F. A. Thompson, W. N. Gardner, G. C. Broome, and R. W. Morton, Langley Research Center; Dr. John C. Evard, Lewis Research Center.

E. P. Martz, Jet Propulsion Lab; J. B. Dozier, C. Q. Lee, P. D. Phinees, J. L. Randall, R. M. Simpson, and C. L. Wyman, Marshall Space Flight Center; T. S. Johnson, physicist, Goddard optical systems branch; W. J. Carrion, associate head, optical systems branch; R. S. Powell, physicist, astrophysics branch, and Dr. Plotkin.

Dr. Charles Townes of the Massachusetts Institute of Technology will speak on "Laser Applications" at dinner on the evening of the first day.

The conference will be divided into four generic classes of papers ranging in scope from proposed programs to the reporting of data obtained through experimental investigations.

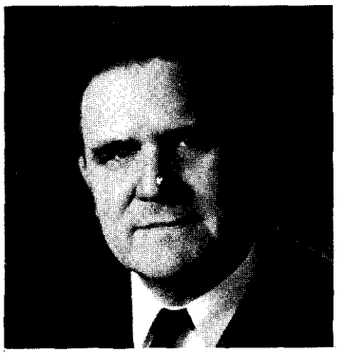
Goddard to Honor Tracking Station Nations At Fifth Anniversary Ceremonies Thursday

The government and people of the United States will express their thanks and appreciation to the peoples and governments of 16 countries when official representatives of the countries, including Vice President Johnson, come to Goddard Thursday to mark the fifth anniversary of international tracking of space vehicles.

An estimated 200 persons representing the scientific and political communities, including

Vice President Johnson

Secretary of State Rusk



NASA Administrator Webb

Astronaut Schirra

Secretary of State Dean Rusk, NASA Administrator James Webb, Astronaut Walter Schirra, and the ambassadors of 16 countries in which tracking stations are located, will participate in the 2:30 ceremonies in the building 3 auditorium.

The Vice President as chairman of the National Aeronautics and Space Council, will present scrolls of appreciation to the ambassadors of the countries which have cooperated with the United States in the establishment of the world-wide networks used in tracking manned and unmanned satellites.

Schirra to Talk

Dr. Harry Goett, Goddard director, will preside at the ceremonies and Astronaut Schirra of the Manned Spacecraft Center, whose Sigma 7 orbited the earth six times last Oct. 3, will be among the speakers.

He will express his personal appreciation and that of his fellow astronauts for the manned space flight network which kept Astronauts John Glenn, Scott Carpenter and himself in constant communication by voice and signal with men on the ground during their orbits around the earth.

Vanguard I "Beep"

During the ceremonies a signal from this country's oldest transmitting satellite—Vanguard I—is expected to be received. The six-inch spacecraft was launched March 17, 1958. Its transmissions have led to calculations showing the earth is pear-shaped. Information received from Vanguard I via the tracking networks has also helped in locating points on earth to an accuracy not previously known and has provided data on the effects of solar pressure.

Models and photos of the first United States earth satellites will be displayed.

Following the formal anniversary ceremonies, the ambassadors and other guests will tour Goddard. The tour will show how the limited communications which tracked Explorer I five years ago have expanded through the demands of the space age to an integrated network of teletype, telephone, and high speed data circuits comprising 177,000 miles of communications with 27 overseas facilities in 19 different political jurisdictions.

Thus far, members of Congress who have indicated they will attend the fifth anniversary celebration are Sen. Stuart Symington of Missouri, member of the senate committee on aeronautical and space sciences, and Congressmen Ben S. Jensen of Iowa, ranking minority member of the appropriations committee; Olin Teague of Texas, ranking majority member of the house committee on science and astronautics; Albert Thomas of Texas, chairman of the subcommittee on independent agencies' appropriations; James Fulton of Pennsylvania, member of the committee on science and astronautics, and George P. Miller chairman of the committee on science and astronautics.

Members of the scientific community indicating at this date their intention to attend include Dr. Fred Whipple, director of the Smithsonian Astrophysical Observatory; Dr. S. Douglas Cornell, executive officer of the National Academy of Sciences; and Dr. Edmond Welsh, executive secretary of the National Space Council.

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Rockets Uncover New Data on Temperatures and Winds

Two years of rocket grenade and sodium vapor experiments have given Goddard new insight into winters that are warmer than the summers in the mesosphere and winds that act like turbulent "jet streams" in the upper atmosphere.

Dr. William Nordberg, physicist in the aeronomy and meteorological division, and Wen-

Norberg

Smith

dell Smith, project manager for meteorological sounding rockets, said that the most important findings from the two-year sounding rocket program are

- The higher temperatures in the winter than in the summer and
- The conclusions that wind patterns and atmospheric circulation which can be explained by standard meteorological means below 80 kilometers (50 miles) undergo a major change above 80 kilometers.

In turning up the first evidence of the "warm" winters and "cold" summers in the mesosphere [a layer of the atmosphere between 50 and 90 kilometers (30 to 55 miles)] above Wallops Island, the findings confirmed a similar phenomenon discovered above Fort Churchill, Canada, in 1957-58. During that time rocket experiments were conducted by a signal corps team which William Stroud, chief of the aeronomy and meteorological division, and Dr. Nordberg headed.

Data compiled from the 1960-62 Wallops Island program indicates that winter temperatures are 25 degrees centigrade (56 degrees Fahrenheit) warmer than summer temperatures at altitudes of 75 kilometers (47 miles), Dr. Nordberg said.

At this altitude, average winter temperatures are —55 degrees centigrade (—67 degrees Fahrenheit). Warmest temperature ever observed at Wallops was about —20 degrees centigrade (—5 degrees Fahrenheit), in winter. Even warmer winter temperatures were observed at Fort Churchill.

Reasons Pondered

While speculation on the cause of the Fort Churchill phenomenon has centered on the peculiar Arctic location, this does not offer an explanation for the Wallops Island findings.

"These, more recent findings, indicate very definitely that the whole atmosphere up to 100 kilometers (62 miles), at latitudes as low as Wallops Island, is in an almost isothermal state during the winter season," said Dr. Nordberg.

"This means that temperature differences between various altitude regions, such as the stratopause [50 kilometers (32 miles), usually warm] and the mesopause [80 kilometers (50 miles), usually cold] are minimized. On the other hand, in summer these temperature extremes are greatly amplified. The theories based on the observations at Churchill alone are therefore not valid."

Temperature variations in the upper atmosphere are usually attributed to incoming solar radiation which warms the earth, and ozone at the stratopause [50 kilometers (30 miles)] and outgoing infrared radiation which cool the regions below and above. Why variations are so much smaller in the winter in these regions still is a cause of speculation.

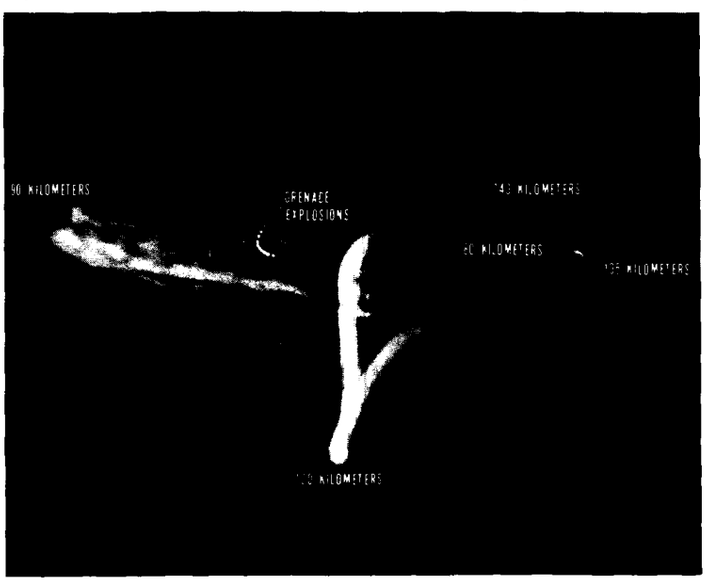
These temperatures, as important as they may be to the physics of the atmosphere, meteorology and aerodynamics design criteria, should not be discouraging to the aspirations of future space travelers, in the opinion of Dr. Nordberg.

He said that the atmosphere above 40-50 kilometers becomes so thin that it makes it nearly impossible to conduct any energy into such a large mass as that of a space capsule. In fact, because the atmosphere is so thin at these altitudes it makes the simple task of measuring temperature difficult. For this reason, an ordinary thermometer, which is effective on the ground where the air is more dense, cannot be used in the higher regions.

Erratic Winds

In addition to temperature data, the sounding rocket program provided new evidence that

- At altitudes above 70 to 80 kilometers (40 to 50 miles), wind behavior becomes erratic and so far unpredictable.



AGAINST a darkening sky, this is the twisting eerie tail of a sodium vapor experiment, illuminated by sunlight, seen by ground observers at Wallops Island. The tail becomes smoother in the higher altitudes indicating the absence of turbulence and predominance of diffusion. The grenades were ejected between altitudes of 40 to 90 kilometers (25-56 miles) from a rocket fired a few minutes after the launching of the sodium trail.

- Above 80 kilometers (50 miles), zones of relative calm are sandwiched between jet stream-like zones in which wind speeds range to 250 miles per hour and shift rapidly in direction. These regions of maximum "wind shears" are identified by sharp bends in the tail of sodium vapor released in this region.

While the wind shears are most pronounced above 80 kilometers (50 miles), they become less so above 120 kilometers, (70 miles) where more uniform velocities of about 200 miles per hour are present.

This region of uniformity may extend to altitudes as high as 200 kilometers (125 miles), but consistent patterns cannot be verified since few properly instrumented rockets have reached above 168 kilometers (105 miles).

Cause of the wind patterns in the lower altitudes can be attributed to the distribution of temperature and pressure, the same factors that determine weather near earth, according to Dr. Nordberg.

Determining Factors

Other factors become increasingly more important in determining the circulation patterns of winds above 80 kilometers (50 miles).

"Traditional meteorological methods of studying the upper atmosphere, such as deriving wind velocities and direction from temperature variations between the equator and the poles, will not fully answer the question of what causes the phenomenon," said Dr. Nordberg.

"The concepts of the ionosphere physicist, such as the inter-action of energetic and charged particles with the upper atmosphere and tidal forces, may be necessary to provide an understanding of these winds."

In carrying out the sounding rocket program, two-time-tested techniques were used—rocket grenade experiments, under the direction of Goddard, and sodium vapor experiments, conducted under contract to NASA by Dr. Edward Manring and John Bedinger, physicists with the Geophysics Corporation of America.

The rocket grenade technique is used to get temperature and wind velocity data from 50 to 100 kilometers (32-62 miles). By exactly measuring the direction of sound waves arriving at the ground from grenades whose explosion time, and locations are known precisely, temperature, wind, pressure and density can be determined.

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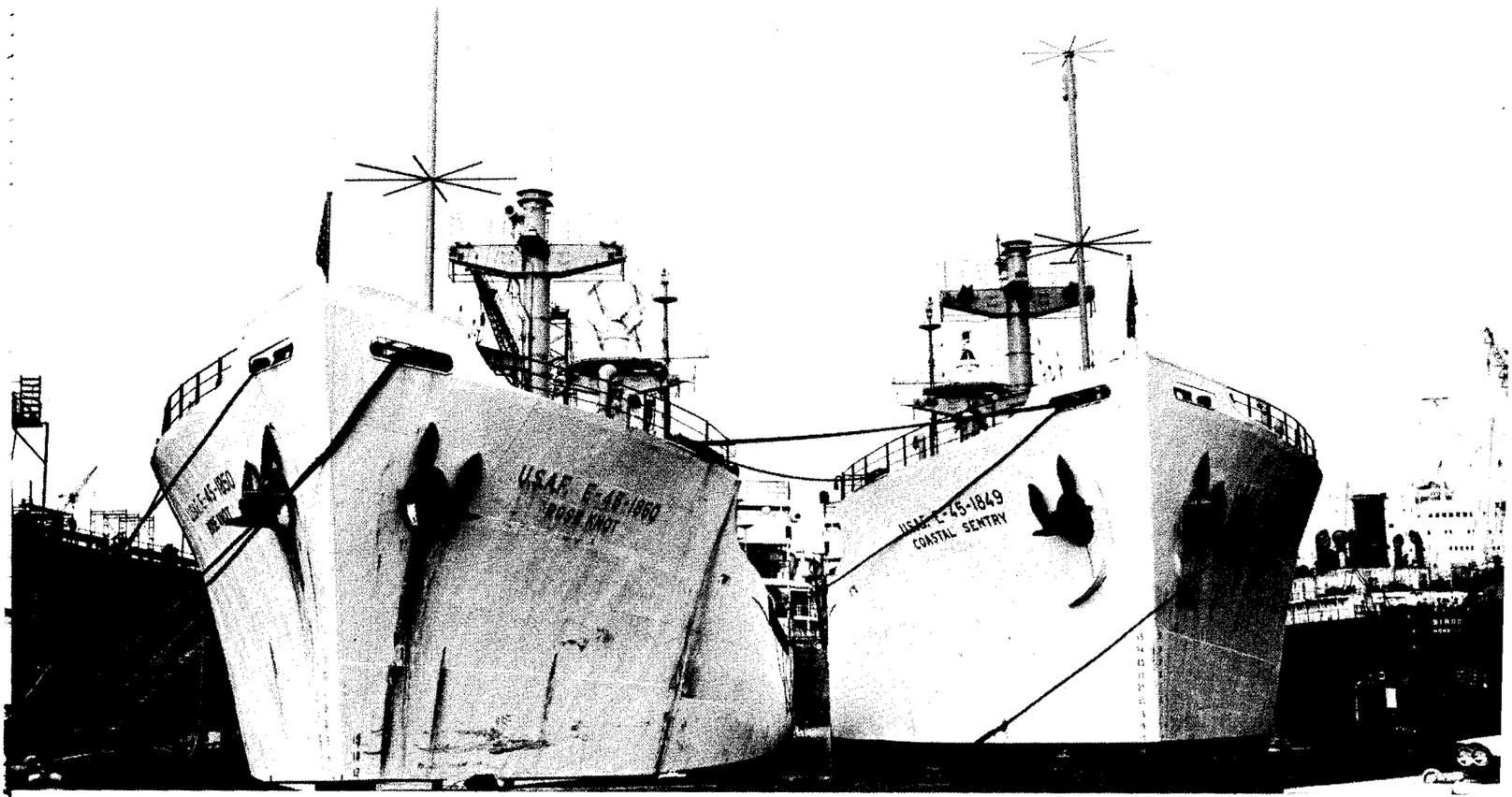


THE Rose Knot and Coastal Sentry are berthed side by side in Baltimore for the first time since early in their Mercury assignments.

GEORGE BRYANT, telemetry engineer in Goddard's network engineering branch, adjusts the slow-scan TV set aboard the Coastal Sentry.

TWO RCA employees aboard the Coastal Sentry—J. Belardo and A. L. Fripp—evaluate readings from the Sanborn Recorder.

Goddard's 'Navy' Readies for MA-9

The Rose Knot and Coastal Sentry, two mainstays in Goddard's world-wide Mercury tracking network, are ready for sea duty again.

After a month and a half of modifications in the Maryland Shipbuilding and Drydock company, the Coastal Sentry has begun a 52-day voyage via the Panama canal for the West Pacific ocean.

The Rose Knot is scheduled to leave Baltimore today for a two-week stay in drydock at Savannah, Ga. It will start its 30-day trek to the South Pacific Feb. 14.

The ships will be taking up their positions for the up-coming ninth mission of the Mercury-Atlas series.

Increased Capabilities

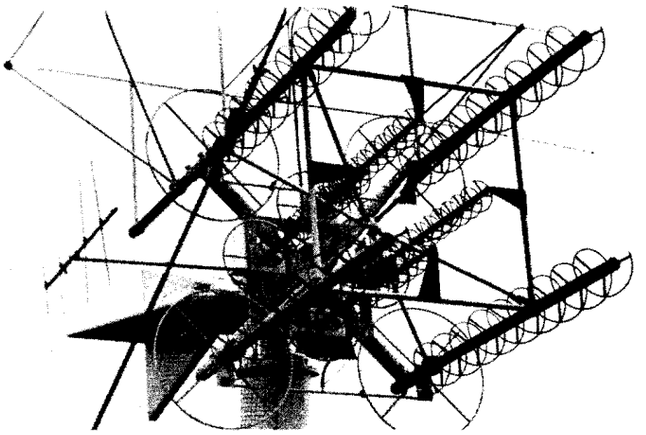
Changes made in the ships, under supervision of Goddard's network engineering branch, have provided increased capabilities to support the flight of Astronaut L. Gordon Cooper, Jr., this spring.

According to Dale Call, branch head, the modifications in the Coastal Sentry consisted of installing a dual 600-watt ultra high frequency command system, control console terminal equipment and antenna changes.

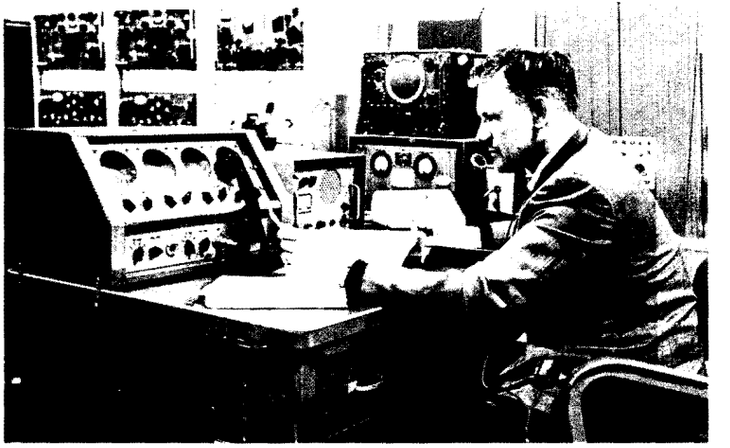
The new command system will permit command with the spacecraft during the retrofire sequence which occurs out of range of Goddard's Mercury network ground stations. It also will be able to control from the ground certain other functions of the spacecraft, e.g., attitude positioning and triggering an "astro-alarm" to awaken the astronaut during periods of sleep. These capabilities will be new to the Coastal Sentry.

"Candid-Camera"

In addition, a slow-scan television monitor has been installed to observe the astronaut during the flight. The slow-scan set develops the image on the screen line-by-line horizontally and is similar in appearance and movement to old-time silent movies.



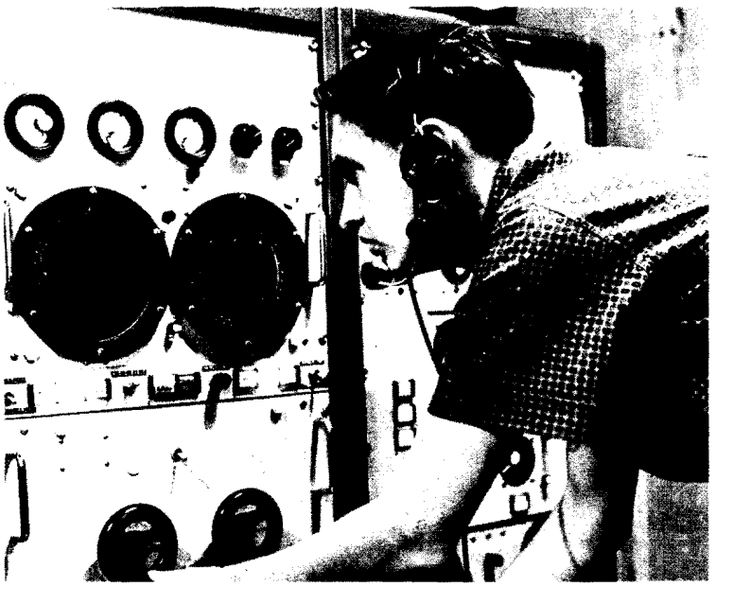
MODIFICATIONS to the Rose Knot included this multi-purpose receiver and transmitter antenna. It will be used for telemetry, high and ultra high frequency voice, and spacecraft command.



JOSEPH BROWN, Pan American World Airways maintenance and operations manager for the Coastal Sentry, reviews a modification report.

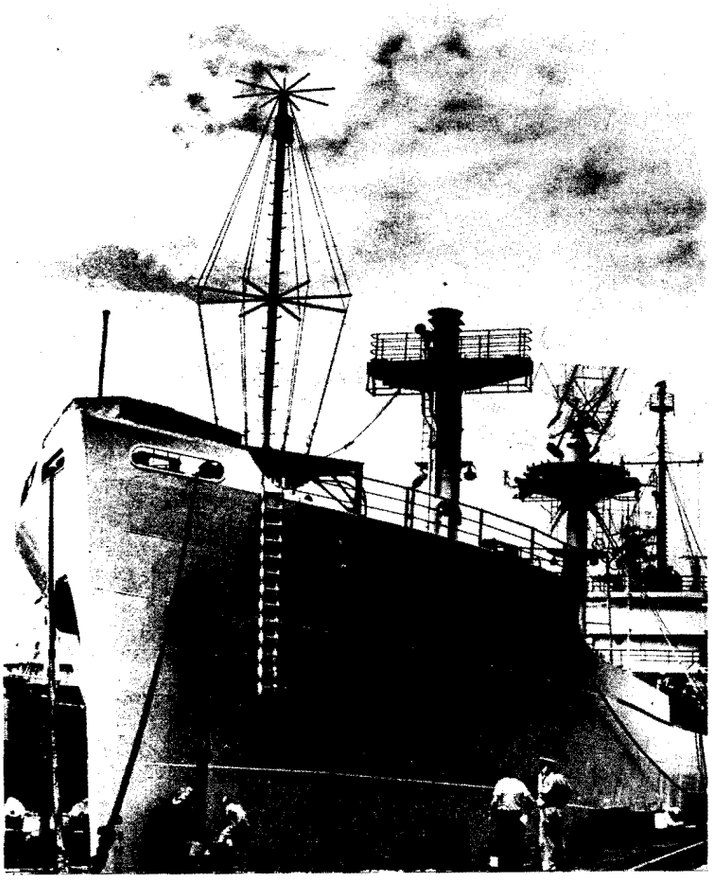
BOB SPEARING, command engineer in Goddard's network engineering branch, steps inside a special van to inspect command equipment installed under the modification program.

JACK KOSLOSKY, communications engineer in the branch, checks out the inter-communications system aboard the Coastal Sentry.



RCA man J. P. Sewell operates the acquisition aid console, which remotely controls ship antennas for automatic tracking of spacecraft.

THE Rose Knot is 338 feet long and 50 feet wide, powered by a 1,750-horsepower direct drive diesel engine.



On the Rose Knot, modifications consisted of adding a dual 10-kilowatt command system to the present 600-watt capability installed during a major modification last March.

Post-Mercury Flights

The 10-kilowatt system has the configuration required for manned space flights that will follow Mercury, according to Mr. Call.

In addition to the command system, other changes made during the March visit to the shipyard include installing two 125-kilowatt diesel generators and 48 tons of air conditioning equipment, constructing electronic equipment and machinery rooms, a recreation room, and additional accommodations for flight controllers and ship's crew.

In addition to the ships regular crew of about 40, 15 technicians are aboard. The ships are operated by the Defense department, with Pan American World airways and Radio Corporation of America personnel providing operational support under contract.

The ships' modifications were performed in record time by the Bendix corporation under its present contract with Goddard.

Lewis Center Works on Variety of Research Tasks

CLEVELAND—Special to the Goddard News—The Lewis Research Center, NASA's primary facility for studies of advanced propulsion and power generation systems, is deeply involved in research on problems associated with interplanetary space flight.

Analysis of one such problem—micrometeorite hazards—is shared with Goddard and the Langley Research Center. Goddard-Lewis cooperation extends well beyond basic research and development —to the launching pad. The Atlas-Agena, under Lewis' technical direction is scheduled to launch Goddard's scientific orbiting observatory series, OGO, and OAO.

Technical management of the Agena program

This is the third in a series of special articles on the activities and responsibilities of NASA's farflung installations and operations.

is only part of Lewis' development responsibility. Headed by Dr. Abe Silverstein, Lewis also has responsibility for the Centaur and M-1 programs.

Centaur, being developed as the nation's first high-energy system using liquid hydrogen fuel, will be used to place satellites in high earth orbits, to launch interplanetary probes and to soft-land instrument packages on the moon.

The M-1 engine, a much larger liquid hydrogen/liquid oxygen rocket, is planned for future heavy-payload manned missions requiring the M-1's 1.5 million pounds of thrust.

Rocket Research Leader

Designed and built in 1941-42 under NASA's predecessor, the National Advisory Committee for Aeronautics, Lewis pioneered in liquid hydrogen technology and today is an acknowledged leader in research involving nuclear, electric, and high-energy chemical rockets and in nuclear and solar energy conversion systems.

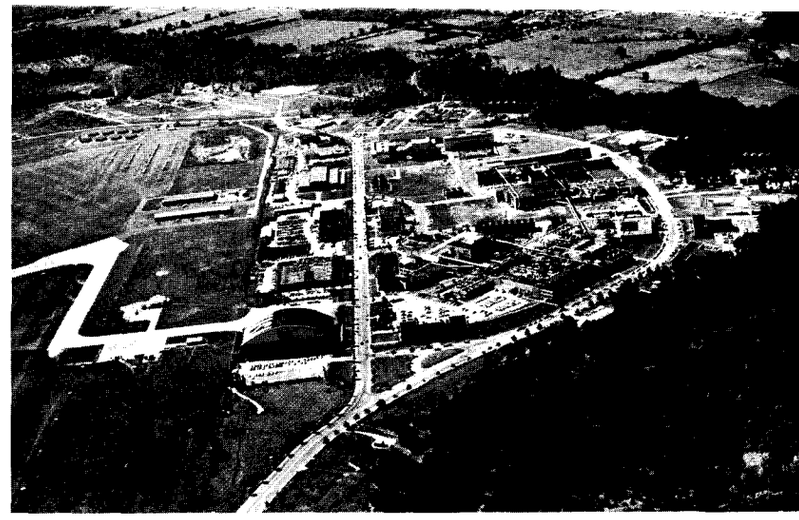
Located on a 350-acre site adjacent to Cleveland Hopkins airport, Lewis also operates a nuclear research reactor and rocket test site at the 6000-acre Plum Brook Station near Sandusky, Ohio. At the main laboratory in Cleveland, unique tools of research are employed to study flight propulsion problems from the chemistry of fuels through the operation of full-scale engines. These studies are conducted under simulated conditions of high-speed and high-altitude flight and space environment.

To meet the demands of high system reliability, large ground-based space environment facilities are used to simulate actual operating conditions. These consist of large vacuum chambers with walls cooled cryogenically to temperatures 400 degrees below zero.

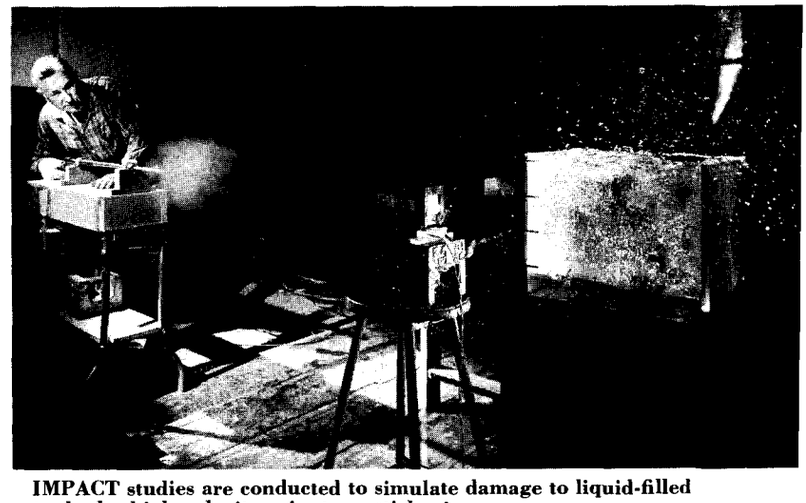
To round out space environment simulation, some facilities use high-intensity arc-light beams as a close approximation of solar thermal radiations. In such facilities detailed performance and reliability evaluations are made of the various propulsion and power systems. Here, at Lewis, several chambers are already in being—with more on the drawing board.

Giant "Space Tank"

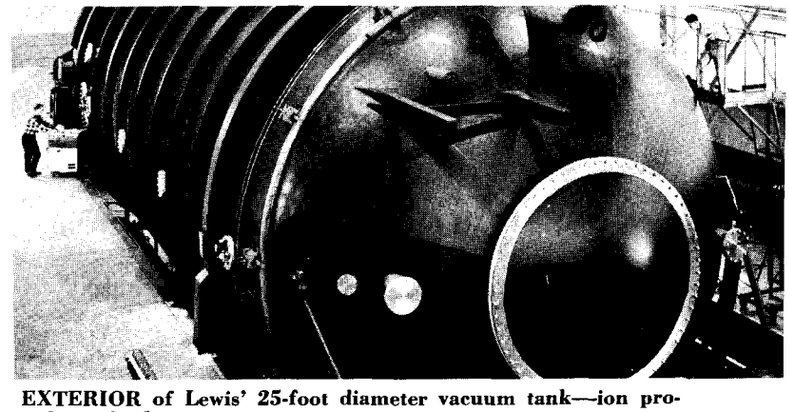
Fiscal year 1963 promises a giant 506- by 326-foot "space tank" for Plum Brook. In this proposed $25 million facility, Lewis engineers will test lightweight chemical and nuclear rocket engines with



LEWIS' sprawling 350 acre Center has a staff of 4,100 persons, including 1,300 scientists and engineers.



IMPACT studies are conducted to simulate damage to liquid-filled tanks by high velocity minute particles in space.



EXTERIOR of Lewis' 25-foot diameter vacuum tank—ion propulsion facility.

particular emphasis on their ignition, control, and re-start capabilities. The interior of this tank can be kept at liquid hydrogen temperatures (—423 degrees) and a pressure similar to that at an altitude of 190 miles for periods up to two weeks.

In effect, this will be like maintaining an advanced propulsion system in space for two weeks —except researchers will be able to follow the system's performance every step of the way and correct anything that needs correcting before the engine ever approaches actual space.

Other planned additions to Plum Brook include a lunar propulsion research facility, a hot hydrogen transfer facility and a nuclear rocket facility.

Research facilities now in use at Lewis include advanced rocket test units; laboratories for electric propulsion, space environment, and materials and structures research; central data and recording systems; apparatus for research on nuclear energy problems; and other specialized equipment pertaining to propulsion research.

Aeronautics to Astronautics

Working with advanced concepts in space technology is not unique at Lewis where engineers helped the World War II aeronautical effort by adding power and altitude to U.S. fighters and bombers. Long before the end of the war, work had begun in Cleveland on jet propulsion systems and early rocket engines.

Lewis' contributions to aeronautics in the last 20 years have been significant. They include:

- Solution of the B-29 engine over-heating problem.
- Development of a thermal ice-prevention system for aircraft, and
- Design of a water inerting system preventing fire after an aircraft crash.

The center was also responsible for early work in the areas of jet noise suppression, thrust reversal devices for jet aircraft, turbojet afterburners, supersonic inlets, and transonic compressors.

Lewis grew from aeronautics to astronautics as the space age began. Project Mercury drew heavily on research efforts at Lewis where scientists provided basic information on solid fuel rockets and designed the rocket escape system for the Mercury spacecraft. In addition, Lewis engineers constructed and operated a "multiaxis test facility" to aid in training the astronauts in techniques for controlling a spacecraft during periods of tumbling.

Valuable research leading to the design of the 1,500,000-pound thrust Saturn rocket was conducted at Lewis using the center's 8- by 6-foot supersonic wind tunnel. At the same time, other Lewis scientists concerned themselves with studies involving the development of high-energy fuels for the upper stages of Saturn and Centaur.

Interplanetary Propulsion

Work on propulsion systems and materials for interplanetary space travel is also much in evidence at Lewis. Looking toward the future and manned flights into deep space, electric propulsion researchers at Lewis began to explore the possibilities of lightweight, long-lived propulsion systems.

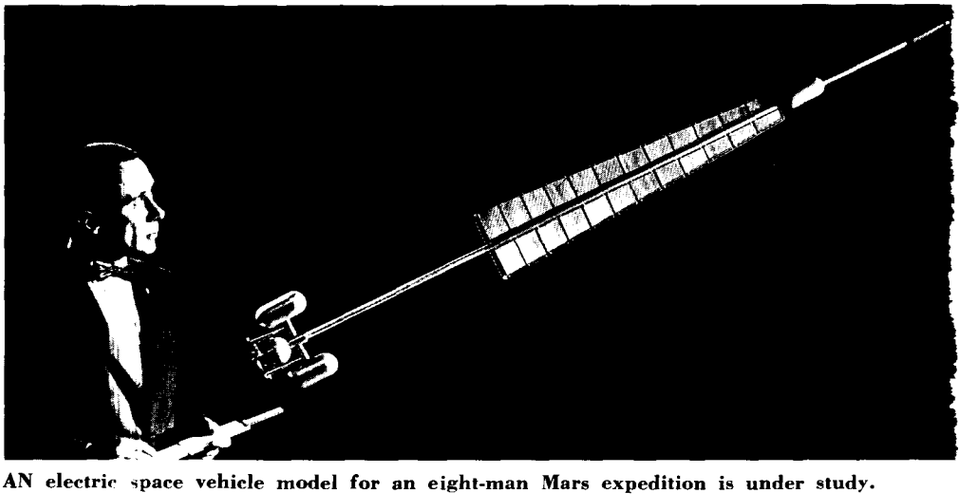
Because the power for electric engines can be drawn from minimum weight fuels—nuclear energy sources or solar radiation—they will be capable of delivering proportionately much larger payloads over infinitely greater distances than conventional chemical rockets.

In space, beyond atmospheric resistance and strong gravitational pulls, the whispery thrust of electric engines could speed multi-ton spacecraft to an interplanetary destination. High operational efficiency and long life make them equally suitable for more immediate uses in orbit adjustment, station-keeping, and altitude sustainer missions.

Lewis is busy on both the electric "thruster" and the necessary power generation system. The electron-bombardment, or Kaufman, ion engine designed at Lewis has been thoroughly researched in the gigantic vacuum tanks of the electric propulsion laboratory. Using mercury as a propellant, this tiny electric thruster is almost 80 per cent efficient —the best yet!

Lewis' work on Project Rover, a point NASA-AEC project, deals with propellant systems dynamics and nuclear engine control components associated with NERVA (acronym for nuclear engine for rocket vehicle application.) Future space missions may begin from an earth orbit where relatively small thrusts will be required for trips to Mars and beyond. Recently, the Atomic Energy Commission granted the NASA authority to operate the Plum Brook reactor at its full 60,000-kilowatt power to study shielding, materials, and component problems of nuclear propulsion systems. A steel disk coated with molybdenum disulfate will be irradiated to examine the characteristics of the solid-film lubricant under exposure to ionizing radiation.

HAROLD KAUFMAN, head of the electrostatic propulsion systems section at Lewis, examines an electron-bombardment engine known as the Kaufman engine.



AN electric space vehicle model for an eight-man Mars expedition is under study.

Another experiment, under contract to Lockheed Aircraft Corporation, will study the effects of neutron bombardment on various alloys of stainless steel, aluminum, and titanium. Metals behave unusually under radiation, especially at low temperatures where they become very brittle. The Lockheed experiment will irradiate alloys for one hour at 430 degrees below zero and measure the strength changes in the metal while it is under bombardment.

In addition to experiments in basic nuclear physics, the reactor will be used to make radiation damage checks on high temperature materials at a fast neutron flux of 2.8 times 10^{14} neutrons per square centimeter per second.

Another scheduled experiment will center around the Nerva actuator. Researchers will observe the cycling of the piston actuator under irradiation. In a nuclear space engine, the heat variation from the core of the reactor to the external walls is tremendous. Heat flux falls off exponentially from the core and determining the operation of the piston under such divergent but simultaneous heat conditions is a major experiment.

Interstellar Clouds May Be Linked To Distant Galaxies

Dr. George Field has taught astronomy and astrophysics at Princeton university since 1957. He has worked on problems relating to radio emission by interstellar clouds and has been associated with research into the gasses thought to lie in the space between galaxies. A consultant to Goddard's Institute for Space Studies, he has also worked on the theory of Jupiter's radio emission. Dr. Field spoke at the weekly Goddard colloquium Friday. A summary of his talk, "Interstellar Clouds," is presented here.

What are interstellar clouds?

Interstellar clouds are condensations of cold gas distributed in the vast reaches of space between the stars. Their most obvious effect is the extinction of the light of distant stars, similar to the obscuring effect of water clouds in our atmosphere. On large scale photographs of the Milky Way one sees large dark areas which are due to the interstellar clouds.

What are the principal constituents of insterstellar clouds?

The obscuring effects appear to be due to very small particles of some type. From a study of the way that the obscuring effects vary with the wavelength of light it seems that the typical dimension of these particles is a fraction of a micron. Because particles of this size are very efficient in scattering light they cause the most obvious effects.

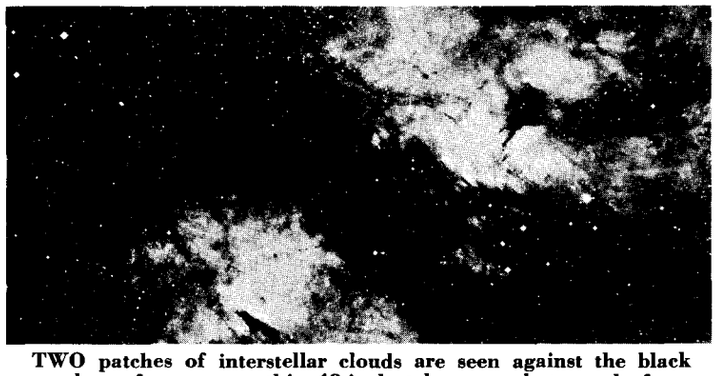
Field

Nevertheless it is thought that the total mass involved in such particles is only about 1 per cent of the mass of the clouds. The rest is thought to be composed of gaseous hydrogen and helium with traces of other gasses. Hydrogen is the most abundant element in the stars and it therefore came as no surprise when it was discovered that interstellar clouds emit radio waves of 21-centimeter wavelength, characteristic of atomic hydrogen gas. By a study of such emission it has been shown that indeed the principal constituent is hydrogen, and furthermore, that the mass of small particles is consistent with the assumption that they are composed of frozen water, methane and ammonia.

What is the distribution and size of interstellar clouds in space?

The interstellar clouds are closely confined to the plane of the Milky Way. Within the Milky Way, however, they are not distributed uniformly but appear to form long lanes of material thought to be analogous to the spiral arms of other galaxies. Why they do so is still a mystery. It is also a mystery as to why the gasses in space form into discrete units or clouds, rather than distributing themselves uniformly.

A typical cloud is about 10 parsecs (300 trillion kilometers) in diameter and has a mass 300 times that of the sun. Such clouds occupy only about 10 per cent of all interstellar space and yet they appear to contain up to 90 per cent of all the matter in space. We are still not sure what the state of matter is in the relatively empty spaces between clouds.



TWO patches of interstellar clouds are seen against the black reaches of space on this 48-inch telescope photograph from Mount Wilson and Palomar observatories. A lane of an even blacker cloud as well as small areas of darker clouds stand out across the bright nebulosities.

How do we detect their presence?

In addition to the obscuring effects and the emission of radio waves, interstellar clouds also absorb strongly at particular frequencies. One can obtain data on the motion of clouds from the study of such absorption, particularly that due to sodium and calcium. Moreover, interstellar clouds appear to be the seat of formation of stars. Such stars often betray the presence of the clouds in which they were formed by causing the hydrogen to fluoresce under the impact of ultra violet light from the hotter new stars.

Is there a relationship between stars and their formation and interstellar clouds?

Yes. There appears to be a definite relation between star formation and the clouds. Theory predicts that if a cloud becomes large enough, its own self-gravitation will overcome its internal pressure and cause it to collapse. The typical clouds do not meet this criterion by a factor of 100 or more. However, about one cloud in ten thousand appears to have a thousand times the mass of a typical cloud, and this is sufficient for gravity to play an important role in the development of the cloud. It is thought that the large clouds are the seat of star formation.

How do these large clouds themselves form? One possibility is that they are agglomerations of smaller clouds built up as those clouds collide with one another. The small units themselves may be formed out of the more diffuse background by an instability due to thermal effects in the gas. Such an instability may play the same role as gravitation, but draw its energy rather from the radiation of the stars.

What is the significance of interstellar clouds in the general structure of the galaxy?

At the present time 99 per cent of the matter in our Galaxy is in the form of stars. Consequently interstellar clouds do not play a dominant role in the structure of the galaxy. Nevertheless, judging from the fact that star formation still occurs in those clouds we may wonder if at one time the Galaxy were not primarily gaseous and whether the stars we encounter now may not have been formed in the billions of years since the creation of the Galaxy. If so, the fact that the Galaxy is a flat object may be a relic of the original distribution of gaseous material.

Do these clouds contain all of the material in interstellar space?

As yet it has proven rather difficult to study directly the low density regions which must lie between the clouds and must extend to great distances from the Galaxy. It has been established, however, that cosmic rays are present as much as 10,000 parsecs (300 quadrillion kilometers) from the Galaxy, suggesting the presence of magnetic fields and ionized gasses also.

If it can be definitely established that this distribution of low density material, or "halo", is really present, it may provide the solution to some of the mysteries connected with interstellar clouds. For example, this low density material at great distances from the plane may constantly be condensing onto the plane to form new clouds. This hypothesis is attractive because it may be connected with the fact that at the center of the Galaxy the interstellar clouds seem to be moving outward rather rapidly. To explain this we need a source of matter, although the dynamical problem of accelerating the material to a higher velocity has not been solved.

Session to Explain New Technique

A new technique added to Goddard's fabrication division capabilities will be the subject of a special session at 1:30 p.m. Feb. 4 in the cafeteria conference room, building 1.

Feature of the program will be a 30-minute color movie titled "How to Design for Aluminum Dip-Brazing." A question and answer period will follow and design manuals will be distributed.

Goddard News

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(ANNIVERSARY from page 1)

Representing NASA headquarters, in addition to Mr. Webb, will be Dr. Hugh Dryden, Dr. George Simpson, D. Brainerd Holmes, Thomas Dixon, Edmond Buckley, Dr. Homer Newell, Raymond Bisplinghoff, Arnold Frutkin, Paul Dembling, Admiral W. F. Boone and Gerald Truszynski. Dr. Abe Silverstein, director of Lewis Research Center, will attend from Cleveland.

Diplomatic Corps Tours Goddard

Families and official representatives of sixteen countries in the Washington diplomatic corps toured Goddard on a special visit last week.

Dr. Harry Goett welcomed about 40 persons from Australia, Canada, Great Britain, Greece, Guatemala, India, Israel, Nationalist China, Japan, Poland, Portugal, Sierra-Leone, Sweden, Turkey, West Germany, and the USSR.

ALBERTA MORAN, administrative assistant to Dr. Harry J. Goett, Goddard director, assists Mrs. Anatoly F. Dobrynin, left, wife of the Soviet Ambassador, when Washington's diplomatic corps toured the fabrication division's optical shop. Reflected in the mirror at the right is Mrs. Alexander Zinchuk, wife of the Soviet counselor.

Resumption of 100 per cent Data Acquistion on Explorer XIV Planned

Goddard scientists will make a special effort beginning Feb. 5 to diagnose the encoder trouble in Explorer XIV.

The spacecraft developed the difficulties after three and a half months of perfect operation, but determining the exact cause is more difficult because telemetry readings on such important items as voltage, temperature, and current will not pass through the encoder system.

Paul Marcotte, Explorer XIV project manager said that beginning Feb. 5 and through Feb. 21 Goddard Minitrack stations will return to 100 per cent data acquisition of the spacecraft. When the encoder problem was first discovered, data coverage was reduced to make more efficient use of the spacecraft, manpower and telemetry tapes.

When full-time read-out is resumed during the two week period, the spacecraft will be passing through the earth's shadow for up to 2¼ hours during each of the 36-hour orbital periods.

Beneficial Procedure

One hundred per cent telemetry recording during this period will be beneficial from two standpoints, according to Mr. Marcotte.

"If there is a thermal cause of the encoder defect, it might be remedied by a change in temperature which the cooling effect of the earth's shadow will provide. This might disclose among other things a bad connection or solder joint that could be corrected by cooling. This can be determined by analysis of the recorded data."

In addition, the spacecraft will also provide data on when the spacecraft enters the earth's shadow, the time it remains in it and when it leaves.

"This data will aid in future 'launch window' predictions," said Mr. Marcotte.

At present Explorer XIV is still transmitting optical aspect data on the spin axis sun angle to within 25 degrees, and is continuing to determine the rotation rate during periods it is in the sunlight.

Objectives Achieved

Scientific data has not been fully analyzed, according to Dr. Frank B. McDonald, project scientist in the fields and particles branch, but preliminary findings may be ready by mid-March. Dr. McDonald said the more than 1,000 miles of data recorded on magnetic tape by tracking stations should fulfill the major objectives of the satellite.

Solar paddle cells on the 90-pound satellite received less than 10 per cent degradation from man-made and natural radiation since its launch Oct. 2. Project personnel believe, with a good deal of certainty, that radiation damage is not the cause of the satellite's present malfunction because the spacecraft's highly elliptical orbit takes it quickly through the radiation zones above the earth.

Explorer XIV has an apogee of 61,000 statute miles, coming within 170 miles of the earth at perigee, or closest point. It takes 36 hours and 24 minutes for the spacecraft to complete an orbit.

"We have every hope that because the trouble is intermittent it will eventually come out of it," said Herbert Myerson, assistant project manager. "If we could just snap the encoder system off and on once it might be all it needs."

(ROCKETS, from page 2)

"Above this altitude the experiment is not useful because the propagation of sound on which measurements are based becomes extremely inefficient," said Mr. Smith, program scientist for the rocket grenade experiments. Four pounds, of explosives detonated at 100 kilometers (62 miles), is barely heard on the ground. But it would require an additional two pounds of explosives—half the weight of the original charge—to sound a mere 10 kilometers (6 miles) higher."

Thus grenade soundings give way to the sodium vapor technique for effective wind measurements in the higher regions. In this process, rockets carrying vapor are launched at dusk or near dawn while the earth's surface and observation site is in darkness but while sunlight can illuminate the trail drifting with the wind. The drift is then photographed by cameras (see photograph).

Goddard Coming Events

Goddard colloquium lectures:

- **Feb. 1, no lecture scheduled.**
- **Feb. 8, 3 p.m., Auditorium, Bldg. 3—Dr. Conway Snyder, Space Sciences Division, Jet Propulsion Lab., Pasadena, Calif. "The Mariner II Mission".**
- **Feb. 13, 3 p.m., Auditorium, Bldg. 3—Dr. Lewis Kaplan, Space Sciences Division Jet Propulsion Lab., Pasadena, Calif., "The Results Of The Infrared Experiment On Tiros II".**
- **Feb. 15, 3 p.m., Auditorium, Bldg. 3—Dr. R. M. Kulsrud, Princeton university. "Research On High Altitude Nuclear Explosions".**

Misc:

- **Goddard Wives — Evening Interest Group Talent Show.**
- **Jan. 31, 2:30 p.m., Auditorium, Bldg. 3 — Fifth Anniversary Tracking Program.**

Goddard Speech and Paper Presentations

(Technical presentations approved as of Jan. 23 for period of Jan. 28 thru Feb. 10 and late approvals for the past two weeks)

SPEECHES

Dr. W. N. Hess, theoretical division, USAF Scientific Advisory Board, Jan. 30, Englewood, Calif. ***"Artificial and Natural Radiation Belts"***

H. L. Hoff, operations support div., Annual Convention of State Wide Surveyors, Feb. 2, Buffalo, N. Y. ***"Precision Surveys and their use in the Worldwide Tracking and Data Facilities"***

R. C. Baumann, mechanical systems branch, American Society of Mechanical Engineers (Student Section), Feb. 6, George Washington Univ., Washington, D.C. ***"Ariel I Satellite"***

C. E. Fichtel, fields and particles branch, Space Physics Seminar, Feb. 12, University of Maryland. ***"Composition of Solar Cosmic Rays"***

N. P. Zylich, thermo dynamics branch, Inst. of Environmental Sciences (local chapter) Feb. 14, Greenbelt, Md. ***"Solar Simulation"***