

# GODDARD NEWS

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## Center Gives Relay Team Top Support

A major team effort being performed by Goddard's tracking and data systems directorate is contributing significantly to the initial successes of Relay, in the opinion of Daniel Mazur, chief of the spacecraft systems and projects division.

The efforts of numerous Goddard and contractor personnel in effecting command and support from the Blossom Point, Md., tracking site; alerting Goddard's world-wide Minitrack network on a special basis; providing emergency updating of orbit calculations, and performing reduction and special processing of Relay data have been outstanding, he said.

A total of 135 special tests—television, simulated telephone, teletype and facsimile—have been conducted to devise a completely new operational procedure to meet the emergency situation, according to Mr. Mazur.

"Once this procedure had been formulated, the pattern of operation of Relay began to take shape. This permitted us to hold a successful demonstration only four days after the first engineering test was conducted."

Sending out operational plans and hurried instructions, and requesting emergency teletype and scamophone service are examples of the first-class service provided by the Relay "team".

Mr. Mazur attributes much of the support for Relay's success to Goddard's Joe Corrigan, George Harris, Bob Chaplik and Dan Quirey and Bob Marshall, George Demas and Larry Grant of Bendix. Innumerable others had equally important parts, he added.

"The project Relay group is deeply appreciative of the consistent, excellent support they are getting from the various Goddard elements," said Mr. Mazur.

## Peak Goddard Effort Pays Off for Relay

Operating procedures have evolved which are paying off for Relay, Goddard's newest communications spacecraft.

Launched Dec. 13, Relay suffered from an abnormal power drain on its storage batteries, preventing operation of its communications equipment and it failed to respond properly to command signals from the ground.

With assistance from telemetry data analysis, command sequence changes were made which have kept Relay functioning and capable of accomplishing the satellite's first successful television and telephone exchanges between the United States and Europe.

Sample of Relay's successful transmissions since taking its place alongside Telstar consist of:

- Orbit 207 — a specially produced taped portion of NBC's Today show was sent from the U. S. via Relay to Plemeur-Bodou, France, and Goonhilly, England. Fucino, Italy, monitored the signal. The tape showed President Kennedy accepting the loan of the Mona Lisa from the French people.

- Orbit 208 — a facsimile photograph taken during the opening of the Mona Lisa showing was sent from the French news agency's Washington, D. C. offices via Relay to France. The picture was a group photograph of President and Mrs. Kennedy, Vice President and Mrs. Johnson, and French Minister for Cultural

Affairs Andre Malraux and Mme. Malraux, all standing in front of the Mona Lisa.

### Excellent Reception

French officials reported excellent reception, while the British General Post Office stated that on the whole the picture received was the "best they have received yet."

- Orbit 215 — a series of tests consisting of two-way voice, teletype, facsimile and random noises were conducted between the ITT communications station at Nutley, N. J., and Goonhilly.

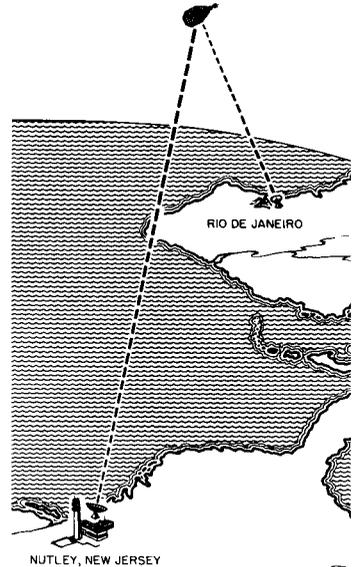
Cause of the early malfunction in the communications equipment has been attributed to improper functioning of the voltage regulator for the communications transponder, according to Joseph Berliner, project manager. The result was an abnormal power drain on the batteries.

"Preliminary analysis indicates that a particular transistor in the voltage regulator does not function properly if temperature environment becomes too hot or too cold. We are making further analysis to determine if the defect is in the transistor or elsewhere in the spacecraft."

Relay carries two identical transponders, each of which has a receiver, transmitter and associated power supply, so that in the event one transponder fails to operate properly, the other can carry out the communication functions it was designed to perform.

Communications experiments are being accomplished by us-

(Cont'd on page 6, col. 4)



NUTLEY, NEW JERSEY

FIRST 2-way teletype and simulated voice experiment was conducted last weekend between Rio and Nutley, and Rio and Goonhilly.



A. JACK YUDD, Goddard representative at the Nutley, N.J., test and ground stations, analyzes Relay data.



STAYING in touch with foreign ground stations over the Scama network are, left to right, John Flaherty, GSFC; Jim Moses, Dave Butterfield and Don Kendall, STL; Varice Henry, GSFC; and Bert Abramson, STL.



KEEPING abreast of Relay's progress are, left to right, Wendell Sunderlin, GSFC; George Goal, Dave Stager, and John Attias, Space Technology Laboratories; and George Marshall, GSFC.



GILBERT D. BULLOCK, Goddard's ground station liaison contact for the Rio de Janeiro station, makes a report in the communications spacecraft operations center in building 3.

## Colloquium Speaker Sees No Hydrogen 'Tail' Originating Near Earth

### What is the Lyman Alpha Nightglow?

The night sky is filled with a diffuse glow of ultra violet radiation which has been proved to be the fundamental spectrum line of the atom hydrogen. This line is called the Lyman Alpha line of hydrogen. The radiation is a bit weaker in the direction more or less directly opposite the sun so it has been thought that the radiation we observe is solar Lyman Alpha which has been scattered or bounced off atoms of hydrogen on the night side of the earth. The problem is just where are these atoms.

### How do you study it experimentally?

Because the radiation is absorbed by oxygen it cannot be observed below about 80 kilometers (about 50 miles). It was discovered and first studied by a group working at the Naval Research laboratory under Herbert



Donahue

Friedman. A prominent member of that group was Dr. James Kupperian now at Goddard. He is still active in the study of Lyman Alpha. Spectrographs and ionization chambers are sent aloft in rockets, probes and presently satellites to map the radiation.

### What can be learned from Lyman Alpha studies?

Eventually we should learn how hydrogen is distributed around the earth and how fast it is escaping or being accreted by the earth.

### What is the present point of view about the source of the Lyman Alpha glow?

At first it was thought the hydrogen responsible for the glow was interplanetary. Now it is known that there is not enough interplanetary gas. So the hydrogen must be in the neighborhood of the earth. The question is whether it is relatively close (10,000 kilometers) (about 6,250 miles) or far away (100,000 kilometers) (about 62,500 miles) in a sort of comet's tail.

### Is there a hydrogen tail to the earth?

*Prof. Thomas M. Donahue has been in the physics department of the University of Pittsburgh since 1951, studying atomic collisions and associated problems in aeronomy and space physics. He has worked closely with a French group under Prof. J. E. Blamont and he spent 1960 working with Blamont on a Guggenheim fellowship. He spoke at the weekly Goddard colloquium Friday. A summary of his talk, "The Earth's Hydrogen and Excitation of Lyman Alpha Nightglow," is presented here.*

John C. Brandt proposed the earth has a comet-like tail 100,000 - 200,000 kilometers (62,500-125,000 miles) away consisting of hydrogen escaping from the earth's atmosphere and that this tail was scattering the Lyman Alpha we see. It now seems sure that such a tail does not exist. If there is a cloud following the earth and producing the glow, it must be considerably farther away than Brandt proposed; it cannot originate from escaping terrestrial hydrogen. There just isn't enough escaping hydrogen. Nevertheless, the experiments so far performed cannot exclude the presence of a cloud, but one which plays a relatively minor role compared to Brandt's proposal.

### So where is the hydrogen?

Hydrogen should stick out beyond the normal oxygen (and helium) atmosphere. Some of this is escaping hydrogen. Some of the atoms are in elliptical orbits which eventually cause them to re-enter. This hydrogen exosphere as it is called should be appreciable out to 10,000 kilometers (about 6,250 miles) or so. Satellite drag measurements indicate the temperature varies enormously between night and day in these regions. Paradoxically this means much more hydrogen is present in this region at night. The Lyman Alpha at least in part gets around to the night side of the earth by several successive bounces off hydrogen atoms. The presence of more hydrogen at night facilitates this process. Not everything is clear, however. We are not sure yet that the hydrogen can react rapidly enough to the



CONDUCTING the "child ambassadors" on their Goddard tour is Ray Roche, left, of Goddard's visits department. Following, left to right, are Dr. Shigenobu Kuriyama, professor emeritus of Tokyo University, who originated the idea for the contest; James Wickel, state department interpreter; Miss Yokoyama and Mr. Sugiura.

## Goddard Hosts 12-Year-Old 'Ambassadors' on Visit from Japan

Two Japanese children representing Japan's 11 million school children toured Goddard last week as part of a three-day visit to the Washington area. Selected this year in the annual contest conducted by the Asahi Shimbun, one of Japan's largest dailies, were Mr. Satoshi Sugiura of the Tanao primary school in Hekinan City, Aichi Prefecture and Miss Misako Yokoyama of the Kabe primary school in Kabe Town, Hiroshima prefecture. The two

youngsters are 12 years old and in the sixth grade. The purpose of the contest which has been held for the past 30 years, is to continually foster improvement of health and education standards by focusing attention annually on two primary school children who are outstanding in intelligence, mentality, good health and social adaptability. The contest is supported by the ministries of education, health and welfare.



CLARENCE HOUSE, branch consultant in the flight data systems branch, supports a proud smile for achieving a distinguished Goddard record—donation of 8 gallons of blood. Given a pint at a time beginning midway in World War II, Mr. House attributes duty, patriotism and a "forceful" blood chairman at the Naval Research laboratory for getting him started. "Now, it's become more of a habit than anything else," he added. Other Goddard personnel are making notable records in the blood drive.

- 4 gallons .....Burton Kellbaugh, sheetmetal branch
  - 3 gallons .....James Hagemeyer, planetary ionospheres branch
  - 2 gallons .....Eugene Stroup, flight data systems branch
- Ernest Hairston, advanced projects branch

temperature change to make this possible. A lot of theoretical and experimental work remains to be done.

### How rapidly is Hydrogen being lost from the Earth?

It is being lost at a rate of

1/16th to 1/2 half pounds per second. At this rate all the gaseous hydrogen on earth would be lost in a million years or so. However, there are other sources such as water vapor and methane.

## Goddard's 'Air Force' Serves Far and Wide

From Corpus Christi to Hawaii, from Point Arguello to Woomera, a five-man Goddard team has the world as its beat.

With the help of three C-54s, the Center's little-known instrumentated aircraft section in the network operations branch checks equipment and personnel performance at sixteen manned space flight tracking stations.

The busy schedule also includes calibrating defense department ships assigned to assist in tracking Mercury missions, performing engineering tests to check equipment modifications, and supporting special missions such as a recent Scout re-entry program.

"Our major effort now is equipping two of the aircraft with equipment that will be needed when the future two-man space missions begin," said Chuck Mason, chief of the section. "Two of the planes will have full spacecraft capability and one will be kept for special missions."

### C-118s in Future

Negotiations presently are underway with the air force to eventually replace two of the C-54s with C-118s (DC-6s). These planes will have pressurized cabins, longer range, air conditioning, more weight carrying capacity, and additional electric power and storage space.

In the process of logging an estimated 850,000 miles in travel—equivalent to nearly two round trips to the moon—C-54 aircraft frequently have gone beyond the call of duty to provide help whenever and wherever the occasion arises.

"One of our planes performed a mercy mission from Bermuda when a commercial flight was not available to bring back a gravely ill child," said Mr. Mason.

On other occasions, when equipment has to be transported to Mercury stations or groups find themselves stranded at isolated locations, the section willingly offers the services of its planes providing there isn't a conflict with normal operations.



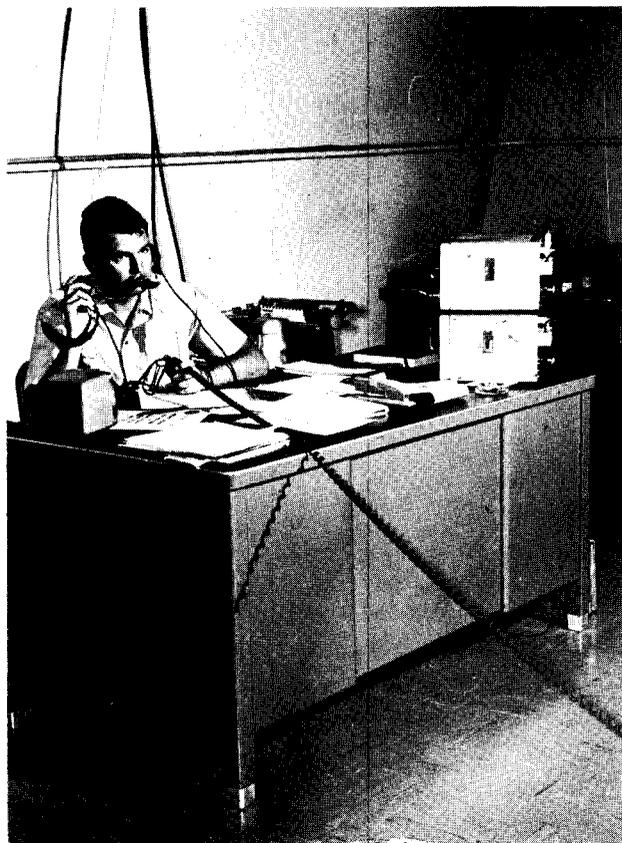
SECTION head Chuck Mason, right, discusses an up-coming mission with Ralph Conrad, aircraft test conductor.



BENDIX electronics engineers Bob Desombre, rear, and Gary Poindexter simulate a Mercury capsule pass from aboard a C-54.

LOYD SHELTON, Goddard aircraft instrumentation engineer, coordinates aircraft and ground station operations while conducting a test from the Canton Island telemetry and control building.

GODDARD's 'air force' prepares for take-off from Baltimore's Friendship airport on a routine station evaluation and training mission.





**BENDIX** representatives Bill Carr, photographer, standing, and Warren Jackson, electronics engineer, analyze 16-millimeter film obtained during an aircraft pass. The camera was positioned on a radar antenna.



**PRACTISING** over Bermuda for a special mission in support of the Langley Research Center's Scout re-entry program are, left to right, Kurt Shaw, Goddard electronics instrumentation engineer and test conductor; Bob Collie of Langley, and Joe Hilliard, Bendix navigator. The group is practising to photograph upon re-entering the earth's atmosphere a Scout nose cone fired from Wallops Station.

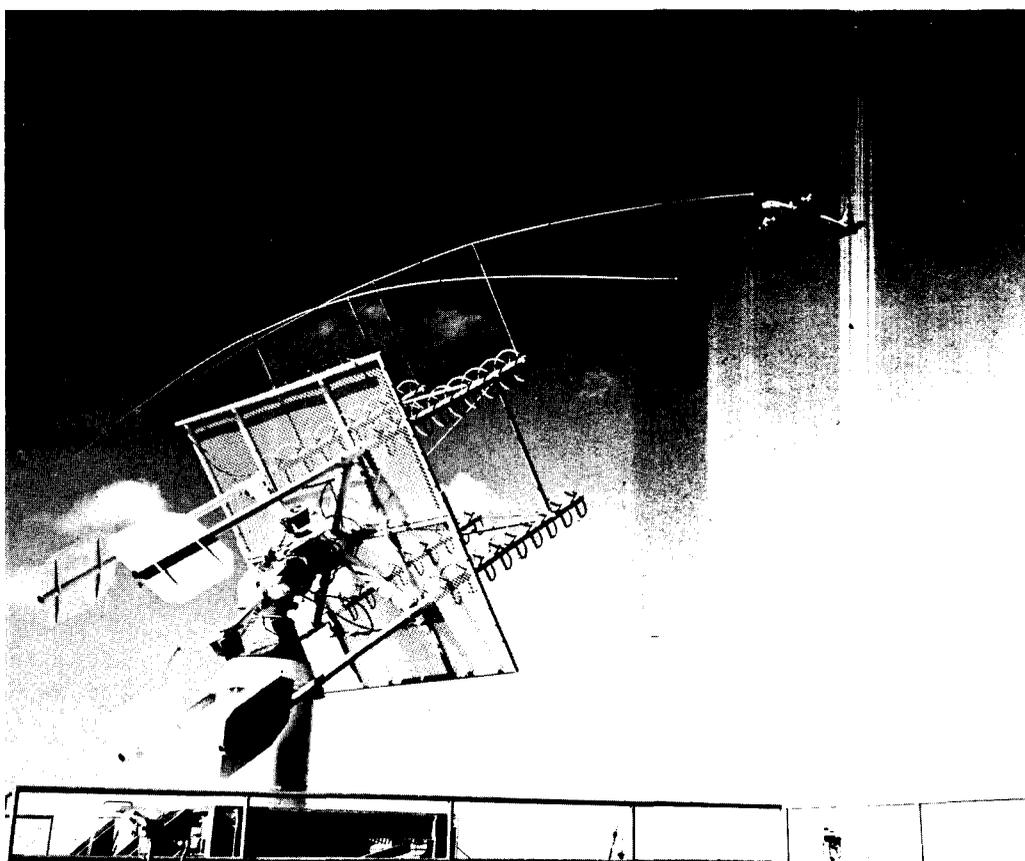


A **C-54** **CARRIES** out a special mission to the Canton Island station to deliver equipment assembled and tested at Goddard.



**PHOTOGRAPHIC** equipment, including 16-millimeter cameras, lenses, film developing apparatus, television camera and monitor, film analyzer and auxiliary power unit await loading on a C-54 prior to departure.

A **GODDARD C-54** passes over the acquisition/telemetry antenna at Corpus Christi. With the help of a closed circuit television camera on the antenna, the pass secured a preliminary alignment of the antenna.



### On Air Force Loan

The Air Force has loaned the planes to NASA for an indefinite period. The Bendix Radio corporation provides under contract the pilots, copilots, flight engineers, navigators, electronics engineers and technicians, test equipment calibrators and photographers for a total of 24. At the Bendix Towson, Md., plant, five additional staff members provide engineering support to help design and build new electronic equipment for the aircraft.

During all flights, a Goddard representative is aboard to take direct charge of the operation. A typical mission consists of:

- Loading the 8-man crew and 10,000 pounds of equipment
- Flying to any one of sixteen distant stations
- Setting up equipment and briefing site personnel
- Conducting special flights to put ground equipment and personnel into operation
- Analyzing and evaluating the data
- Carrying out the simulated capsule passes

So far nothing has stopped the section from getting the job done, although it has experienced everything from forest fires to international red tape.

"We feel we make a vital contribution to the success of each manned flight," said Mr. Mason. This means surmounting any obstacle to put all Mercury equipment and personnel in readiness."

## Goddard Scientists Consider Causes for Explorer XIV Precession Motion

One of Goddard's most successful and useful scientific satellites—Explorer XIV (S-3a)—developed a “seasick” motion after it was launched last fall.

But Goddard scientists have successfully coped with the brief illness and developed some useful new processes and theories because of it.

*Unfortunately, just after press time a malfunction in Explorer XIV's encoder systems caused the spacecraft to become inactive.*

“We are developing a special data processing procedure specifically to eliminate such variables as “precessional” mix motion,” according to Paul Marcotte, project manager. (The precessional motion or “coning” caused the spacecraft to take in a bigger sweep or “look angle” of space as it orbits.)

“We don't expect any loss of data and some experimenters feel that the wider “look angle” may now be available to each sensor without loss of directivity.”

### “Pinwheel” Effect

Preliminary examination of the spacecraft configuration by Jesse Madey, senior mechanical engineer for S-3a, indicates the center of pressure of the craft is somewhat below the center of gravity. According to Mr. Madey, solar radiation pressure tends to tip the spin axis and also causes a “pinwheel” or spin-speedup effect on the solar paddles. This re-

sulted in a slight rise in spin rate from 9½ to 12 revolutions per minute but which now has dropped to 11.

A theory advanced by Dr. Joseph Fedor, research associate in the mechanical systems branch, indicates that an ion-electron density experiment on board may be a major contributor to the precession in the following way: approximately every five seconds a solenoid in the experiment actuates, producing a magnetic moment (a pulsing torque or force) on the spacecraft. The force is small but occurs with such timing that it reinforces the coning.

“Any other time frequency would not have had as great an effect because the torque and coning would have been out of phase,” said Dr. Fedor.

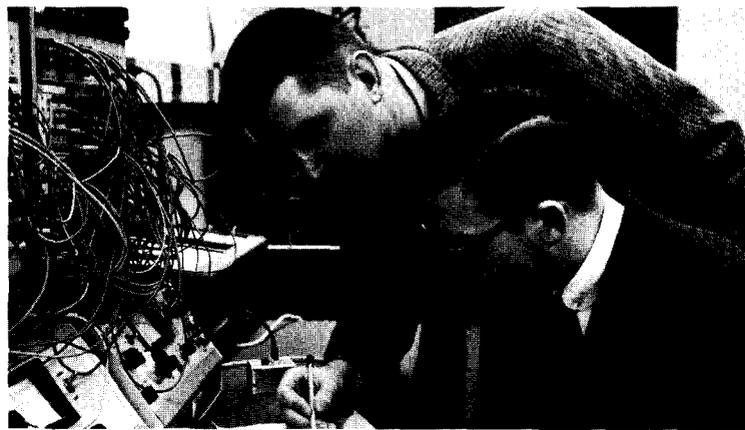
### Precession Decrease

At present, the pulsing torque and coning are out of phase because the precessional motion has “damped” out considerably. The shift in phase is attributed to the changing sun aspect in which the solar radiation pressure has affected the spin and precession rates. Combined with a natural dissipation of mechanical energy in the spacecraft, the resonant condition has decreased to a near minimum.

As the sun aspect changes again it is possible that the precession and magnetic moment would come back in phase, according to Dr. Fedor.

### Explorer XIV Team

**NASA headquarters** . . . Dr. John Naugle and Eugene Eurlich.  
**Goddard** . . . Paul Marcotte, Dr. Frank B. McDonald, and Herbert Meyerson  
**Scientific Experiments** . . . Dr. Frank B. McDonald, Dr. Upendra Desai, Leo Davis/J. M. Williamson, Drs. J. A. Van Allen/B. J. O'Brien (State University of Iowa), Dr. Michael Bader, (Ames Research), Dr. Laurence Cahill (University of New Hampshire)  
**Instruments and Engineering Experiments** . . . G. W. Longnecker, D. Schaefer/J. Albus, R. Kidwell, J. Madey, G. Linsey/D. Robinson, J. Schaffert/J. Libby, Dr. B. J. O'Brien (State University of Iowa), T. Hennigan, L. Slifer, J. Scobey, D. Hepler/R. Somerlock, J. Steckel, G. Porreca, A. Flanick, F. Yagerhofer  
**Orbital Plan** . . . R. Sandifer  
**Field Projects** . . . R. Gray/D. Shepard, J. Johnson  
**Documentation** . . . W. Freas/C. Mooney  
**Reliability and Design Reviews** . . . H. LaGow, H. Street, E. Hixson, J. Peake, P. G. Marcotte, H. Meyerson, R. Rochelle, R. Dorrell, J. Holeman, G. Linsey, W. Adams  
**Ground Test Stations** . . . H. Levy  
**Procurement Analyst** . . . A. Schifano  
**Test & Evaluation** . . . H. Norris, A. Armand, K. Rosetti, E. Lang  
**Structural Assembly** . . . X. W. Moyer, A. Pierre, D. Bower, P. McConnell, D. Corbin  
**Plastics and Potting** . . . G. W. Moore  
**Radiation Safety** . . . C. Hamilton  
**Vehicle/Spacecraft Integration** . . . W. Schindler/A. Brozena  
**Tracking & Data Acquisition** . . . J. Madden, J. South/R. Wilson  
**Data Reduction** . . . C. Stout, T. Lynch, A. Buige, D. Dembrow, M. Roy  
**Field Station Operation** . . . R. Stroble



DR. JOSEPH FEDOR and Hank Cornille, former Goddard researcher in the mechanical systems branch, perform computations on an advanced type of yo-yo that reduces errors in spacecraft spin-ups.

## Gals Learn New Travel Procedures

New travel order and voucher instructions were explained to an estimated 250 Goddard employees in separate sessions last week.

Conducted by Mrs. Evelyn Vaughn, chief of the travel section, and Mrs. Helen Jack-

son, group leader of the travel voucher examiners, the three hour-long sessions acquainted Goddard secretaries with NASA regulations listed in a new travel handbook prepared by NASA headquarters.

While the training program was a refresher for many, it provided new secretaries with initial instruction in travel order and voucher preparation.

## Goddard Speech and Paper Presentations

(Technical presentations approved as of Jan. 1 for period of Jan. 1-27 and late approvals for the past two weeks)

### MEETINGS

- Dr. J. W. Siry**, theory and analysis office, NASA Conference on Celestial Mechanics, Jan. 10-11, Washington, D. C. “*Orbit Determination at the GSFC*”
- W. M. Kaula**, theoretical studies br., NASA Conference on Celestial Mechanics, Jan. 10-11, Washington, D. C. “*Problems in Satellite Geodesy*”
- J. A. Kaiser**, antenna systems br., Institute of Radio Engineers Professional Group on Microwave Theory and Techniques, Jan. 15, Philadelphia. “*A Passive Automatic Direction Finder*”
- L. E. Richtmyer**, aeronomy and meteorology div., (presentation), 9th Annual American Astronautical Society, Jan. 15-17, Los Angeles. “*Experiments from a Small Probe which Enters the Atmosphere of Mars*” (authored by Dr. R. A. Hanel, aeronomy and meteorology div.)
- J. J. Donegan**, data operations br., Symposium on Management of the Development of Large Computer Program Systems Development Corp., Jan. 21-23, Washington, D. C. “*Mercury Computing Network*”
- Dr. J. C. Lindsay**, solar physics br., Institute of Aerospace Sciences, Jan. 21-23, New York. “*Solar Radiation*”
- Dr. F. B. McDonald**, fields and particles br., Institute of Aerospace Sciences, Jan. 21-23, New York. “*Solar Cosmic Rays*”
- Dr. P. H. Fang**, spacecraft technology div., American Physical Society, Jan. 23-26, New York. “*Ferroelectricity in Manganites of Some Rare Earths and of Yttrium*”

### SPEECHES

- P. Yaffee**, electronics test br., Student Chapter, American Institute of Electrical Engineers, Catholic Univ., Jan. 9, Washington, D. C. “*Electronic Testing of Spacecraft*”
- Dr. J. A. O'Keefe**, theoretical div., United States Navy Oceanographic Training Office, Jan. 10, Suitland, Md. “*Geodesy on Satellites*”
- H. L. Hoff**, operations and support div., Washington Building Congress, Jan. 14, Washington, D. C. “*Design and Construction for Space Programs*”
- Dr. J. P. Heppner**, fields and particles br., American Rocket Society—Institute of Radio Engineers, Jan. 16, Minneapolis. “*The Role of Geomagnetism in Space Science and Technology*”
- Dr. W. N. Hess**, theoretical div., College Convocation, Montana State Univ., Jan. 22, Missoula, Mont. “*Exploration of Space*”
- R. L. VanAllen**, flight data systems br., Industrial Management Club, Jan. 23, Butler, Pa. “*Opportunities at GSFC*”
- Dr. J. A. O'Keefe**, theoretical div., Blessed Sacrament Church, Jan. 24, Washington, D. C. “*The Surface of the Moon*”

## 22 Graduate from Red Cross Course

Twenty-two Goddard employees have graduated from the first Red Cross first-aid instructor's course given at the Center.

Spread over a 7-week period, the course consisted of 45 hours of practical instruction in basic and advanced techniques of first-aid.

Purpose of the course was to train selected employees to be Goddard first-aid instructors.

"These instructors will be used to teach first-aid practices to other Goddard employees," said Mike Patchan of the employee development branch.

The course was taught by Robert Fulton, staff representative of the D. C. Red Cross.



**RED CROSS** class graduates are, front row, left to right, Carl Styers, procurement and supply, Robert Snyder, spacecraft technology, John Moye, tracking systems, Don Phillips, space systems and projects, William Mitchell, operations and support, Jerry Hodge, space sciences, Mary Rogers, space sciences, Nancy Lassus, theoretical, Mildred Harris, project support, Evelyn Chaney, office of assistant director for tracking and data systems, Diane Lewis, office of assistant director for tracking and data systems, Fred Hartman, Goddard safety officer; back row, left to right, William Shergold, facilities-engineering, Bob Porter, spacecraft technology, David Butcher, spacecraft technology, William Logan, spacecraft technology, William O'Leary, management services, Robert Murray, safety office, Joe Chisholm, fabrication, Tom Foran, security, Robert Von Roeder, management services, Burton Kellbaugh, fabrication, Sgt. Earl Hayes, security, and Robert Fulton, Red Cross instructor.



**MILDRED HARRIS**, secretary in project support office, demonstrates mouth-to-mouth respiration on Diane Lewis. Jerry Hodge, engineering designer in fields and particles branch, left, and Dave Butcher watch with interest.



**PRACTICING** the application of a forearm splint on Nancy Lassus, secretary in the theoretical division, is Mary Rogers, secretary in the office of space sciences division, with the assistance of Bob Porter, engineering technician in flight data systems branch. Looking on approvingly are, left to right, Captain Tom Foran of the Goddard guards and Dave Butcher, fabrication contract coordinator in systems integration branch.



**JERRY HODGE** relaxes on a two-man chair carry practiced by Diane Lewis and Mary Rogers. Red Cross instructor Bob Fulton gives an assist.



**CARL STYERS**, contract assistant in space science negotiations branch, applies a splint for a "fractured" upper arm of "patient" Diane Lewis, secretary in the tracking and data systems directorate. Florence Chaney, secretary in the office of space projects and integration, and Mary Rogers carefully scrutinize the procedure.

(Relay, Cont'd from page 1) ing the second transponder and employing a special sequence, whereby the telemetry encoder does not operate when the transponder is commanded to turn on.

"The result so far has been six consecutive days of successful spacecraft operations," Mr. Berliner said. "We haven't as yet solved the problem with the command system. However, the communications tests are continuing."

## Trial Solar Cell Is Damaged Severely

Radiation damage to an experimental solar cell aboard Relay has been unexpectedly severe, according to Dr. Ramond Waddel, Relay project scientist, and consultant in the spacecraft technology division.

Preliminary findings indicate that the damage to the cell—which was considered to be damage resistant—was "presumably caused by Van Allen radiations."

"There is some component of the radiation which is very effective and which hasn't been demonstrated in the laboratory," said Dr. Waddel.

Purposes of the radiation damage experiments on Relay are to compare different types of solar cells and the effects of radiation shields used.

The experimental cell was specially built for the damage radiation experiment. It never has been used to actually power a satellite.

Also aboard the spacecraft were commercial-type cells similar to those used in the main Relay solar power supply, as well as experiments to measure the damaging agents such as the Van Allen particles. Findings from these experiments have not become available as yet.

Initial data from the solar cell experiment was provided through the courtesy of the space electronics branch under Joe Purcell, branch head.

### Goddard Coming Events

Lectures: Goddard colloquim lectures:

- Jan. 18, 3 p.m., Auditorium, Bldg. 3—Father Martin J. McCarthy, Vatican Observatory, Rome, Italy, "T. Tauri Stars".
- Jan. 25, 3 p.m., Auditorium, Bldg. 3—Prof. George Field, professor of astronomy, Princeton university, "Interstellar Clouds."