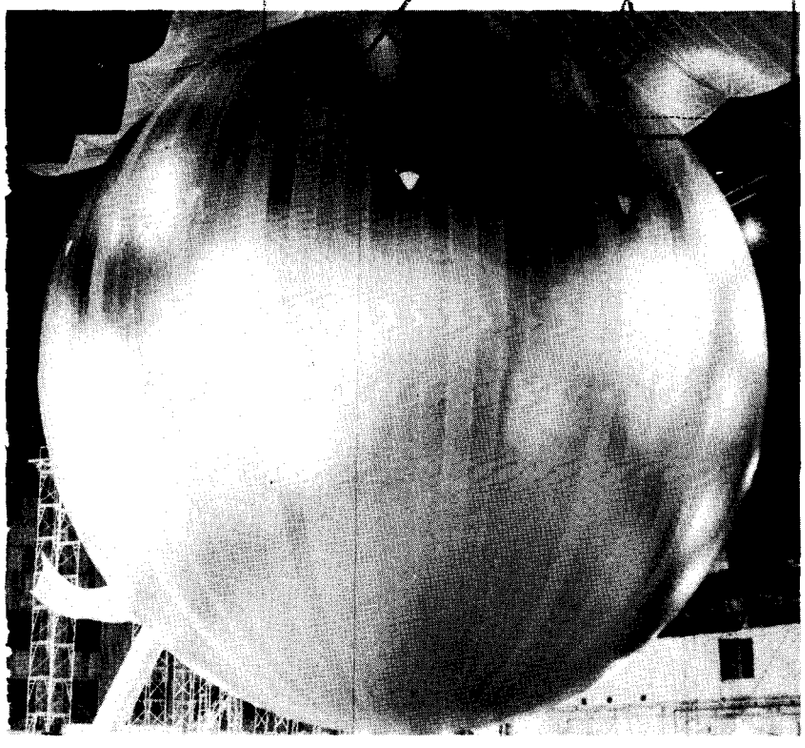
GODDARD



NEWS

VOLUME VI, NUMBER 5 THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION JANUARY 27, 1964

Two Goddard Projects—Echo II, Relay II—Share Spotlight

Rigorous Testing Preceeded Echo II

Echo I, NASA's most talked about satellite, will soon be joined by its sister, Echo II. As the GODDARD NEWS went to press, Echo II was scheduled for launch within the week.

Neatly folded in a cocoon-like canister, Echo II will be launched from the Pacific Missile Range into a 800-mile-high circular, near-polar orbit by the Thor-Agena launch vehicle. Without accessories it weighs approximately 540 pounds; with accessories—canister, beacon transmitters and other equipment—it weighs 770 pounds.

Echo II is larger than Echo I, with a diameter of 135 feet as compared to 100 feet—it will orbit lower than Echo I. And most important to millions of Echo watchers around the world, the new satellite's larger surface will reflect more light. This combination — bigger, brighter and lower orbit—will make Echo II easier to see.

Echo II's mission is to demonstrate a method of deploying and rigidizing passive communications satellites, an advance in the state of the art which can lead toward a global passive communications network for civilian use. Other experiments, such as, propagation, tracking, pointing and communications, will be performed with Echo II.

Prior to launch, two types of tests and flights referred to as application vertical tests (AVTs) were performed.

The two AVTs were launched from Cape Kennedy—one on January 15, 1962, and the other on July 18, 1962. The balloon reached an altitude of about 900 miles in both tests.

Ground test objectives were to qualify the controlled inflation system and the spacecraft with the system installed, and to evaluate the surface characteristics of the balloon with its skin stressed, along with the balloon's RF-reflectivity properties.

While packed in its canister the balloon was subjected to vibration, acceleration and

(Cont'd on p. 4)

Relay II Joins Sister Satellite As Delta Marks Success No. 22

The successful launch of Relay II from Cape Kennedy Tuesday last was also the 22nd straight success for the Delta launch vehicle, which boosted the new 172-pound Relay into an orbit of about 4600 miles apogee and 1325 miles perigee. It will orbit the Earth every three hours and 15 minutes while moving in a path inclined 47 degrees to the Equator. Now two of the Goddard-managed comsats are in orbit.

Relay I, which led a versatile and durable life in 1963, persists contrary to the plans of scientists and engineers.

Launched from Cape Canaveral (now Cape Kennedy) on Dec. 13, 1962, with a life expectancy of a year, the stubborn satellite refuses to die. The built-in destruction device which was supposed to have killed off communications in Relay I has not done its job yet.

Relay I, during its more than a year of operation, has made many telecasts between the U.S. and Europe, and several—including the first TV transmission to Asia—were made to Japan from the U. S. (See sidebar story on '1000 Cranes'). More than 2000 experiments were made during the 300 hours of transmission time.

Relay II's Mission

Relay's mission is to continue the work of its successful sister satellite, Relay I, and to provide an evaluation of improvements built in the new spacecraft. Its communications experiments, including television, will help determine the feasibility of this type spacecraft in future operational space communications networks.

The expanding network of ground stations around the world will get an opportunity to work with two Relay satellites simultaneously. The new Relay will send back to Earth

(Cont'd on p. 2)

Relay II (from p. 1)

data of radiation encountered and the degradation radiation may cause the spacecraft's components.

The new Relay, identical to Relay I in most respects, has no automatic cutoff device. Scientists want to learn how long this one can communicate. It has N-on-P (negative on positive) solar cells which give greater resistance to radiation than the P-on-N solar cells on the previous Relay.

Other component changes are different transistors for the voltage regulator; electrically operated mechanical switches to assure ability to turn off transmitting equipment; relocated temperature measuring devices and a new traveling wave tube. The traveling wave tube transmits the television or radio signal through the spacecraft antenna to the ground.

The newest Relay, like Relay I, can transmit one-way wideband communications (television, 300 one-way voice channels or high speed data) or two-way narrowband communications (12 two-way telephone conversations or teletype, photofacsimile and data).

Improved Visibility for Relay

Relay is in excellent mutual visibility position between North America and Europe for transmission of television between the two hemispheres.

Mutual visibility with Japan, which will be about 40 minutes at maximum, will decrease to nothing by mid-July and continue with no mutual visibility until mid-November.

On the whole, this satellite will constantly be in much better mutual visibility relation to Europe, South America and Asia than Relay I. During the first month, it will afford opportunity to conduct tests of 15 to more than 50 minutes duration three times a day between U.S. and overseas ground stations.

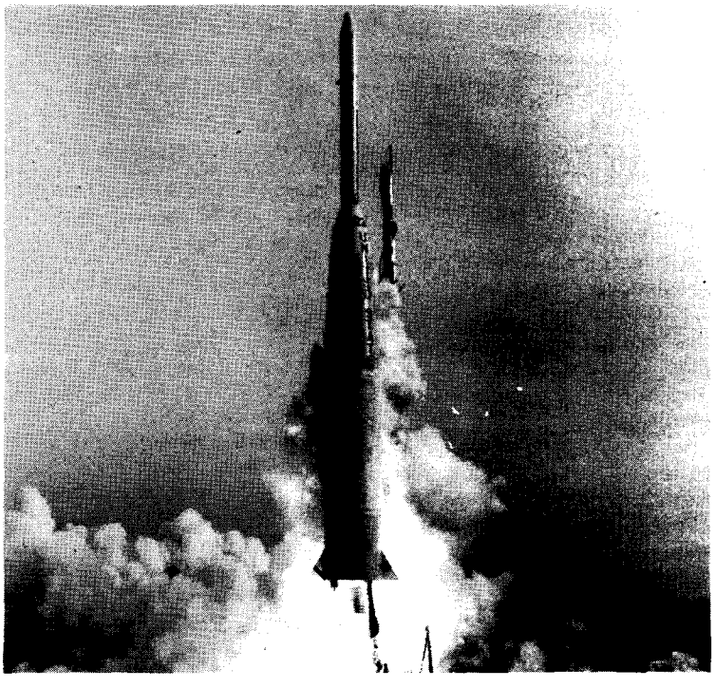
Relay II Tracking

As soon as Relay was injected into orbit, Goddard's world-wide STADAN (Satellite Tracking and Data Acquisition Network) started to track and receive data from the spacecraft. Data will be transmitted continually to Goddard's Operations Control Center for analysis by Relay project officials.

Goddard's Wendell Sunderlin is Relay project manager. Robert H. Pickard is spacecraft manager and Robert J. Mackey, Jr. is head of Goddard's communications satellite research branch.

RCA's Astro-Electronics Division built the spacecraft under contract to this Center.

The Delta launch vehicle was built by the Douglas Aircraft Company.



NASA Delta 23 is shown at lift-off at the launch of Relay II from Cape Kennedy last Tuesday afternoon. This is the 22nd consecutive successful launch by Delta.

Space Shots — PICTORIAL REVIEW

What about Mars?

This preliminary design for a 1975 Mars mission Earth re-entry vehicle was conceived by Lockheed for NASA's Manned Spacecraft Center at Houston. It could return as many as six astronauts to earth, and is designed to protect its crew in air where temperatures can soar to 20,000 degrees centigrade—resulting from re-entry speed up to 65,000 feet per second. It would be able to maneuver to alternate landing sites.

Is there life on Mars? The answer may well come from this strange creation dubbed "Gulliver." As discussed by Gilbert V. Levin on March 29, 1963 at a Goddard colloquim, and reported in the April 1 issue of GODDARD NEWS, Gulliver's "sticky strings" will be reeled into the body of the miniature biological probe. Any microorganisms trapped on the strings will be placed into contact with a radioactive nutrient broth. The digestion of the broth would produce radioactive gasses, and results would be radioed to Earth.

News About Space & Aeronautics

● The moving of manned spaceflight tracking and data acquisition facilities in Australia from Muchea to a new site being constructed near Carnarvon at the westernmost point of the country was announced in December by NASA and the Australian Department of Supply.

The move will consolidate at one site NASA's ground support facilities in Australia for the manned Gemini and Apollo projects.

• • •

● NASA and the Atomic Energy Commission have jointly announced a revision of the ROVER nuclear rocket propulsion program.

The revised program places the emphasis on ground-based research and engineering and defers further development of flight systems.

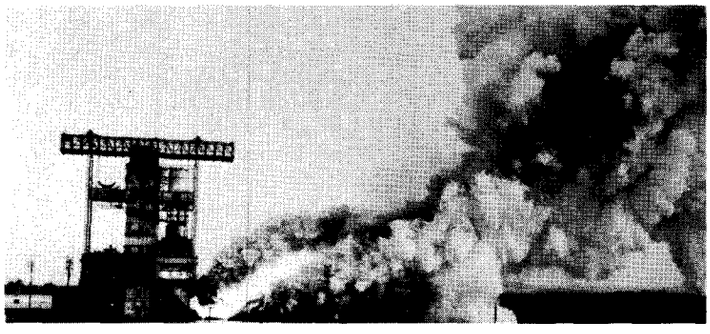
This means that ROVER's Kiwi (Ground reactor) project is unchanged, that NERVA (Nuclear Engine For Rocket Vehicle Application) will be continued but with its flight objectives deferred and RIFT (Reactor In-flight Test) is cancelled. RIFT has been a technological project without actual hardware development to date.

The revision provides adequate funding for continued development of nuclear propulsion and at the same time, by deferring flight systems and tests related to NERVA and RIFT, will save as much as $180 million of planned and programmed funds in FY '64 and '65.

• • •

● "I found that consumables—the part of the program we literally throw away, including the price of the materials in the rockets and spacecraft launched into space and burned up in tests, as well as all the costs of the supporting forces used in recovery—represents less than 8 percent of the total expense. The remaining 92 percent of the funds are used for creating permanent capital—the necessary technology, and industrial manufacturing complex, a government test and launch complex, and a team of people trained in the production, test, and flight of space vehicles. About 10 percent goes for the development of technology—learning how to do things that have never been done before. Another 12 percent goes for the construction of the installations we will use. The remaining 70 percent is used to employ, and thus to train, the team of people—300,000 strong—that will result from carrying out the Apollo Program."—*Dr. George Mueller, Associate NASA Administrator for Manned Space Flight*

• • •



● The above fireball and smoke pall that looks like an oil well fire is the result of a 10-second test of an F-1 engine at NASA's Marshall Space Flight Center. Each F-1 generates 1.5 million pounds of thrust. This is the first time Marshall has captive-fired a single engine packing that much power.

Impetus

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

"If there has been a single characteristic responsible for our success over the past two hundred years, it has been the characteristic American confidence in the future.

"Today there are those who argue for the view that we should not push forward into new realms or new enterprises unless there is clear evidence of competition from other nations. I believe the American people reject the concept that their future—or the future of free men everywhere—shall be defaulted to the vision and ambition of the totalitarians. . . .

"American's commitment to the exploration of space for peaceful purposes is a firm commitment. We will not retreat from our national purpose. We will not be turned aside in our national effort by the transparent maneuvers of those who would attempt to divert us.

"Our national purpose in space is peace—not prestige."

—*Then Vice President Lyndon B. Johnson speaking at Space Center Dedication, Los Angeles, November 14, 1963.*

Goddard Speech and Paper Presentations

Technical presentations approved as of January 20 for period of January 12 through February 9. Requests for copies of speeches and papers should be made directly to the author.)

SPEECHES

W. N. Hess, University of New Hampshire, January 13, 1964, Durham, New Hampshire, ***"Space Physics Research on and about the Moon."***

R. A. Stampfl, I.E.E.E., Princeton Section, January 14, 1964, Princeton, New Jersey, ***"System Performance of Meteorological Satellites."***

W. N. Hess, University of New Hampshire, January 14, 1964, Durham, New Hampshire, ***"The Exploration of Space."***

C. E. Fichtel, American Physical Society, January 22-25, 1964, New York, New York, ***"Low Energy Cosmic Ray Heavy Nuclei."***

D. E. Guss, American Physical Society, January 22-25, 1964, New York, New York, ***"Modulation of Low Energy Galactic Cosmic Rays."***

PAPERS

Richard Lehnert, NASA Conference on Communications Through Plasmas of Atmospheric Entry and Booster Exhaust, January 14-15, 1964, Langley Research Center, ***"Plasma Effects on Apollo Reentry Communication."***

Bernard Rosenbaum, NASA Conference on Communications Through Plasmas of Atmospheric Entry and Booster Exhaust, January 14-15, 1964, Langley Research Center, ***"Plasma Effects on Apollo Reentry Communication."***

D. W. Dembrow, AIAA Aerospace Sciences Meeting, January 20-22, 1964, New York, New York, ***"Fin Temperature Measurements—Nike-Cajun Sounding Rocket."***

E. F. Sorgnit, AIAA Aerospace Sciences Meeting, January 20-22, 1964, New York, New York, ***"Fin Temperature Measurements—Nike-Cajun Sounding Rocket."***

Peter Musen, Yale University, January 30-31, 1964, New Haven, Conn., ***"On the Application of Pfaff's Method in the Theory of Variation of Astronomical Constants."***

GODDARD NEWS

"It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow."
—Dr. Robert H. Goddard

The Goddard News is a bi-weekly publication of the National Aeronautics and Space Administration's Goddard Space Flight Center, Greenbelt, Md., suburban Washington, D. C.

Phone—Ext. 4141 or 4142

Bruce Brough, *Editor* Shirley Deremer, *Inside Goddard*

Echo II Inflation and Reflectivity Tests, a Dress Rehearsal—

(cont'd from page 1)

Echo II on arrival in Hanger Number One at Lakehurst, New Jersey for inflation and RF tests.

John Thurber checks calibrations of radar backscatter equipment in cold hanger last month.

Some members of the Echo team are (from left): John Thole, asst. project manager; Jim Talentino, Echo balloon fabrication; Dick Wirth, Echo thermal analysis; and Frank Boyne, asst. spacecraft systems manager.

shock. Tests were also made while the balloon was fully inflated. The tests were undertaken at the test and evaluation laboratories here at Goddard, at the Grumman Aircraft Company's laboratories on Long Island, at facilities of the Viron Company and the G. T. Schjeldahl Company in Minnesota, and (inflation tests) at the Naval Air Station, Lakehurst, New Jersey.

Goddard has long been interested in controlled inflation systems for erecting large platforms in space. Mechanical systems presently entail tremendous weight drawbacks. Echo II employs a controlled inflation system, designed to inflate slowly enough so the balloon will not rupture, yet fully enough to stress the skin to its maximum RF—reflecting surface.

Static inflation tests were made in hanger number one at the Naval Air Station at Lakehurst. To determine the balloon's sphericity and surface characteristics, photogrammetry of the balloon's surface was used, and RF signals were reflected against it, which indicated the pressure required to stress the skin for good RF signal reflectivity.

Goddard has full management responsibility for Echo II, as well as management responsibility for the tracking and data systems. Herbert L. Eaker is project manager, John M. Thole is assistant project manager and Norman L. Martin is project coordinator.

The inflation system will take approximately 90 minutes to inflate the 135-foot sphere to full pressure. This will allow the satellite to hold high pressures since slower inflation will not allow as much stress to suddenly strain the skin, thus causing it to burst. The skin is made of Mylar plastic .00035 inches thick with .00018 inch thick aluminum alloy foil bonded on both sides.

The heart of the system is the method of packing 72 thinly folded and specially treated plastic bags containing chemical wafers of pyrazole. When these crystals of pyrazole are exposed to the heat of the Sun they turn into vapor filling the sphere with gas.

In order to prevent heat reflected from the Sun from damaging the tracking beacons on the spacecraft or the laminate

Recent Technical Publications Authored by Goddard Staff

E. J. Habib, A. G. Ferris, H. W. Cooper, and R. L. McConaughy, "Ground Operation Equipment for the Orbiting Astronomical Observatory," NASA Technical Note D-1856, December 1963.

C. W. McCracken and M. Dubin, "Dust Bombardment of the Lunar Surface," NASA Technical Note D-2100, December 1963.

W. J. Neff and R. A. Montes de Oca, "Launch Environment Profiles for Sounding Rockets and Spacecraft," NASA Technical Note D-1916, January 1964.

E. C. Whipple, Jr., "Electricity in the Terrestrial Atmosphere Above the Exchange Layer," NASA Technical Note D-2092, January 1964.

E. M. Darling, Jr., "An Analysis of Errors in the Geographic Referencing of Nimbus Cloud Pictures," NASA Technical Note D-2137, January 1964.

J. A. Munford, B. R. Cantor and A. Piltch, "Ultrasonic Welding of a Beryllium Window Assembly," NASA Technical Memorandum X-935, January 1964.

T. L. Eng, "Energy Absorber of the Ariel II Instrument Booms," NASA Technical Memorandum X-936, January 1964.

R. W. Forsythe, "A Method for Simulating Zero-Gravity Erection of Satellite Appendages," NASA Technical Memorandum X-937, January 1964.

R. W. Forsythe, "Analysis of Dissimilar Satellite Appendages During Erection," NASA Technical Memorandum X-938, January 1964.

J. P. Bauernschub, Jr., "A Lightweight Folding Boom for Accurately Placing Scientific Experiments up to 25 Feet from Large Spacecraft," NASA Technical Memorandum X-941, January 1964.

J. B. Schutt, "A Phenomenological Model of Thermophototropism," NASA Technical Report R-184, January 1964.

R. W. Rochelle, "Pulse-Frequency-Modulation Telementry," NASA Technical Report R-189, January 1964.

INSIDE GODDARD

GODDARD SPACE FLIGHT CENTER / GREENBELT MARYLAND

JANUARY 27, 1964

Goddard Employee Flys Through The Air

Bob Porter, flight data systems branch, floats through the air with the greatest of ease—but not on a flying trapeze. During his spare time Bob can be found, weather permitting, sky diving at the Columbia Airport in Croom, Md.

Bob was asked how he became interested in such a unique sport. He said it started back in 1943-45, while he was in the Army. He had just turned 18 and was stationed in England. Volunteers were requested for airborne aid. This interested Bob—so he volunteered and was sent to a parachute school in England.

After his tour with the Army 20 years passed before he decided to join the Pelican Sky Divers Club for sport parachute jumping.

There are 65 members in the club, one member a women. There are also two women who are students.

Bob has made a total of 41 jumps, 17 of which were made during his Army career. His best jump was a 45-second delay at 9,800 feet—traveling more than 100 miles an hour through space.

Bob's aim is to make a 60-second delay in a stable body position, which means he has complete control over the vertical and horizontal axes of his body.

During an actual jump a large cross or X is displayed on the field in the jump area, referred to as the drop zone. This is used as the marker and is the target for sky divers. It takes skill to jump at 9,800 feet—stablize the body for 45 seconds—then guide yourself to land on the spot marked with the big X. A unique hobby —you bet!

Bob is the holder of a U. S. Class B "Parachutist" license. To acquire the Class B license Bob had to complete 25 or more delayed fall sport parachute jumps which included delayed falls of up to at least 30-seconds in duration.

Many people use the term "parachutist" loosely. But only those in possession of a Class B or higher license can carry the title "parachutist."

In 1962 Bob had the opportunity to jump with Jim Arender at the Olympic tryouts—Arender has been world champion jumper for the past two years.

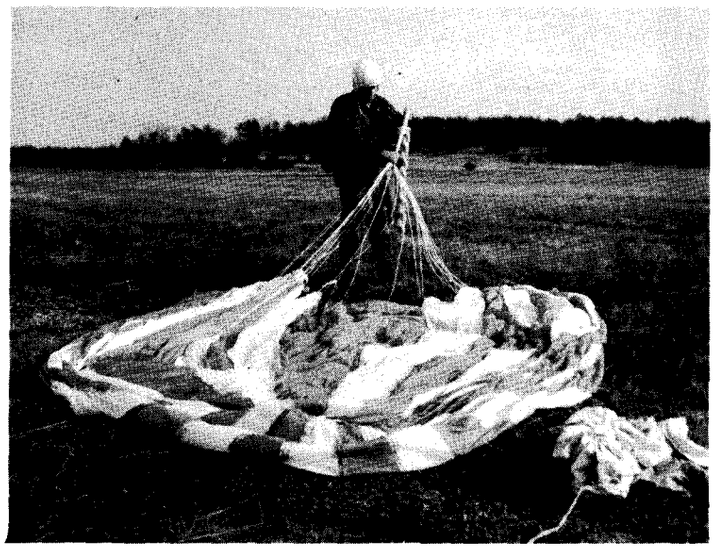
Bob is chairman of the Washington Chapter of the 82nd Airborne Division Veterans, which has about 3,000 members. A native Washingtonian, Bob, his wife Geraldine and their four children live in S. E. Washington.

"If an individual has adequate and thorough training, sufficient drill and supervision —sport jumping is as safe as driving a car," said Bob airily.

Bob Porter displays proper uniform for sky diving.

Bob checks altimeter before take-off.

Making sure all hooks are fastened on parachute.



Landed—Bob is shown pulling in his parachute.

When Bad Weather Strikes...

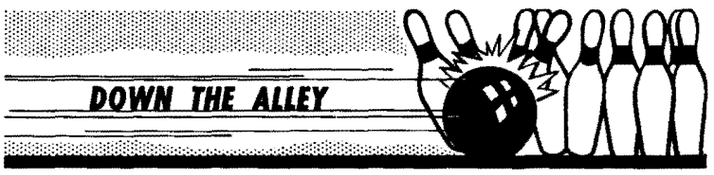
It is suggested that before normal departure time for duty, employees turn on their radios or television sets for the latest information on possible closing of Federal agencies. Should agencies be officially closed, those employees engaged only in necessary services which cannot be suspended or interrupted are expected to report for work.

Employees *are* expected to report for duty in the absence of any official notification that Federal activities are closed.

For Safety's Sake

Goddard's safety office has relayed some information from the Food and Drug Administration which warned householders and others against use of "X-33 Water Repellent," an extremely flammable masonry water proofer. FDA Commissioner George P. Larrick urged consumers who have purchased the product to return it unopened to their dealers immediately because of the extreme risk of flash fires and explosions.

Mr. Larrick warned householders against trying to destroy or dispose of the product themselves without first consulting their local fire department.



GODDARD MIXED TENPIN LEAGUE STANDINGS

Tuesday
(As of January 7, 1964)

	W	L		W	L
Apaches	41	19	Scatterpins	31	29
Twiggits	38½	21½	Full House	29	31
Alley Cats	36½	23½	Alley-Oops	29	31
Orbiting Elements	35½	24½	Imps	26	34
No Names	35½	24½	Spouses	26	34
Ichi-Bans	35	25	Split Fits	22	38
Elites	35	25	Zooms	20	40
8-Balls	34	26	Lucky Five	19	41
Mor-Wood	33	27	Team No. 17	15	17

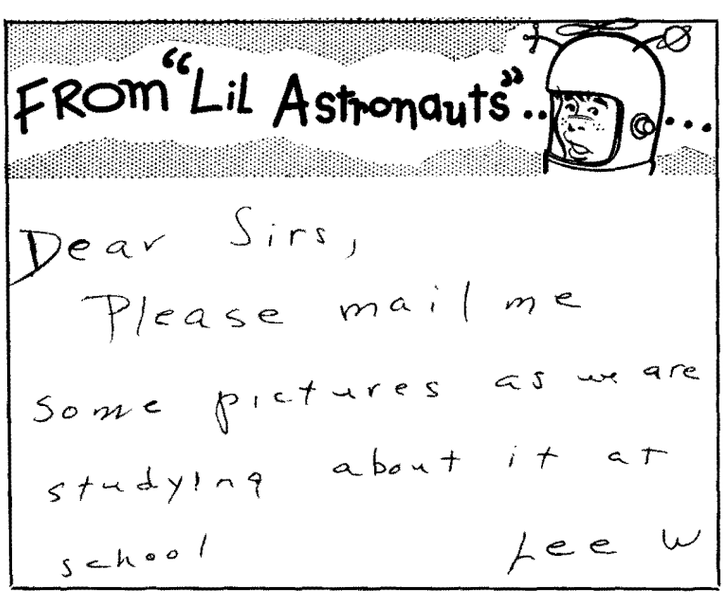
GODDARD MIXED DUCKPIN LEAGUE STANDINGS

Tuesday (As of Jan. 15, 1964)	W	L	Thursday (As of Jan. 16, 1964)	W	L
Alley Catz	32	19	Astronauts	32	22
Stargazers	31	20	Tick Tocks	31	23
Cole's Coolies	31	20	Moon Pilots	31	23
Comets	30	21	Safety Pins	30	24
Quicksilvers	28	23	Bob Cats	30	24
Alley Nauts	27	24	Meteorites	30	24
Bob Cats	27	24	Wombats	29	25
Vagabonds	26	25	Woodchoppers	28	26
Bluffers	25	26	Thor Heads	28	26
Toppers	24	27	Starliters	27	27
Ducklings	21	30	Syncoms	23	31
Dukes & Duchesses	20	31	Satellites	23	31
Moonshiners	19	32	Strikers	19	35
Possibilities	16	35	Space Katz	17	37

GODDARD MEN'S TENPIN LEAGUE STANDINGS

Wednesday (As of Jan. 8, 1964)	W	L	Thursday (As of Jan. 17, 1964)	W	L
Outcasts	36+	27+	Gutterballs	45	23
Rabs	36	28	Pinspallers	41½	26½
Bandits	35	29	Kiboshers	40½	27½
Quiet Ones	34+	29+	Longshots	39	29
Gubaths	32	32	Marvelous Ones	39	29
Rackets	32	32	Tartars	37	31
Snakeyes	31	33	Old Goats	34	34
Vibrators	31	33	Hi Lows	32½	35½
The Junto	30+	33+	Fink's Grp.	32	36
Keglers	29	35	Spoilers	32	36
Packers	29	35	A&M PM's	31	37
Rattfinks	27+	36+	Markers	30	38
			Guided Muscles	28	40
			Fat Sparks	28	40
			Bad Risks	28	40
			Manywatts	26½	41½

All bowling standings should be submitted one week prior to publication.



Goddard Welcomes

NEWCOMERS TO GODDARD SINCE THE LAST ISSUE.

William Michaelson
Aeronomy & Meteorology Div.

Robert E. Sutton
Spacecraft Integration & Sounding Rocket Div.

Herbert F. Frisbie
Space Sciences Div.

John N. Nielsen
Test & Evaluation Div.

Laurence M. Goodman
Project Support Division

James R. Winemiller
Facilities Engineering Div.

John A. Klisch
Network Engineering & Operations Div.

Ronald O. Britner, II
Network Engineering & Operations Div.

William O. Macoughtry
Network Engineering & Operations Div.

Solomon Levine
Network Engineering & Operations Div.

Russell J. Leary
Procurement Div.

James D. Crane
Network Engineering & Operations Div.

Herbert Mitnick
Manned Flight Support Office

Cora G. Westmoreland
Procurement Div.

Your Credit Union—At Your Service

• It's new car time again and members are reminded that their Credit Union is ready to help them finance that car. Recent Board action resulted in reducing the interest on new car loans to ⅝ of 1% per month on the unpaid balance. You can get up to ⅔ of the list price of the car, including the cost of accessories. You are protected by borrowers' life insurance equaling the balance of the loan at no additional cost!

• Members with low share balances are urged to increase their savings in the Credit Union. To permit an account to remain idle at a low balance aids neither the member or the Credit Union. Drop a few extra dollars in the Credit Union from time to time and you'll be surprised how easy it is to accumulate a tidy sum.

Followed by Successful Orbit

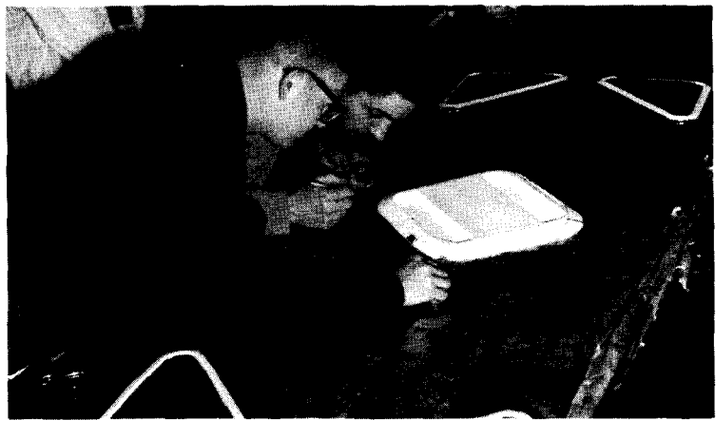
itself, the balloon is coated with alodine, a chemical acid.

To keep as even temperature as possible between the Sun side and the shade side of the sphere, the inside surface is coated with black India ink.

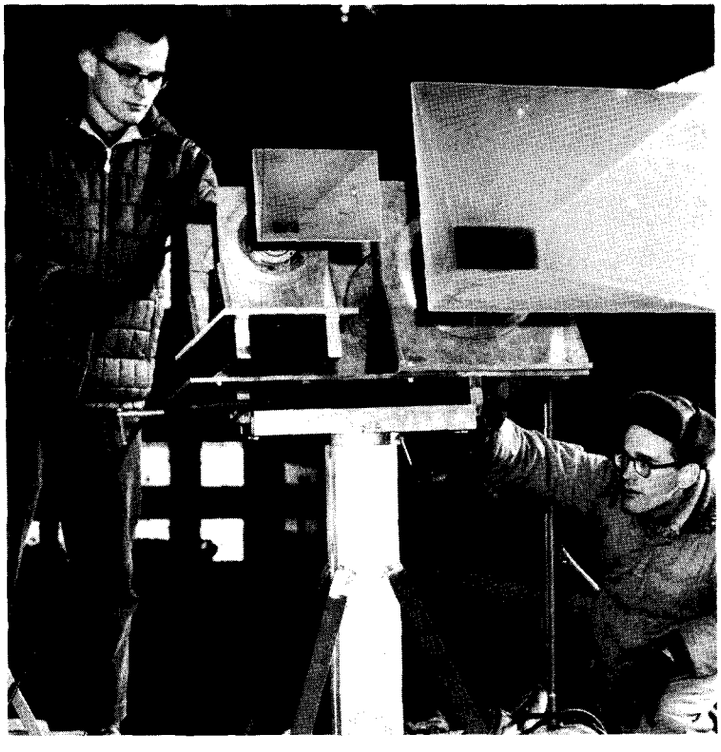
Two 13½ inch square ¾ inch thick beacon transmitters are mounted opposite each other on reinforced sections on the balloon's equator. These beacons will telemeter balloon skin temperature and internal pressure to NASA's world-wide STADAN (Satellite Tracking and Data Acquisition Network) stations. The beacons will also aid the experiments by providing tracking signals.

Goddard will score another space first with the Agena vehicle borne TV system that will observe the injection of the satellite into orbit. The canister ejection, canister separation, balloon deployment, and the initial balloon inflation can be seen on monitors and recorded on two video tape recorders at a ground station in the Republic of South Africa.

The success of Echo II will be attributable to the excellent cooperation and support that was provided by the many Goddard employees and contractors.



Ken Parks (left) and Don Phillips of Goddard are shown installing the Echo II's telemetry beacons.

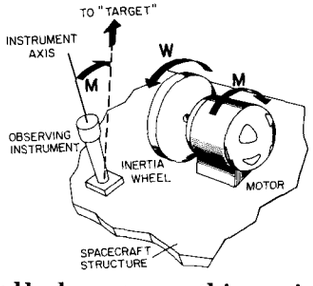


James Driver aligns the L band and C band antennas to determine backscatter quality of the pre-flight balloon.

Checking controlling device to regulate pressure in the balloon is Goddard's Henry Sweet.

How It Works—#4

Inertia Wheels



Uncontrolled spacecraft tumble erratically in orbit, Inertia wheels are one of several types of devices used by space scientists to stabilize or align a spacecraft so that a particular experiment sensor is made to point in a desired direction. The spacecraft may be turned to point at a new target upon command from the ground or programmed computers aboard.

The operation of inertia wheels is based on Newton's third law of motion: for every action there is an equal and opposite reaction. A man stepping from a canoe (action) imparts an opposite motion (reaction) to the canoe. In the same way, if an electric motor is used to increase the turning speed of an interia wheel in direction W, an opposite torque or turning motion is imparted to the motor mount. This causes the spacecraft structure and attached sensor to turn in direction M. During this swing, the inertia wheel is made to decelerate at a rate which slows the spacecraft's turn and stops it with the sensor exactly on target.

The same process then works to hold the sensor on target despite various disturbance forces on the spacecraft. Some originate within the spacecraft (e.g., moving machinery) while others come from outside (e.g., micrometeoroids, solar wind pressure).

Accelerating and decelerating the wheel will allow many alignments of the spacecraft to be made. However, the wheel may reach its maximum allowed rotational speed. From then on it can only be used to turn the spacecraft in one direction—the one obtained by decelerating the wheel. To regain usefulness for both directions its rotational energy must be dissipated. Gas jets are used to produce an opposite, steadying torque on the spacecraft while the wheel is slowed down.

Dust Doesn't Daunt Satellites Thanx to White Bench

For ages dust has been a housewife's horror, but now the shoe is on another foot—that of the aerospace scientist. While dust tends to only annoy a housewife, it can mean the difference between success and failure to the delicate instruments orbited aboard NASA's complex and expensive spacecraft.

Thankfully, we can do more about the problem here at Goddard than just wiping it off with a cloth and complaining as it resettles.

A device called a "white bench" has been installed in building 11 by the structural and mechanical applications section, according to Francis Le Doux, section head. The section is part of the spacecraft integration and sounding rocket division's mechanical systems branch.

The white bench is simply a work bench enclosed in a controlled environment. The entire work area, 12 feet long and three feet wide, is surrounded by an airtight flexible plastic cylinder. The enclosed volume is supplied with air that has been conditioned and filtered to class four (ultra clean) requirements. This is cleaner than any "clean room" facility built to date.

The white bench has other advantages over the clean room, which was once considered the optimum in contamination-free work space. For example, the users of the white bench do not need to indulge in the expensive use of especially laundered clothes to use the facility. The bench is portable, something that the clean room can never attain.

Labor costs are cut with the bench, since it does not require exhaustive preparation and clean-up time. Also, the possibility of the work environment being contaminated by the operator is almost nil. The latter factor alone may result in more reliable spacecraft components.

Current Uses of the Bench

The white bench is now being used for the assembly of some of the components for the Orbiting Geophysical Observatory (OGO). Final assembly of the intricate and delicate mechanisms for the satellite flight models must be carefully protected from contaminents. Let's follow some components through the procedure in the white bench area and see its effectiveness.

First, the components to be assembled are put into the air lock at one end of the bench. This is done after the filtering and conditioning system has been turned on. Positive pressure is built up in the encased volume, and the relative humidity is usually set at 15% with a temperature of 70 degrees Fahrenheit (although both these figures are variable at will).

The lock is a box with one door opening into the bench environment and one opening into the room. There is one at each end of the bench.

Parts can be ultrasonically cleaned inside the air lock if necessary, and dried in the dehumidified chamber. After cleaning, the items are placed inside the bench area and the air lock is closed.

Once inside, how can the parts be assembled?

Operators work in the enclosure by means of diaphrams and/or glove ports. The gloves are the only items which must be specially cleaned. Flexible flaps close around the forearms once the hands are inside, and the air volume's positive pressure does the rest to keep outside dust away from the work area.

An operator of the bench has access to the entire length. As he walks along the bench area with his hands inside the glove ports, the enclosing plastic bag "follows" him along on tracks above head level. The loose plastic material folds and unfolds accordian-style to accommodate his movement. A clear plexiglas face plate is centered between each pair of glove ports to prevent distortion of vision.

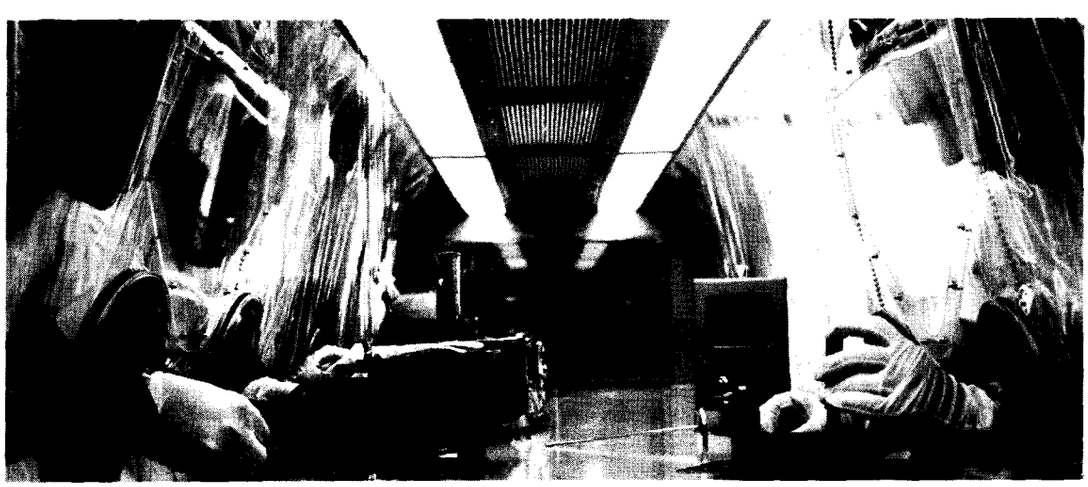
Contractor Charles Drew, of Washington Technological Associates and Francis Le Doux (right), section head, are discussing a component in the white bench area.

The white bench is an adoption of techniques originally intended for the germ-free isolation of hospital patients.

The bench in building 11 was built and installed by Matthews Research, Inc. of nearby Alexandria, Va. It processes air through two filter stages—a rough pre-filter and the final filter. Using the two filters, 99.97% of all particles down to 0.3 micron is possible. For a size comparison, consider that some bacteria are as large as 5.0 microns—more than 16 times larger than the bench's capability.

A third filter is obtainable which utilizes activated charcoal to remove any airborne hydrocarbons. With minor modifications, the bench can also be converted for use as a sterile assembly area.

And that is Goddard's answer to an age-old problem. Dust, the plague of housewives, has met it's match in Building 11.



This is an "inside look" at the white bench. C. Drew, left, is working on an engineering model of an improved OPEP 2 scan mechanism for OGO. Lewis Paul, right, of Goddard, is assembling an airglow shutter mechanism, also for OGO.

Goddard Men Meet Nehru at Cosmic Conference

Two Goddard physicists attending the International Conference on Cosmic Rays in India last month had an added experience of rare proportions. Both had an opportunity to meet Prime Minister Nehru.

Dr. Carl Fichtel and Dr. Thomas Cline, members of the energetic particles branch of the space sciences division, presented papers at the conference, a semi-annual affair organized by the International Union of Pure and Applied Physics.

Dr. Fichtel's paper was titled "Modulation of Low Energy Galactic Cosmic Rays." Dr. Cline presented "Velocity Dependence and Source Spectra of Solar Proton Events."

Approximately 200 solar ray physicists from all parts of the world attended the two-week session at Jaipur. During the meetings, Prime Minister Nehru visited from New Delhi to meet some of the "guests," and to deliver a short greeting.

Dr. V. K. Balasubrahmany and Dr. Frank Jones, National Academy of Science Fellows who are working at Goddard, also attended the conference. Both presented papers: "A Study of Primary Cosmic Ray Change Spectra" was given by Dr. Balasubrahmany. Dr. Jones' paper was titled "Secondary Galactic Electrons."

Goddard's Dr. Fichtel (left) is shown here meeting Indian Prime Minister Nehru at the International Conference on Cosmic Rays in Jaipur.

Dr. Thomas Cline (left) also met Nehru (center). At right is Nobel Prize winner Dr. C. F. Powell of the Univ. of Bristol in England. Dr. Powell organized the conference.

Goddard Coming Events

Goddard colloquium lecture:

- **January 28, 3 p.m., Auditorium Bldg. 3—Dr. Lawrence A. Schmid, Theoretical Division, "A Self-excited Dynamo as the Source of the Earth's Magnetic Field."**
- **January 30, 4 p.m., Goddard Institute for Space Studies, Room 431, 475 Riverside Drive, New York, N. Y.—Dr. Ivan King, University of Illinois Observatory, "The Dynamics of Spherical Stellar Systems."**
- **January 30, 12:30 p.m., Auditorium Bldg. 3—"Spacecraft Environment and Test Facilities."** *(This is a Goddard film showing the failure analysis and calibration laboratories of the test and evaluation division.)*
- **January 30, 12:30 p.m., Auditorium Bldg. 3—"Ionospheric Rocket Experiment."** *(A second film presentation.)*

Goddard's Data Tape—30 M. P. D.

The term "halfway around the world" brings a different image to every mind's eye. But few would ever attach this rhetoric to Goddard's data systems division. The connection comes when one comes to realize that this division handled enough analog magnetic tape last year—more than 10,000 miles of it—to reach nearly from pole to pole.

Approximately 30 miles of tape per day, representing nearly six *million* data points are analyzed by the data processing branch. (A data point is a unit of measurement roughly comparable to a single reading of a thermometer. A data point reading is usually a number between 0 and 1000.)

When OGO (Orbiting Geophysical Observatory) is launched later this year, the division expects its work load to increase to more than 50 million data points daily. This is in addition to other major spacecraft, some with dozens of experiments, to be launched soon.

And there could be many more examples quoted of the staggering amount of work expected from the men (and computers) at Goddard. Whether a launch involves an astronaut or a scientific payload, the reams of information relayed back to earth is the lasting and most significant part of any mission.

This mass of information must be reduced from its raw form to a useable format.

With 1964 tagged as a year of heavy launch activity by NASA, support groups will be busier than ever. Last year's statistics may be used as a yardstick to measure what will be expected of data systems this year. For last year, a year of relatively little "action," these are some accomplishments:

- Orbit predictions were performed for 32 satellites;
- 760 satellite prediction reports were produced;
- A total of 30,160 hours of large scale computer operation was accounted for;
- A total of 38,632 satellite station predictions were processed and transmitted to the stations and 24,424 station data reports were received or more than 58 million characters of data;
- 159,025 tracking parameter units were passed into the orbital correction operation;
- TIROS telemetry information of 37,213 messages was composed of more than 53 million characters;
- The computers were used to support 17 satellite or vehicle launches, ten of these used real-time operations support under control of the data operations branch;
- Completely processed data accounted for 250,000 data points per hour.

This year, the launch schedule is a full one. But after the newsmen go home and the headlines fade back into routine and earthly matters, work will begin in earnest for the men and machines of the data systems division.

And even the example of tape winding half-way around the world takes on symbolic significance: For the results reduced at Goddard will have worldwide impact.

Japanese Girl Says 'Thanks' for Relay—Sends Cranes

Shown here at Goddard with the 1000 cranes are members of the COMSAT office (from left): Marguerite Thacker, Kay Smith, Hilda Hall, John Flaherty, Peg Provencha, Pat Mishler, Mary Lampe, Pat Mattia, and Jayne Silva.

Yoshie Noomoto is not a famous person in Japan, nor is she a widely known writer. Nevertheless, her spirit and refreshing open-heartedness strike a chord that we can all appreciate.

Yoshie wrote a letter of appreciation to the Japanese television interests which carried the experimental pictures to that country from the United States via Relay at a time of mourning for the late President Kennedy.

The chief of the Japanese satellite communication organization relayed Yoshie's message to Goddard's Communications Satellite Project Office here at Greenbelt. She also sent us *a thousand cranes.*

Excerpts from his letter tell the story about hers: "We received a letter . . . from a girl who had seen the program sent from Mojave . . . and broadcast to all Japan.

"In the letter, she asks us to send the message and a thousand cranes (made of paper) to the space communication center in U.S.A.

"Do you know the meaning of a thousand cranes? In our country, the number 'a thousand' has special meaning. This number seems to have been too large to count for old Japanese. So they use this number in the case that things were numberless, besides they used this in special cases such as in congratulation. . . .

"Now a thousand cranes are made by oneself when the maker hopes something, for example . . . success of something, etc. . . .

"The girl . . . also says in her letter, 'Cranes are birds of happiness. I made them believing that they might make all the people happy.'

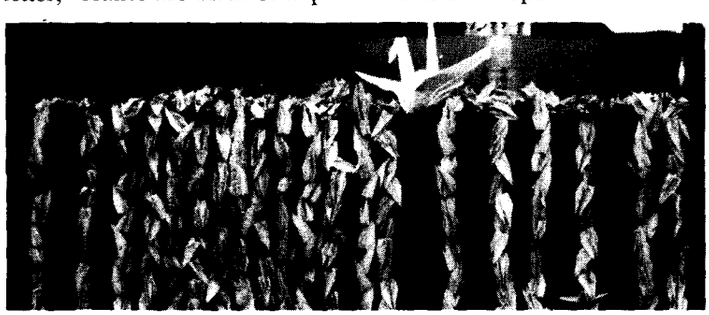
"We send these prayerful cranes to you. Let us continue our experiments onwards and make effort to gratify her prayer.

"In addition, we send you her poem which was with the cranes. The poem is difficult to interprete into English. Therefore, we will sum up the poem briefly. It is as follows:

"At five o'clock on the 23rd (Nov.)
Came to see the TV program sent from U.S.A.
By space communication.
And then heard of the mourning of America.
How miserable.
Tears filled my eyes, sad and angry.
With swimming eyes, waited the second program.
Pictures from America came for the second time.
Again tears filled my eyes.
But this tear was of gratitude for the people of America working for Japan in such a sad time."

Yoshie Noomoto saw the telecasts of the events surrounding the assassination. She saw and appreciated the efforts of scientists and statesmen working together to shrink the world in trying times. She saw the fruits of NASA's Relay, which is still in operation after having been joined by Relay II last week.

She saw hope.



This close-up shows the thousand cranes before they were sent here from Japan. The detail of the large one is repeated 999 times. The cranes represent hours of work.

Spacemobile Plans for Pa. Set

Goddard's chief of educational programs and services, Elva Bailey, is shown at left during Spacemobile conference. Others, from left, are: Mrs. Mary Blatt, Dr. Albert Eiss, John Bannister, and Karl Heilman.

One of the spacemobiles operating from Goddard will tour 25 Pennsylvania counties from January 20-May 29. Groundwork for the tour was set at two conferences between Goddard and NASA Headquarters Spacemobile team members and the Pennsylvania Department of Public Instruction. More than 160 lectures are scheduled during this tour in addition to classroom sessions.

The first conference was held in Harrisburg on December 10. The second was held here at the Center January 17. The Pennsylvania educators were given a tour of Goddard with briefings during the morning. The conference began after lunch.

Items discussed were:

- Methods of making most effective use of the Spacemobile during the upcoming tour in Pennsylvania;
- Plans for scheduling the Spacemobile for the 1964-65 school year; and
- Spacemobile teacher workshop activities in the State for the upcoming summer.

Participants from Pennsylvania were: Dr. Eero W. Davidson, Coordinator of Regional Instructional Materials Centers, Pa. DPI; Dr. Albert F. Eiss, Coordinator of Mathematics and Science, Pa. DPI; Mrs. Mary Blatt, Science Specialist, Pa. DPI; and Mr. Carl Heilman, Mathematics Specialist, Pa. DPI.

Goddard personnel involved were: Charles P. Boyle and Elva Bailey, who are responsible for Goddard's educational programs & services; Jack Callow, Spacemobile coordinator; and Robert Perry and John Bannister, Spacemobile lecturers.

Stewart Tinsman, National Spacemobile Coordinator, NASA headquarters and Herman Oberle, Regional Spacemobile Coordinator, NASA headquarters also took part.

The spacemobile program was initiated early in 1961 under the direction of the office of educational programs and services. The interest of educators and the public on a national basis stimulated a rapid expansion of the program. Goddard became a co-ordinating center for a five state (Maryland, Delaware, Pennsylvania, New Jersey and West Virginia) area late in 1963.