GODDARD NEWS

GODDARD SPACE FLIGHT CENTER / GREENBELT, MARYLAND

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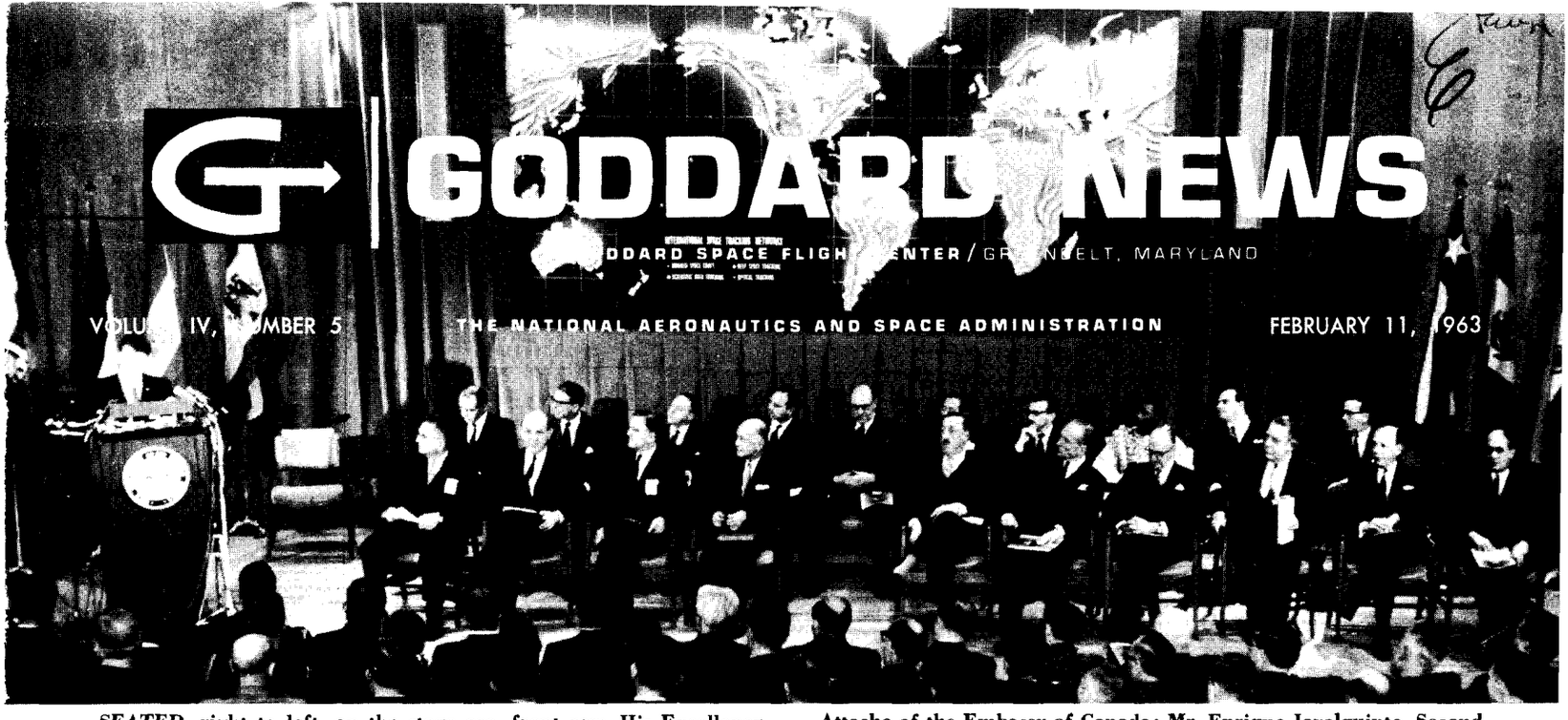

SEATED, right to left, on the stage are, front row, His Excellency Hossein Ghods-Nakhai, the Ambassador of Iran; His Excellency Dr. Neftali Ponce-Miranda, the Ambassador of Ecuador; His Excellency Willem C. Naude, the Ambassador of South Africa; His Excellency, the Honorable Sir Howard Beale, K.B.E., Q.C., the Ambassador of Australia; His Excellency Dr. J. Herman van Roijen, the Ambassador of the Netherlands; His Excellency Fernando Berckemeyer, the Ambassador of Peru; Dr. Edward C. Welsh, Executive Secretary of the National Aeronautics and Space Council; James E. Webb, Administrator of NASA; the Honorable Dean Rusk, Secretary of State; and Dr. Harry J. Goett, Goddard Director. In the second row, right to left, are Dr. Elwyn O. Hughes, Scientific Attache of the Embassy of Canada; Mr. Enrique Javalquinto, Second Secretary of the Embassy of Chile; Mr. Godwin A. Onyegbula, Counselor of the Embassy of Nigeria; Mr. Carlos F. Leckie Lobo, Counselor of the Brazilian Embassy; Mr. Masao Kanazawa, Counselor of the Embassy of Japan; The Honorable Michael A. M. Robb, the Information Minister of the British Embassy; The Honorable Avtar Krishna Dar, the Minister of the Embassy of India; The Honorable Eugenio de Anzorena, the Minister of the Embassy of Mexico; His Excellency Antonio Garrigues, the Ambassador of Spain; and His Excellency Dr. Roberto T. Alemann, the Ambassador of Argentina. At the rostrum is Astronaut Schirra.

Ceremonies Mark 5 Years of Tracking

Goddard played host Thursday, Jan. 31, to the official representatives of sixteen countries which make up the world-wide space tracking network.

With Secretary of State Dean Rusk, NASA Administrator James Webb, Executive Secretary Edward Welsh of the National Aeronautics and Space Council, Astronaut Wally Schirra and congressional representatives in attendance, the speakers praised the countries for their cooperation during the first five years of space tracking by the United States.

At the conclusion of the ceremonies, Secretary Rusk presented each of the representatives with scrolls of appreciation for their international efforts.

Invited but forced to cancel his visit at the last moment was Vice President Johnson, whose prepared remarks were delivered by Dr. Welsh.

In his opening remarks, Dr. Goett painted a visual picture of tracking a satellite, as experienced by the participants directly involved—the network personnel and those at Goddard's Operations Center.

In tracking the progress of a spacecraft as it passes over the countries of the Mercury or Minitrack networks, Dr. Goett described the tenseness and sense of drama that develops with each anticipated message or bit of information transmitted by an astronaut.

". . . This tenseness will only relax when the capsule is sighted by one of the recovery craft in the Atlantic, and you know that once again the tracking network has done its part of the job in pinpointing the landing spot. . ."

Dr. Goett called the roll of the 16 nations involved in the large scale space effort and expressed his thanks for their contributions and a "job well done. Without this support, the success, of which all of us are proud, could not have been achieved," Dr. Goett said.

* * *

Secretary Rusk

Secretary Rusk in comparing the similarities of space exploration with discoveries in other fields that have come before, demonstrated the great magnitude and complexity of the advances being made in science and technology.

Said Secretary Rusk, in part:

"Science has never recognized man-made boundaries. The continued development of science must always rest on an international base, for nature does not play favorites. We 17 nations have embarked on a cooperative effort to expand the knowledge of man to an un-

(Cont'd on page 6, col 4)

* * *

Mr. Webb

Mr. Webb emphasized in his talk the rapidly accelerating rate of cooperation in international space activities by summarizing space projects undertaken in 1962:

"Two international satellites were launched — Ariel, built here at Goddard and carrying six experiments prepared by the United Kingdom, and Alouette, a joint project with Canada, in which the satellite was wholly developed by Canadians. Ariel was designed chiefly to contribute to man's knowledge of the ionosphere. . . .

"Alouette, a so-called topside

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* * *

Dr. Welsh

Dr. Welsh traced the background leading to the passage of Public Law 85-568, which established NASA, referring throughout his talk to the nation's fundamental policy, stated in the Act, that space activities of the United States should be dedicated to peaceful purposes for the benefit of all mankind. He concluded by quoting from President Kennedy on America's space effort. In part, the President said:

"We set sail on this new sea because there is new knowledge to be gained, and new rights to be won, and they must

(Cont'd on page 6, col 4)

* * *

Astronaut Schirra

Astronaut Schirra, in recalling statements at the time of his mission that the "flight was as close to perfect as could be achieved by human report," attributed the success in large measure to the tracking network.

"Nothing can be perfect without a lot of people knowing their job and caring that it gets done the right way," Commander Schirra said.

"There were several times when the communications network relayed messages that marked the high points of the flight for me. The first time

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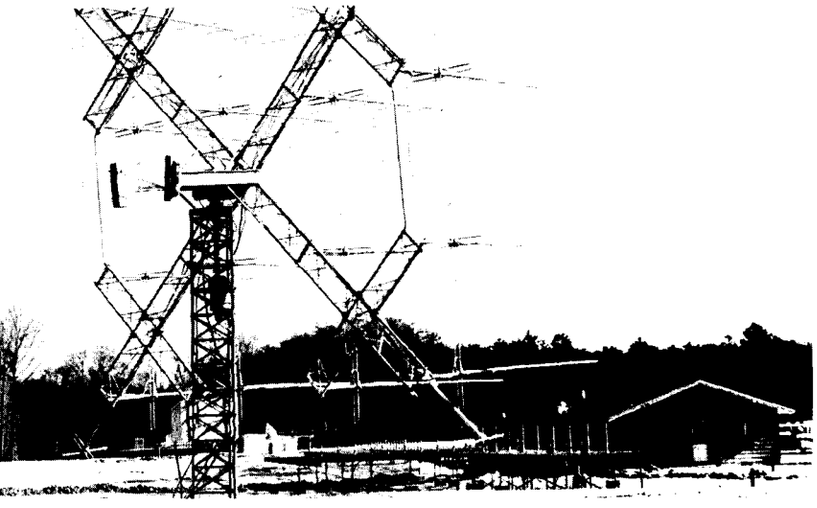
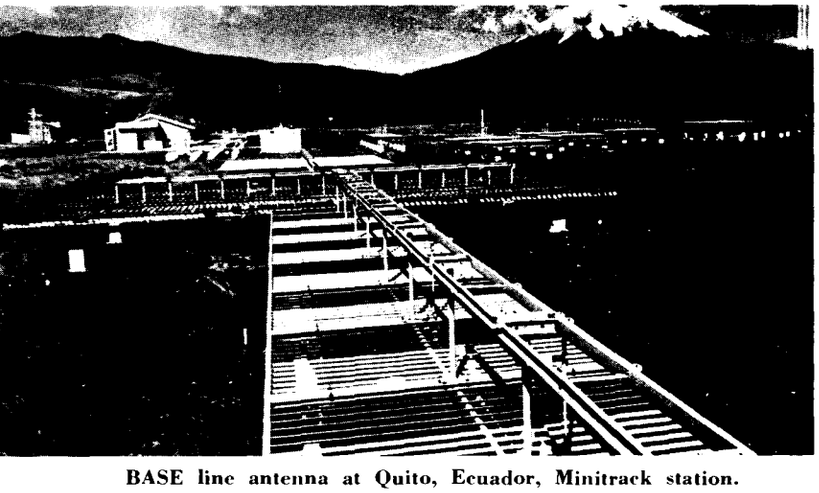


BLOSSOM POINT, MD., tracking station consists of experimental and Minitrack antennas and operations building



BASE line antenna at Quito, Ecuador, Minitrack station.

The deep space instrumentation antenna facility at Goldstone, Calif.

Minitrack Network

W. J. Botha
South Africa

C. Cunningham
Chile

James Moore
Chile

Rowland Nelson
Minnesota

C. Nicolson
England

R. L. Kerr
Newfoundland

Bruce Robb
Maryland

C. Matthes
Florida

D. McClenon
Ecuador

G. Neville
California

Jake Kerr
Australia

John Miller
Alaska

Not Pictured
Leo McGee,
Peru

DSIF Network

D. Hogg
South Africa

Walter Larkin
California

Bill Mettyear
Australia

Four Wo

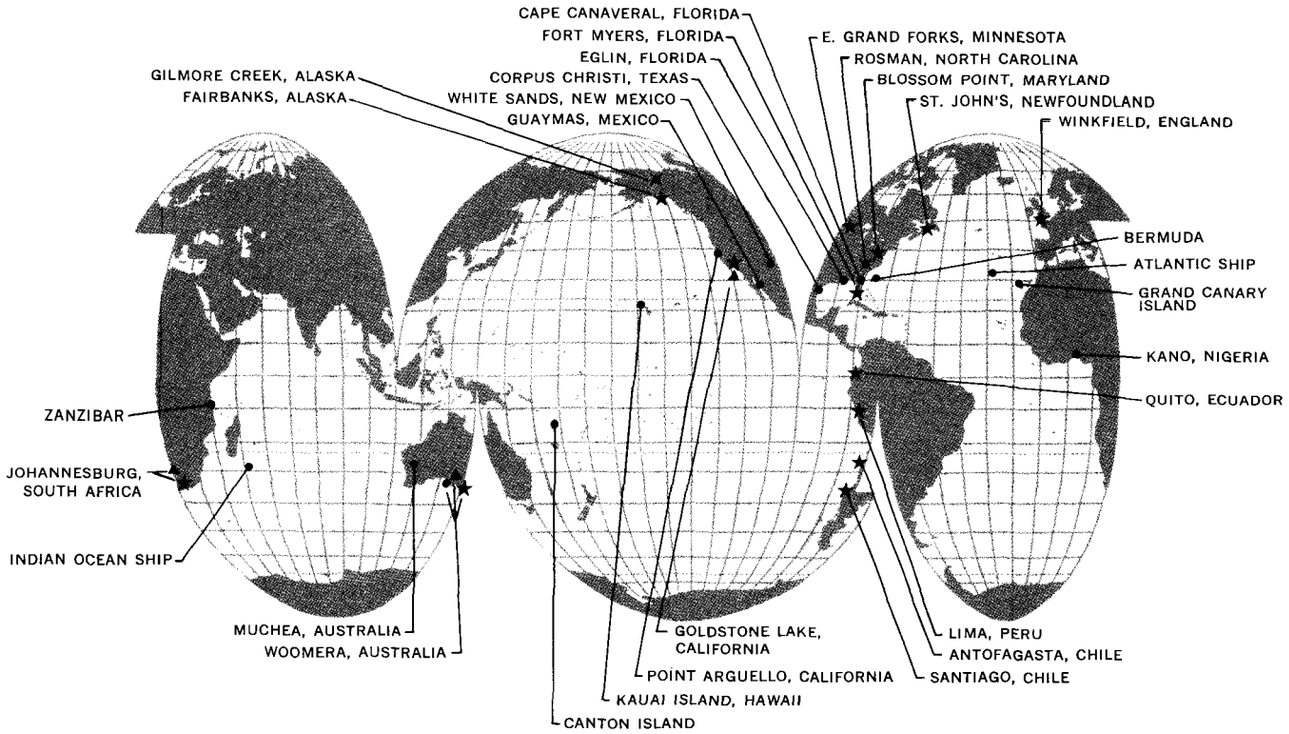
A spacecraft with the finest scientific instruments, launched perfectly into orbit, is worthless unless it can be tracked to determine where it is, and its scientific information can be retrieved and recorded on the ground. Then the data, recorded on magnetic tape, must be reduced into facts and figures in order that the scientist can analyze the results of his space-borne experiments.

To accomplish this task, the Goddard Space Flight Center serves as the tracking, communications and computing hub of NASA's world-wide Minitrack and Manned Spacecraft networks.

In addition, the Jet Propulsion Laboratory, Pasadena, Calif., operates Deep Space Instrumentation Facilities in two countries abroad for the tracking and data acquisition of lunar and planetary satellite projects.

Deep Space Instrumentation Facility stations are located at Goldstone, Calif.; Johannesburg, Republic of South Africa; and Woomera, Australia. The Network Control Center is at the Jet Propulsion Laboratory, Pasadena.

The Goldstone Tracking Facility is located at a remote site in the Mojave Desert near Barstow, Calif. The Goldstone facility, named for adjacent Goldstone Dry Lake, was se-



★ MINITRACK NETWORK • MANNED SPACE FLIGHT NETWORK ▲ DEEP SPACE INSTRUMENTATION ✖ WIDE BAND DATA ACQUISITION

In addition to the stations shown above, the Smithsonian Astrophysical Observatory (SAO) has optical tracking sites in Argentina, Australia, Netherlands West Indies, Florida, Hawaii, India, Iran, Japan, New Mexico, Peru, South Africa and Spain.

rld-Wide Tracking Networks Serve America's Peaceful Space

lected as the site for these antennas, because it offers extremely low background noise levels. Due to the sensitivity the three permanent installations are located approximately 120 degrees apart around the earth. Their tracking coverage overlaps so as to provide continuous contact with the spacecraft. Throughout the mission each station locks onto the spacecraft, tracks it until the rotation of the earth carries the station to the limits of its horizon, and then passes the spacecraft on to the next station.

The DSIF stations, in addition to the gain derivable from their large antennas, also must attribute their ability to communicate across millions of miles of space to their extremely sensitive and stable receivers.

The Smithsonian Astrophysical Observatory operates, under a NASA grant, 12 optical tracking stations each equipped with a Baker-Nunn telescopic camera. This optical tracking serves as a back-up system for ground radio stations. It provides information on atmospheric densities and is employed on geodesy—the determination of exact distances on earth.

Minitrack Network

Thirteen Minitrack stations which serve as "eyes and ears" for un-manned scientific satellites provide precision tracking, command and telemetry data to the space operations control center at Goddard.

The instrumentation used primarily for unmanned satellite missions is an outgrowth of the system which was originally created as part of Project Vanguard in 1957. This network was used to track Explorer I, first U.S. earth satellite launched on Jan. 31, 1958.

The number of Minitrack stations and their locations were chosen to insure that at least one station will be within line of sight of a satellite during almost every orbit, regardless of the inclination or the orbital altitude. Each station generates a fan-shaped antenna radiation pattern approximately 11 by 76 degrees. The data obtained is automatically sampled and punched, in digital form, suitable for teletype transmission, on paper tape along with time and other appropriate information. It is then transmitted back to Goddard for computation of the satellite's position.

Most of today's small satellites will give way to the large orbiting observatories. This will increase the complexity, range of operation, mission duration and volume of data. Improved ground facilities to handle the new generation of spacecraft are needed. Some already exist; others are in the planning stage.

Present equipment for the big observatories consists of an 85-foot antenna at Rosman, N. C., and another at Fairbanks, Alaska. In addition, one more is under consideration for Rosman and one for a station in the Far East. These antenna systems, because of their high power and sensitivity, will handle information in much greater volume and variety.

Goddard's Manned Network

For manned space flights, conducted by the Manned Spacecraft Center, Goddard operates a global network of stations for tracking, telemetry, and voice communications on a "real-time" basis. The focal point of this communications system is Goddard which determines and predicts satellite orbits, and controls a voice network, called SCAMA, linked to stations in the network. Appropriate data so obtained is transmitted to the Mercury Control Center at Cape Canaveral and used for flight operation control. Dual high speed computers, each with a "realtime" channel, make constant flight contingency recommendations, predict flight paths, determine the time to initiate reentry and predict the impact point of the capsule on a near-instantaneous and continuous basis during the mission. These computers, in the simplest mathematical explanation, can add, for instance, a column of 10-digit numbers ¾ of a mile in length every second.

The manned spacecraft tracking system spans three continents and three oceans, interconnected by a global communications network. It utilizes land lines, undersea cables and radio circuits, and special communications equipment installed at commercial switching stations in both the Eastern and Western hemispheres.

Goddard's site facilities include equipment for acquiring the spacecraft; long range radars for automatic tracking; telemetry equipment for controlling the manned vehicle from the ground if necessary, and voice channels for ground-to-air communications.

Optical Network

As a further method of obtaining the position of an earth satellite, the 12 Baker-Nunn photographic tracking stations of the Smithsonian Astrophysical observatory are located in Argentina; Australia; Curacao, Netherlands West Indies; Florida; Hawaii; India, Iran; Japan; New Mexico; Peru; South Africa; and Spain. Each station has a standard complement of six observers. The network is supported by a tech-

(WEBB, from page 1)

sounder, also was designed to study the ionosphere, but from above. By 'sweeping' radio frequencies across the ionosphere, Alouette measures electron density at various altitudes over almost the entire globe. Of particular interest to Canadian scientists . . . was the possibility of learning more about the severe and prolonged disturbances that plague radio communications in that nation's northern areas.

"In other cooperative projects, 21 sounding rockets were launched, 11 in this country and 10 abroad, in areas of special consequence to the scientific world.

"Two active communications satellites, Telstar and Relay, were launched . . .

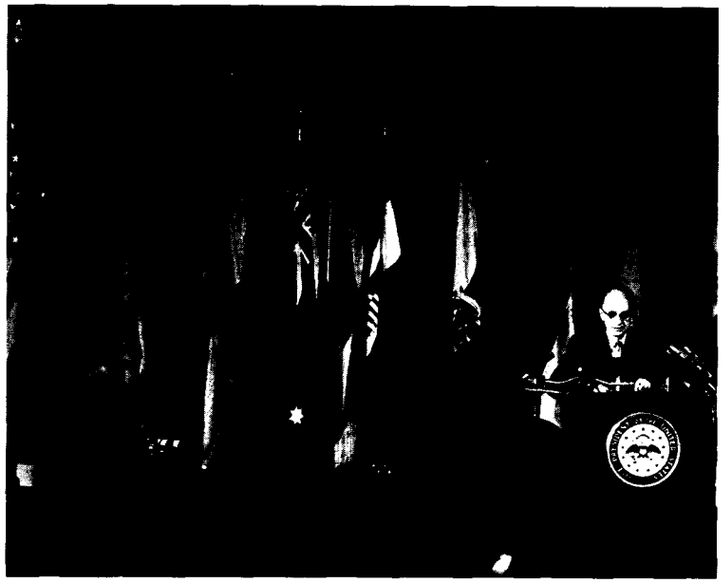
"In the field of weather satellites, 35 countries are cooperating in weather observations synchronized with the passes of our Tiros weather satellites over their territory. A new system, called the Automatic Picture Transmission Subsystem (APT), which we will soon test experimentally will, if successful, ultimately permit local readout of photographs of their own cloud cover by nations over which it passes.

"Other international satellites are being prepared. The United States and Italy are working together on the San Marco project which will lead to the launching of an Italian satellite by an Italian launch crew using an American Scout rocket from a platform in the Indian ocean off the east coast of Africa.

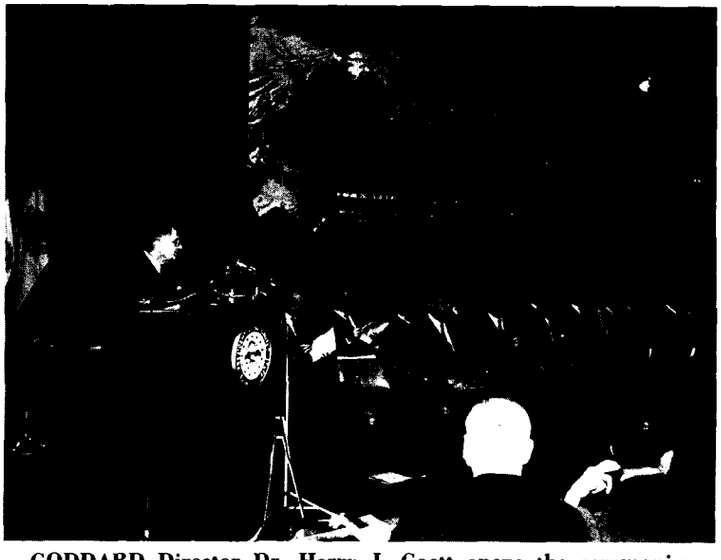
"Also, in 1962, arrangements were completed between this country and the Soviet Union which may eventually lead to cooperation in international magnetic survey programs and in the use of weather and communications satellites."

Mr. Webb noted the broadening base of international space activity in steps being taken to form

- the European Scientific Research Organization (ESRO),
- the European Launch Development Organization (ELDO),
- plans for satellite and space probes to be used in astronomical and planetary research and
- cooperative sounding rocket endeavors by several groups in South America.



Flanked by the flags of the 16 nations being honored, Dr. Edward Welsh represents Vice President Johnson, who was forced to cancel his visit.



GODDARD Director Dr. Harry J. Goett opens the ceremonies in building 3 auditorium.

(SCHIRRA, from page 1)

came just after sustainer cutoff when the Cape spacecraft communicator informed me I had a seven orbit capability. It announced the successful start of the mission.

"I realize that the favorable decision was made possible by those ultra fast computers here at Goddard. When we're talking about orbital speeds, it means snap decisions that are right. For the men to make these decisions, they must have the facts from the machines instantly. But however much more we rely on the machines to do the work, the decisions must be made by men. In the final analysis, it is the man who runs the machines. . .

"The second milestone of the flight came with the go-ahead for the fourth orbit. It was again a situation where the supporting role of the network and the computers played an important part in getting a fast decision. My reaction that they were 'sweet words' that came over the receiver was no understatement. If we were going to make a sizeable advance in technology beyond the flights of John Glenn and Scott Carpenter, it would be made after the third orbit, and I was glad to hear that the whole net was ready to talk to me for a few more passes.

"The third outstanding feature of the mission was the reentry that brought me down within sight of the aircraft carrier assigned to pick me up. It's no small feat to hit a preselected spot in the middle of the world's biggest ocean, but thanks to the retrorocket firing calculations provided by Goddard and the communications link with the Rose Knot, I managed to get Sigma Seven pretty much in the pickle barrel.

"Even after I came down, I had good communications with the spacecraft communicator at Hawaii, and they never left me until they were sure I was recovered and the mission was completed. It's a pleasant feeling to have that kind of communications."

NASA, Congress Are Represented

NASA headquarters and Congress were well represented at the Jan 31 ceremonies.

Among those who attended, in addition to Mr. Webb, were Dr. Hugh Dryden, Dr. George Simpson, Edmond Buckley, Arnold Frutkin, Paul Dembling, Admiral W. F. Boone, Leonard Jaffee, Gerald Truszynski, Bill Lloyd, Ralph Cushman, Julian Scheer and Dr. Albert Kelley.

Other distinguished guests included Congressman George P. Miller, Chairman, and Congressman James Fulton of the House Committee on Science and Astronautics.

(RUSK, from page 1)

precedented extent. We are doing it in the full glare of light. The world watches us in our successes and our failures. And the whole world will benefit from our discoveries. . . "

"The United States will continue to be guided by these principles in our relations with the international community," Secretary Rusk said at the conclusion of his talk.

(WELSH, from page 1)

be won and used for the progress of all people. For space science, like nuclear science and all technology, has no conscience of its own.

"Whether it will become a force for good or ill depends on men, and only if the United States occupies a position of pre-eminence can we help decide whether this new ocean will be a sea of peace, or a new, terrifying theater of war.

"That it will be a sea of peace, I strongly believe."

Manned Network

C. Rouiller, Jr.
Grand Can'y Is.

Dalton Webb
Bermuda

L. Wainwright
Australia

Bill Kaye
Australia

Tom Spencer
East Africa

Alva Smith
Nigeria

Otto Womick
Mexico

John Jepson
Florida

Morton Berndt
Corpus Christi

Herbert Nolte
White Sands

George Fariss
White Sands

Not Pictured:
Mission Control Center
J. Sharkey
Grand Bahama.....S. Monfette
Grand Turk.....J. R. Collins
Kauai, Hawaii.....Virgil True
Canton Island.....D. Rathner
Point Arguello, Calif......P. Umbaugh
Rose Knot Ship.....J. White
Coastal Sentry.....Joe Brown

Program

nical and administrative staff in Cambridge, Mass.

Each station is equipped with a Baker-Nunn camera specially designed for the photographic tracking of artificial earth satellites. The camera can track along any great circle at a controllable rate and can photograph satellites to the thirteenth magnitude.

Using the predictions that the Cambridge staff specially determines and cables to each station, the observers set the camera so that it will follow the satellite at the correct velocity. This is necessary because many of the satellites are extremely faint and cannot be photographed with a fixed camera.

To date, no satellite orbiting the earth has exceeded the range capability of the Baker-Nunn camera. Vanguard I, the six-inch "grapefruit" satellite, was photographed at distances up to 3,000 miles.

At present, the Baker-Nunn cameras satisfactorily photograph more than 2,000 satellite passages each month, an output that is the result of constant improvement in station efficiency. On an average basis, out of each 100 passages predicted, about 35 are observed, 40 are lost because of weather, and the remainer are not observed for miscellaneous technical reasons.

SAO Network

Howard Marsh
Netherl'ds, W.I.

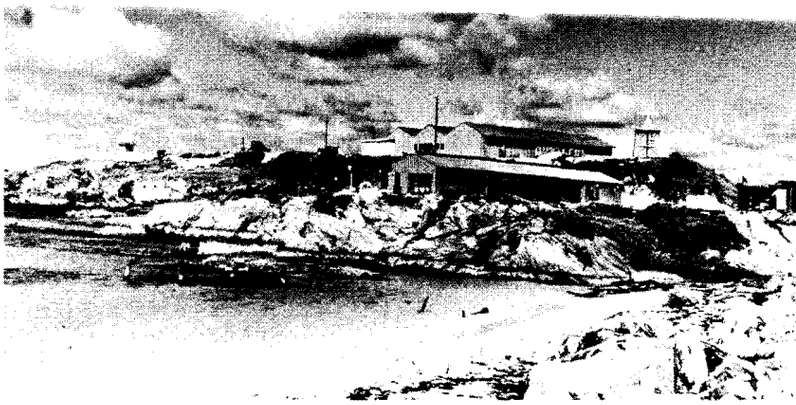
F. Budreski
Peru

Ken Morrison
Argentina

R. Citron
South Africa

Donald Tingle
Spain

Dorik Mechan
Hawaii


TRACKING radar, at far left, and main instrumentation building are part of the Bermuda Mercury tracking station.

NATIVES work at the Mercury station on Grand Canary Island.

OPERATION of the Smithsonian Baker-Nunn camera at Shiraz, Iran, is explained to the Shah of Iran and party.

Not pictured: Directors of the SAO stations in India and Japan.

Ed Horine
New Mexico

Fred Warren
Australia

Roy Procter
Florida

Hal Cozzens
Iran

VISITING dignitaries were conducted on a tour of Goddard tracking facilities in building 3 after the ceremonies. Here they stop in the Mercury center. The dignitaries pictured in the front foreground are Secretary Rusk, Mr. Webb, Congressman George P. Miller, Dr. Welsh, Congressman James Fulton, and Mr. Godwin A. Onyegbula, counselor of the Embassy of Nigeria.

ASTRONAUT Schirra and Secretary Rusk look at a Goddard exhibit in building 3.

DR. JOHN LINDSAY explains Goddard space projects to a group tour of news media representatives in building 1.

In the Goddard receiving line are John Mengel, assistant director for tracking and data systems, in the foreground, and Eugene Wasielewski, associate director, at the right.

At the conclusion of the special ceremonies, the invited guests participated in tours of the Center. Tour hosts included Messrs. Wasielewski, Mengel, Townsend, Vaccaro, Lagow and Covington of Goddard; and Dembling, Dryden, Buckley, Frutkin, Jaffe, Kelley, and Truszynski of NASA headquarters. Speakers included Messrs. Butler, Hoff, Donegan, Rados, Lindsay, Hedrich and New, all of Goddard.