

GODDARD NEWS

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JULY 30, 1962

Close-up of a GSFC Satellite

Project Relay

A SEQUEL TO TELSTAR

With Telstar in orbit, Goddard's people are getting ready for Relay, Relay is a low-altitude active communications satellite, designed and built by the Astro-Electronics Division of the Radio Corporation of America, under contract with the GSFC.

Under the initial contract with the Goddard Space Flight Center, RCA will supply three flight models of the Relay satellite. Relay follows Project Score, Project Echo, Project Courier and the U.S. Telstar effort to develop operational communications satellite systems.

Project Manager for Relay is J. Berliner, Project Coordinator, W. S. Sunderlin, Spacecraft Manager, R. Pickard and Ground Station Manager, J. Flaherty, all with Spacecraft Systems and Projects Division.

Relay has some design characteristics in common with the Bell Telephone Laboratories Telstar satellite, but has greater power and incorporates several features not included in previous experiments.

Relay is in fact the first active repeater communication satellite projected by NASA and initiates the agency's program of a continuing series of research experiments in this field.

Relay is designed to carry out specific experiments and to obtain and report back certain scientific information, based on relatively low-altitude flight.

By means of Relay communications, it is expected that a TV picture comparable to a conventional picture transmitted from ground stations—as clear and free from noise—can be

sent and received between North America and Europe.

Timetable

The first flight model of Relay, together with a back-up unit, is scheduled to be delivered to NASA at Cape Canaveral four weeks prior to launch. It is to be launched with a Delta rocket vehicle some time in early fourth quarter of 1962.

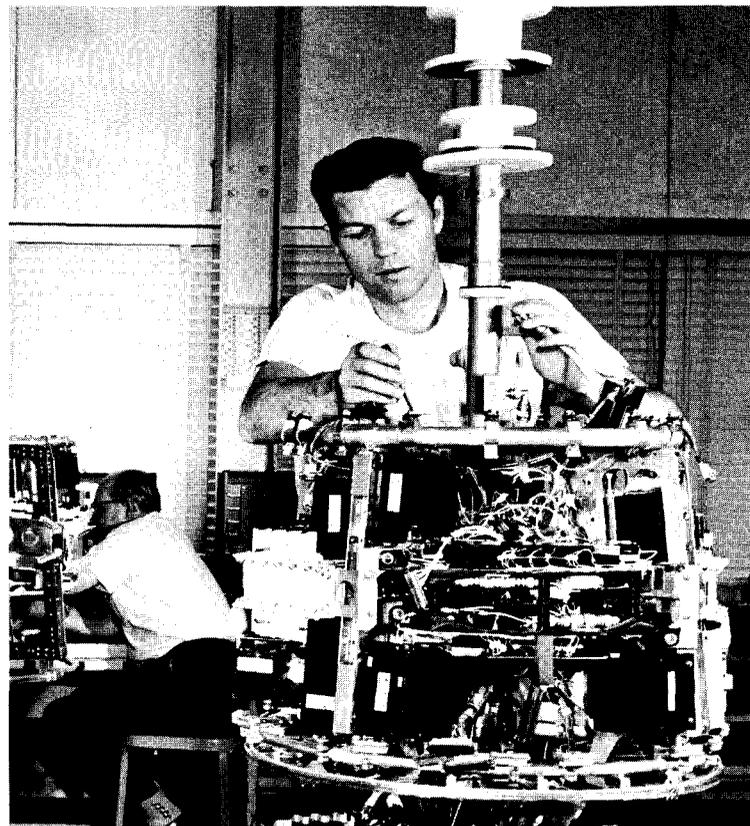
Objectives

The spacecraft is to be used experimentally by NASA to:

1. Demonstrate active satellite relay on high-quality wide-band television communications between continents.
2. Test satellite communication techniques and equipment in relaying multi-channel telephonic, telegraphic, facsimile and electronic data processing information between continents.
3. Measure radiation particles and determine the destructive effects of the Van Allen radiation belts on communications equipment, especially the rate of deterioration of solar electric cells.
4. Conduct detailed technical experiments to measure rates of teletype error, using both digital and frequency-shift-keying, quality of voice and television transmissions, gain and phase stability, distortion, and noise-interference.

Orbital Characteristics

The Relay spacecraft is to be placed in an elliptical orbit at an angle of about 50 degrees. Its orbit period will be about 2½ hours. It is estimated that there will be mutual visibility



NEW TELEVISION SATELLITE . . . Technician install equipment in RELAY, the communications satellite designed and produced by the RCA for the Goddard Space Flight Center. RELAY, scheduled to be delivered this year by RCA's Astro-Electronics Division, has features not included in previous experiments.

between North America and Europe during the first month of operation a minimum of 36 minutes per orbit. In operational terms, however, useful transmission time is expected to be around 15 minutes in any one orbit from the beginning to the end of each period of visibility. Relay will have an apogee of about 3,000 nautical miles and a perigee of about 800 nautical miles. This means that the satellite will be exposed during a portion of each orbit to effects of the Van Allen radiation belt.

Frequencies

The frequency for transmission to spacecraft is:

Wide-band receivers 1,725 mc

The nominal frequencies for transmission from the spacecraft are:

Transmitters 4,170 mc

Beacon 4,080 mc
Telemetry 136 mc

Lifetime

It is hoped that one year of operational lifetime will be achieved at the planned duty cycle not to exceed 100 minutes total wide-band operation in any three consecutive orbits for one month. Reduced duty cycle may be required after one month, due to damage to solar cells by radiation. The rate of radiation damage is one of the unknown quantities in the experiment.

Relay's reliability is increased by duplication of every essential sub-assembly, and by rigid pre-launch testing in RCA's space environmental chamber at Princeton, where conditions of stress in launching and in outer space are simulated. About 3,000 components are involved in the critical units that are duplicated.

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ECHO II—SUCCESSFUL



SEQUENCE PHOTO . . . Inflation of Goddard's 135-foot diameter rigidized ECHO balloon with photographs taken by a 16mm movie camera in a recoverable capsule which was mounted on the Thor booster. During the successful inflation test conducted from Cape Canaveral on July 18, the 500-pound balloon reached an altitude of 920 statute miles and reentered the atmosphere about 600 miles off the Florida coast. An identical sphere is scheduled to be launched into a polar orbit during the fourth quarter of this year to serve as a passive communications satellite.



CHARLIE SMITH'S early interest in communications helped his alma mater, Fortier High School in New Orleans, out of a jam one day in 1940. According to the New Orleans Times-Picayune, the band director at Fortier wanted the student body to hear a concert from the band room. But there was no auditorium in the school. Smith came to the rescue. Recalled Joseph Abraham, then the school's counsellor: "Charlie got a microphone and some wire from the school's 'ham' shack, and, with a burst of ingenuity, dropped a line from the soundproof band room to the principal's office. After some experimentation, he installed a homemade communications system which he tied in to the schoolwide public address apparatus." Charlie Smith was still experimenting this week, only this time with Telstar.

TELSTAR WORKS TO PERFECTION

"Everything is performing so well it is almost like evaluating something on a laboratory bench."

Charles P. Smith, Jr., Telstar Project Manager for Goddard, was speaking of the first inter-continental communications satellite.

"The Goddard orbital and antenna pointing data has been of excellent quality from the start."

The information is being received by Goddard's world-wide network of tracking stations as part of NASA's participation in the satellite agreement with American Telephone and Telegraph.

Satellite position data are sent to the Andover, Maine; Goonhilly Downs, England; and Pluemyer-Bodow, France ground stations over direct full time teletype links. Although the American and French stations have relatively broad beam tracking antennas to acquire the spacecraft, the United Kingdom station is wholly dependent upon the Goddard data.

An example of the results can be seen from a quotation from a British telegram:

"Your predictions have proved to be quite incredibly exact, very hearty congratulations."

Smith, of the Communications Branch at Goddard, said that within a month a complete initial evaluation of Telstar will be completed.

"Although spectacular and exciting, inter-continental television pictures and phone calls via Telstar serve only as a subjective evaluation for demonstration purposes. The objective tests most people won't know or even wonder about will provide the most important information that will be used to evaluate the system.

The objective findings will determine the performance of the satellite's repeater and the transmission characteristics over long distances. The repeater is quite similar to those being used in microwave relay links throughout the country.

(TELSTAR, See Page 4)

X-15 SETS NEW ALTITUDE RECORD

Recently a new record for the X-15 was made when Major Robert M. White, Air Force X-15 project pilot, reached an altitude of 314,750 feet in the X-15 over California's Mojave Desert.

White's flight represents a marked advance over the original altitude of 250,000 feet for which the X-15 was designed to fly. NASA engineers expect to send the airplane to still higher altitude in future flights as the step-by-step program progresses.

Main purpose of the flight was to complete checkout of a new self-adaptive control system, which was built by the Minneapolis-Honeywell Regulator Co. The system, installed only in X-15 No. 3, is capable of sensing air density and other factors affecting control and of automatically adapting to meet these conditions. It makes use of both reaction jets and the more conventional movable aerodynamic surfaces for control.

The X-15 is a joint program of the Air Force, Navy, and NASA.

In the latest flight, the X-15 was carried aloft under the wing of a B-52 carrier plane from Edwards Air Force Base at 8:45 a.m., PDT, and launched from an altitude of 45,000 feet at 9:30 a.m. He climbed at an angle of 41 degrees above the horizon for 81 seconds while the rocket engine burned at full thrust. He shut down the engine at 156,000 feet and the flight continued upward to the maximum altitude in a long trajectory over the California Mojave Desert. He landed on Rogers Dry Lake at 9:41 a.m. Highest speed reached on the flight was 3784 MPH (Mach 5.04). The flight was White's 15th in the X-15.

Nearly 400 civilian and military staff members participated in the operations, under the direction of Joseph R. Vensel, Chief of Flight Operations. Walker was ground controller at High Range "NASA One." Crew of the B-52 included Maj. John E. Allavie, USAF, pilot; Squadron Leader Harry Archer, RAF, co-pilot; Staff Sergeant



PILOTS AND NASA officials receive commendations for space contributions. (Left to right) Major Robert M. White, Hartley A. Soule, NASA Administrator James E. Webb, Vice President Lyndon B. Johnson, Paul Bikle, Dr. Joseph A. Walker and Commander Forrest Petersen.

Bruce C. Byington, USAF, flight engineer, and Stanley P. Butchart (NASA, launch panel operator).

NASA Honors X-15 Pilots

On July 18, the following three prime government pilots of the X-15 program received NASA's Distinguished Service Medal: Dr. Joseph A. Walker, physicist and veteran chief research pilot of NASA's Flight Research Center, Edwards, California; Major Robert M. White, X-15 project pilot of the Air Force Flight Test Center, Edwards Air Force Base, California; and Commanding Officer of Navy Fighter Squadron 124 (VF 124), Miramar, California, who until last March was the Navy member of the X-15 pilot team.

The pilots also received the 1961 Collier Trophy, Aviation's highest honor, from Vice President Lyndon B. Johnson.

At the same ceremony, Paul Bikle, Director of Flight Research Center and Hartley Soule, who led development of the project from its inception, received NASA's Outstanding Leadership medals.

NASA Administrator James E. Webb hailed the five men for leading the X-15 to outstanding success among research ventures. "This program is a classic example of a most

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operated efficiently and has developed a wealth of valuable information for our nation. Now that the design goals have been achieved, we find the X-15 valuable for purposes well beyond its original intent. Far from completion of its useful life, it is slated to make many more flights and many advanced experiments."

The X-15 program was conceived in 1962 to conduct research into the aerodynamic stability and control and operational problems at hypersonic speeds, and to obtain aeromedical data on pilots at high speeds and altitudes. It has made 60 successful flights at a wide variety of speeds and altitudes. Last June 27, Walker attained a speed over 4100 mph, and both he and Maj. White have flown as high as 246,700 feet. Walker's top altitude mark has been submitted for an official world record by the Federation Aeronautique Internationale.

Project officials have estimated more than 35 flights will be made with three airplanes in the next two years.

NASA has awarded its Distinguished Service Medal to only seven men, including four Mercury Astronauts. The Outstanding Leadership Medal has been presented three times.

effective way to conduct research," he said. "Since its origin as a research device with which to push back the frontiers of knowledge about flight at extreme speeds and altitudes, the X-15 program has been



Fourteen "Future Scientists of America"

TOURING GODDARD, prior to representing the U.S. at the Fourth International Youth Science Fortnight in London, are the future scientists of America. These high school students were selected from nationwide screening to comprise the U.S. delegation. Final selection was made by a committee of Washington, D. C. scientists, educators, and teachers.

They will join 400 others from 15 different countries for the science congress and tour of the continent.

The future scientists program is conducted by the National Science Teachers Association. NASA provided supporting grants for the London meeting.

The students represented thirteen states, including Maryland.

Collier Trophy was presented by...

TEACHERS JOIN GODDARD TO CONDUCT VISITS

Under a new program of co-operation between GSFC and educational institutions, six science teachers from nearby high schools have joined Goddard's staff for the summer.

Their purpose is to conduct tours and visits for the increasing numbers of scientists, professional organizations, the general public, and special groups wanting to see the Center's space science activities.

The new venture in community relations involving high school participation in Goddard's mission is advantageous to both, according to Charles Boyle, Public Affairs Officer.

Participation by these educators in NASA activities is helping spread knowledge of our space program and will enhance the teaching of space science. In addition, it is substantially relieving the need for Goddard scientists and technicians to be used in presenting the Center to visitors. Furthermore, the teachers will be valuable spokesmen for the Center's expanding role in the peaceful exploration of space.

Instrumental in setting up the new program were John Soden, Placement Officer; Gerald Griffin, Visits and Tours Coordinator; Robert Geier, Operations and Support Division; and a number of scientists and technicians who contributed to the intensive three-week training of the new teachers.

According to teacher Bill O'Leary of Our Lady of Good Counsel High School, each of the teachers performed repeatedly for his colleagues during the practice sessions. "We acted as a 'murder board,' for each

other, and it helped in polishing our facts and delivery," said Bill.

The teachers are assigned to specific buildings and have been

for several weeks. When they return to school in September, they will continue on a "call" basis to host Goddard tours in the evenings and on weekends.

TEACHER REACTIONS—

Do they like it? Hear them . . .



Dale Gerster: (Bladensburg High School, Subject: Physics)
"While providing this service we're acquiring knowledge useful in our teaching and in career guidance for students."



John McNelis: (Northwestern High School, Subject: Mathematics)
"This summer will enrich the education of my students at Northwestern."



Richard Stewart: (High Point High School, Subject: Biology)
"It is a privilege to have acquired this knowledge and to be a part of the group that is passing it on to the public."



Kenneth Edwards: (Bethesda Chevy Chase Senior High School, Subject: Chemistry)
"The courteous, cooperative treatment I have received has already made this an enjoyable and memorable experience."



Robert Love: (Duval High School, Subject: Chemistry)
"Gaining this first hand knowledge of the space effort will enhance our teaching function."



William O'Leary: (Our Lady of Good Counsel, Subject: General Science and Mathematics)
"I was amazed and pleased to learn of Goddard's vast role in space exploration and I enjoy passing the information on to others."

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TELSTAR

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Pre-orbital launch participation by Goddard in the Telstar experiment involved approval of model testing conducted by Bell Laboratories, integration

of the satellite to the Delta launch vehicle, and launching of the satellite.

AT&T built the satellite and paid for its launching. Douglas Aircraft Company developed the Delta rocket for NASA.

RELAY

(Continued from Page 1)

It should be borne in mind that TV signals and voice transmissions radiated by Relay cannot be picked up directly by home TV or radio receivers, but must be received first by special microwave antennae, converted to appropriate frequencies, and then sent to TV or radio stations for rebroadcast. The same will be true of two-way telephone, telegraph, and high-speed data communication experiments.

Ground stations in the United States, Brazil, Britain, France, and Italy are planned for early participation in experiments involving television, facsimile, data communication, teletype, and two-way telephone communication.

Ground stations in Brazil and Italy will communicate with the United States in voice experiments only.

Recent Technical Publications Authored By GSFC Staff (July 6-23)

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Ogilvie, Keith W., "Solar Protons, A Lecture Given May 1961," NASA Technical Note D-1139, July 1961.

Temkin, A., "Nonadiabatic Theory of Electron-Hydrogen Scattering," NASA Technical Note D-1343, July 1962.

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