GODDARD NEWS

THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

GODDARD SPACE FLIGHT CENTER / GREENBELT, MARYLAND

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OSO-II Provides A Bonus

The Orbiting Solar Observatory–II, silent since it was turned off November 3, 1965, was turned back on this week to provide a bonus of scientific and engineering data.

OSO project officials here at Goddard successfully turned on the OSO–II on June 1 and obtained useful data from it before turning it off on June 6.

The spacecraft has been in orbit more than 16 months since it was launched from Cape Kennedy on February 3, 1965. Designed to operate six months, OSO–II excedeed this life expectancy by fifty percent before it was turned off in November because the gas supply for its pitch control system was nearly depleted.

By saving this small amount of pitch gas, the Goddard engineers made it possible to evaluate the effects of long-term space conditioning on both the spacecraft and its scientific experiments during the recent turn-on.

In addition to the valuable data from his Low Energy Gamma Ray experiment, scientist Kenneth J. Frost has been provided with the first data on the performance and life expectancy of the "sequencing eyes" for his experiment. Both the experiment and its "eyes" worked perfectly after 16 months in the harsh space environment.

The "sequencing eyes" turn on the Low Energy Gamma Ray experiment to look at the Sun and the background respectively. These "eyes" consist of a pair of slits behind which are located light sensitive silicon control switches and associated electronic circuitry.

Another experimenter, Carr B. Neel of NASA's Ames Research Center in California, has expressed a great deal of interest in the new data from his Emissivity Stability experiment on the spacecraft, according to OSO–II project manager Lawrence T. Hogarth.

This experiment is designed to support NASA's Apollo manned lunar landing program by testing special coatings to be used on the Apollo capsule as a means of helping to control its temperature. Essentially, this experiment measures the absorption and emissivity properties of various coating samples when exposed to the Sun and space. The samples are coated to a disc on the wheel section of the OSO–II.

See Page 3

OGO III SMASH HIT

One of the nation's busiest weeks in space was capped with the successful launching of OGO III, June 6, into a near-perfect orbit from Cape Kennedy, Florida. As the GODDARD NEWS went to press, the newest scientific satellite was operating as planned.

Joining Gemini 9 and Surveyor I on the space record books, the 1,135-pound spacecraft, crammed with 21 experiments to study earth-sun relationships, performed perfectly during its journey into a highly elliptical orbit.

Initial computation of the OGO III orbit showed an apogee of 75,768 statute miles, a perigee of 169.65 miles, an inclination to the equator of 30.9 degrees, and a period of about 48½ hours.

These figures are almost exactly as planned, according to Goddard's OGO Project Manager, Wilfred E. Scull.

OGO III, the third in a series of seven insect-shaped scientific spacecraft, underwent most of its experiment integration and environmental testing here at Goddard. In charge of the team responsible for this enormous job was Joseph Purcell, Head of the Space Electronics Branch of the Information Processing Division.

The OGO III experiment turn-on schedule was slated to begin late last week. This critical phase of the mission was to be conducted from the OGO Control Center in Building 14. In charge of OGO operations is Kenneth I. Kissin.

Other key people in the Goddard-wide OGO project include Dr. George H. Ludwig, Project Scientist; Abraham Leventhal, Assistant Project Manager who supervised OGO launch operations at Cape Kennedy; Thomas H. Ragland, OGO Project Coordinator; and Ronald O. Britner II, OGO Tracking and Data Systems Manager. OGO prime contractor is TRW Systems, Inc.

. . . and from the Vice President

To: Dr. John F. Clark

As chairman of the National Aeronautics and Space Council, my personal appreciation to you and your fine associates for your competent work in making OGO III a brilliant success.

Hubert H. Humphrey

DATA TOPICS

Part II of a two-part series:

The Data Processing Engineer

by Michael Mahoney

A primary function of the Information Processing Division is the processing of satellite telemetry data, starting with the output of the physical sensor on the spacecraft through data sampling, encoding, transmission, ground processing, analysis and display.

On each space mission it is the job of the Data Processing Engineer to pull together the activities of the various disciplines within the division which are required for this task.

He accomplishes this by obtaining assistance in matters concerning flight hardware from the Space Electronics Branch, ground hardware support from the Processor Development Branch, computer software support from Telemetry Computation Branch, and day to day operations support from the Data Processing Branch.

At present there are twenty-two signal processing lines in use by the Information Processing Division for production processing of raw telemetry data. The types of processing range from the production of strip charts, filming and scaling of ionogram data, decoding and interpretation of command data, and the analog to digital conversion of all known types of telemetry data onto digital magnetic tape. Once data is on digital magnetic tape it is available for further processing via a high speed computing system. The Information Processing Division makes use of three such large scale digital computer systems.

The processing that takes place and the output of telemetry data from these computing systems may also take many forms. Data may be correlated with other information such as orbital position or spacecraft attitude, or it may be simply stripped out for each experimenter and written on digital tape for further processing by him. The way the data is presented to the user is also of prime importance. Some requirements merely call for data point by data point listings with data converted to scientific or engineering units. Others require plots of telemetered data versus time or other parameters. The Information Processing Division makes use of several plotting devices. One of these plotting devices is a Stromberg Carlson 4020 Microfilm Plotter capable of producing high quality microfilm and hard copy printed listings and graphs at an extremely high rate.

Plots showing three variables have been produced. To accomplish this the third variable is presented as a variation in intensity on an x-y plot, another method is to display the graph or an isometric view of a surface. A requirement to show four and five variables has been accomplished by presenting the graph or surface as a motion picture.

One can see that a multitude of equipment types, processing techniques and forms of final output are available for use on the many types of satellite telemetry systems.

There is one more dimension to the overall data processing task—that is operations.

The Information Processing Division is currently processing data from twelve active satellites. We receive approximately 200 station tapes per day containing a total of nearly 60 million data points. These tapes are all processed through their respective processing systems. The systems range in complexity of operation from simple receiving, logging tape evaluation and reshipment: to analog to digital conversion, computer processing through detailed and indepth spacecraft subsystem analysis.

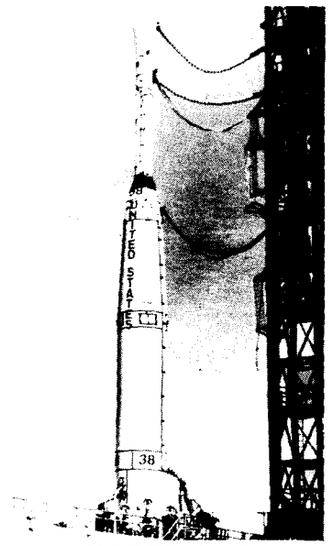
A highly skilled staff of operations personnel is required to provide for the efficient scheduling, accounting, and production processing for each step in the data processing system.

Providing for the processing of telemetry data involves many disciplines. These include equipment specialists both for spacecraft and ground processing hardware, computer specialists for ground digital computer systems (and it's not inconceivable that this specialty will also be required aboard the spacecraft in the near future), and operations specialists for running the system on a production basis.

Within the area of information processing the DPE is a generalist who finds challenge and satisfaction in dealing with many kinds of problems. As space projects grow more ambitious, as the equipment available becomes more powerful, and the software more sophisticated, his work can be expected to become more interesting and valuable than ever.

EXPLORER XXXII SENDING USEFUL SPACE DATA

The latest scientific satellite to be placed in orbit by NASA, Explorer XXXII, is operating normally.



THE ATMOSPHERIC EXPLORER-B spacecraft atop the Delta 38 launch vehicle undergoes a radio frequency interference test at launch Complex 17 before its successful launch.

All eight experiments onboard the Goddard-managed spacecraft are functioning as expected and the 495-pound aeronomy spacecraft is spin-stabilized at the required 30 revolutions per minute.

Launched May 25 from Cape Kennedy, the spacecraft was placed into an orbit ranging from 1629 to 173 miles rather than the expected 750 by 170 miles. A lack of command cutoff in the second stage of the Delta launch vehicle caused it to burn an extra eight seconds which resulted in the higher apogee.

According to Nelson W. Spencer, Explorer XXXII project manager, "The high apogee of the orbit means that we will tend to concentrate our measurements in the lower portion of the existing orbit to obtain similar measurements desired with the original orbit."

"Although this causes some modification to our previous plan, the higher apogee will permit some measurements that were not planned originally and which are expected to prove useful scientifically," he added.

Explorer XXXII is designed to collect accurate data on the upper atmosphere to provide a better understanding of how and why changes occur there. In addition, it is studying the effects of short term disturbances in the atmosphere caused by radiation from solar storms.

GODDARD NEWS

JUNE 13, 1966

"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

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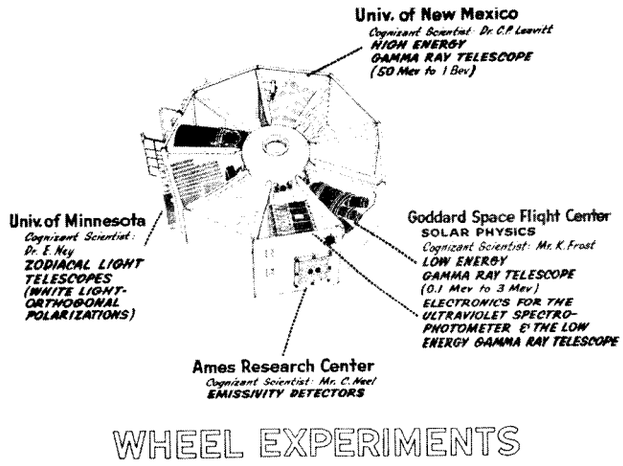
OSO-II Bonus! *from page 1*



***ARTIST'S CONCEPT** shows those experiments now sending scientific and engineering data back from OSO II.*

Two other experiments which produced useful scientific data during the recent turn-on were the University of Minnesota's Zodiacal Light Monitor and the University of New Mexico's High Energy Gamma Ray experiment.

OSO–II carries a total of eight experiments. The four remaining experiments which did not come on were the Harvard University's Ultraviolet Spectrometer, the Naval Research Laboratory's Solar X-ray Burst Monitor and White Light Coronograph, and the Goddard Ultraviolet Spectrophotometry experiment.

Goddard engineers commanded the OSO–II on by working through the Ft. Meyers, Florida, station of Goddard's Space Tracking and Data Acquisition Network (STADAN). The pitch control system came on immediately and locked onto the Sun. A pitch angle of plus two degrees was achieved. Battery voltage went up to 20 volts and its charge rate was normal.

Initial data looked like the spacecraft had been off for a matter of minutes rather than seven months. The spin rate of the wheel section was normal at about 30 rpm. The pointing accuracy was better than the expected one minute of arc in azimuth and elevation and the pitch gas pressure was 37.5 psi while the spin gas pressure was 230 psi. These are the same pressures which existed when the spacecraft was turned off in November, 1965.

The OSO spacecraft are built and tested by Ball Brothers Research Corporation in Boulder, Colorado.

Carl E. Westman of the OSO–II project coordinated the effort to glean the bonus data from the spacecraft. William D. Worrall of Goddard's Project Operations Support Division played a major role by directing the ground operation.

According to Westman and Worrall, "the performance of the Ft. Myers ground station was outstanding during the entire operation."

Project "Red-Tape" Needs You

Here is your opportunity to show your displeasure with forms and reports which consistently find their way to the waste basket—

Project "Red-Tape" is primarily concerned with reducing paperwork to the barest minimum. In this connection, methods are being sought to minimize the forms and reports required by the various Center elements. An undertaking of this nature would be incomplete without considering the opinions and suggestions of the Center personnel. Please call Project "Red-Tape" on extension 6471, with your ideas on what forms and reports can be discontinued, combined, or improved.

Trainer of the Year

***GODDARD'S DR. MICHAEL J. VACCARO** presents the Individual Trainer Award to James Reese.*

James C. Reese, Head of Goddard's Employee Development Branch was recently honored by the joint Washington area chapter of the Training Officer's Conference and the American Society for Training and Development (TOC/ASTD) as their outstanding Training Officer of the Year. This annual award was bestowed in recognition of Mr. Reese's professional achievements reflected in his development of a comprehensive program to service Goddard's varied, complex and often unique training and education needs.

The Training Branch sponsored over one hundred on-site courses during the past year and has originated several special long-term training sequences for novice scientific, engineering and administrative professionals; for technicians, and most recently for supervisors. Through his initiative, significant cooperative arrangements have been established with local universities including the ¾ Credit Graduate Study and pre-and post-doctoral summer research fellowship program.

Mr. Reese directs, according to him, "a young, dynamic staff of three training and education professionals, a Branch secretary and a clerk. I attribute much of the recognition accorded me to their creative efforts and outstanding spirit of cooperation."

OGO-III Sidelight...

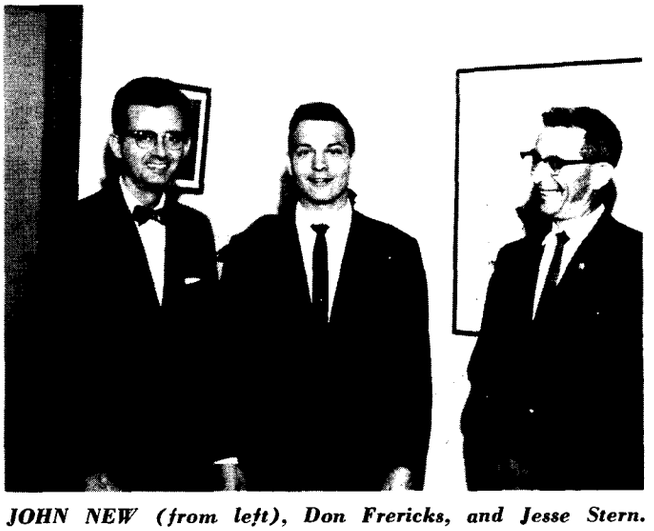
"You mean that I don't have the right one?" questions Dr. George Ludwig, OGO Project Scientist. During the Monday evening satellite launch, only people with the correct badge were admitted to the control areas.

Results of ¾ by Degrees

Four Goddard employees received advanced degrees, all were M.S., in June, 1966, under the sponsorship of the ¾ Credit Graduate Study Program.

Mike Fitzmaurice, Don Frericks, and Joe Sciulli received M.S.E.E. degrees from the University of Maryland. Brian Kritt completed his M.S. in Physics at the Catholic University of America. All except Mr. Sciulli, who is presently hospitalized, are pictured below being congratulated by their Division chiefs and supervisors.

HARRY TAYLOR (from left), Brian Kritt, and Nelson Spencer.



JOHN NEW (from left), Don Frericks, and Jesse Stern.

PETER MINOTT (from left), Michael Fitzmaurice, Dr. Robert Coates, and Dr. Henry Plotkin.

DARRIN GRIDLEY (pointing), Associate Chief of the Data Systems Division, briefs Dr. Cohen (at his right) and Dr. Cook (at his left), Head and Advisor respectively of the Department of Mathematics, University of Maryland, on the applications of a computer operation. Other members of

¾ CREDIT PRO

Goddard's Organization and Personnel Division has announced that the ¾ Credit Graduate Study Program is expanding this year to include additional fields of study at the University of Maryland —physics and mathematics. A ¾ arrangement with the George Washington University for advanced degree work in engineering administration has also been added and will begin this fall. Goddard is already cooperating with the Catholic University of America and the University of Maryland in this program in the fields of engineering, physics and astronomy.

This approach to graduate study is a unique compromise between part-time and full-time academic pursuit. Participants enroll for approximately nine credits each semester. This is generally considered ¾'s of a normal full-time graduate study program. Through this vehicle, the graduate education of promising Goddard employees can be accelerated considerably at both the master's and doctorate levels. Participants are usually scheduled to work at the Center on Monday, Wednesday and Friday during the fall and spring semesters. On Tuesday, Thursday and, as necessary, on Saturday they spend full-time at the university.

Departments at the universiti
gram, the degree options in the
ate advisors are:

CATHOLIC UNIVERSITY OF AMERICA

Participating Department	Advisor	Degree Options
Space Science and Applied Physics	Dr. C. C. Chang	1. Aerospace Engineering 2. Applied Physics 3. Space Sciences 4. Fluid Mechanics and Heat Transfer
Physics	Dr. James Brennan	1. Physics
Mechanics Division of Mechanical Engineering	Prof. John Baltrukonis	1. Solid Mechanics 2. Advanced Dynamics 3. Engrg. Acoustics 4. Applied Physics

Goddard's Applied Method Computer Science Training Advisory Group participating in the briefing are (from left): Patrick Gorman, Snowden Conkey (Data Systems Division), Robert Hite, and William Cahill (co-chairman).

GRAM EXPANDS

Interested employees who feel that their participation in this program would benefit Goddard, should discuss this possibility and their career goals with their supervisor. If agreement to nominate the employee is reached, the supervisor should follow the procedures outlined in the current Goddard Announcement on the ¾ Credit Graduate Study Program.

While going through this application process, all applicants should apply concurrently to the appropriate graduate school and outline a proposed plan of study. This is essential because applicants must be acceptable to the participating school. Applications of candidates will be reviewed and the applicants interviewed by a committee specially appointed by the Education Policies Committee prior to final selection of participants. Final selection of employees to participate will be in early August.

The Employee Development Branch coordinates and administers this program. Any additional information may be obtained by calling extension 6111.

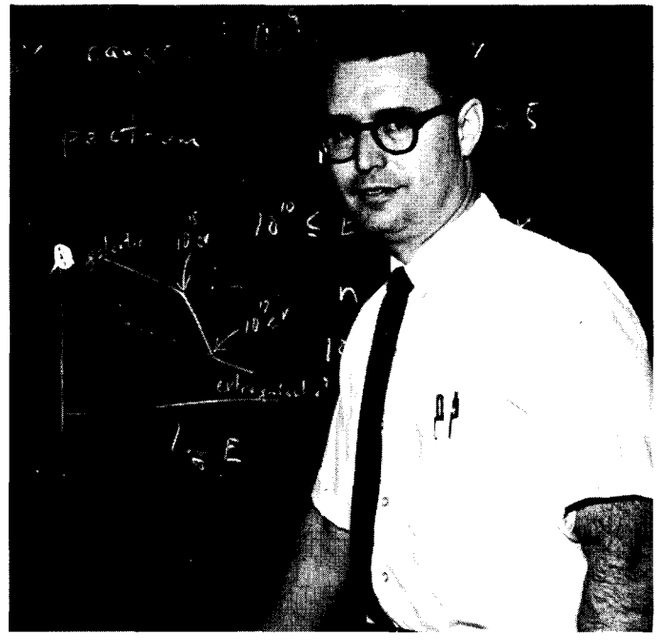
es which cooperate in the ¾ pro-
:se departments. and the appropri-

UNIVERSITY OF MARYLAND

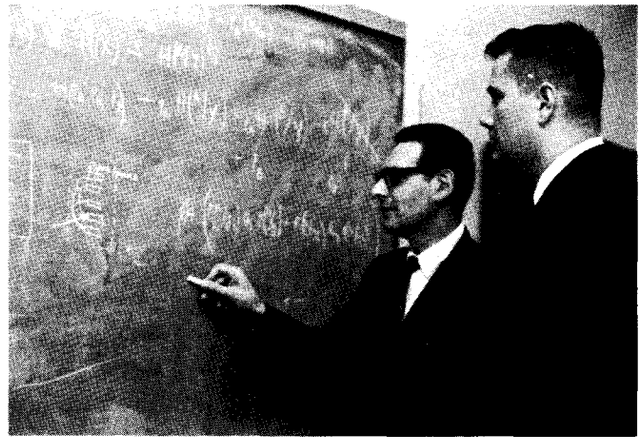
Participating Department	Advisor	Degree Options
Electrical Engineering	Dr. Ray Basham	1. Electrical Engrg.
Physics and Astronomy	Dr. Gart Westerhout	1. Astronomy
Mathematics	Dr. Clarence Cook	1. Pure Math 2. Applied Math

GEORGE WASHINGTON UNIVERSITY

School of Engineering and Applied Science	Dr. Herbert Smith	1. Engineering Administration



DR. HOWARD LASTER, Head, Physics Department, University of Maryland, prepares to respond to queries about a theory. His department will be cooperating with Goddard in the ¾ program.



JIM MORAKIS (with glasses), Advanced Development Division, analyzes a problem relevant to his Ph.D. thesis with Dr. Robert Jennings, his advisor from the University of Maryland's School of Electrical Engineering.

DR. HERBERT E. SMITH, Assistant Dean and advisor for engineering administration at George Washington University explains this graduate degree program to interested Goddard supervisors.

Dr. O'Keefe discusses "Physical Processes on the Surface of the Moon"

The topic of the June 3 Goddard Scientific Colloquium could not have been more timely in light of the successful landing of the first Surveyor on the moon the previous day. Dr. John O'Keefe, Assistant Chief of Goddard's Laboratory for Theoretical Studies, was the final speaker in the current colloquium series and discussed "Physical Processes on the Surface of the Moon."

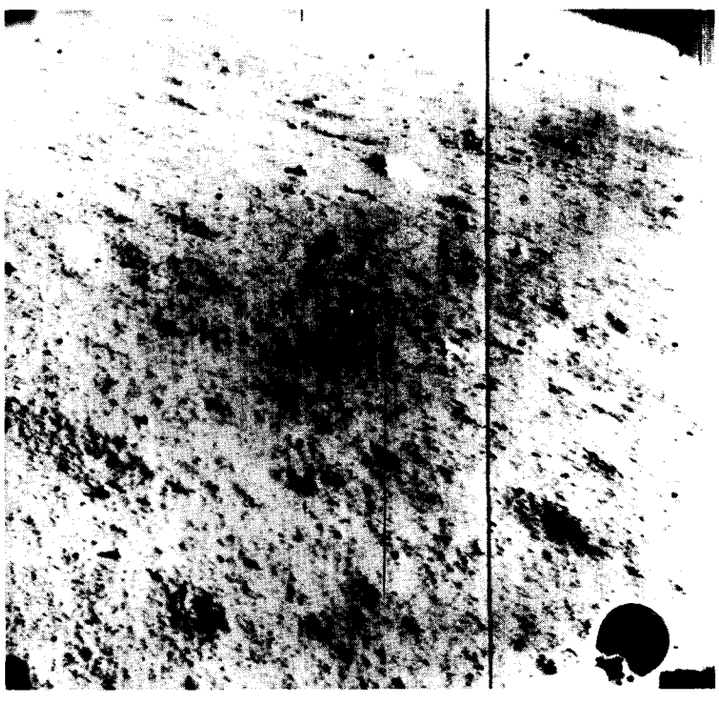
Dr. John O'Keefe

Speaking before a filled auditorium in Building 3, Dr. O'Keefe outlined four processes which he believes to be very important on the lunar surface and which he feels are also demonstrated by the Surveyor photographs. The process of erosion by micrometeorites was considered first. An upper limit on the order of ½ gram/cm²/million years has now been set, which is far less than some theorists have considered in the past.

The nature of moonlight was next discussed. Unlike sunlight reflected by the shiny Echo satellites, light falling on the moon is reflected directly back, just as roadside signs return car headlights. This retro-directive property is especially marked for the lunar rays, suggesting that they may be composed of small glass beads.

As to the cause of the well-known luminous red spots, Dr. O'Keefe argued that it is physically impossible for these spots to be excited by solar radiation. It seems likely that they are of internal origin and are perhaps associated with volcanic action.

***TERRAIN PICTURE** from the 600-scan-line camera, showing flat area of Oceanus Procellarum around the Surveyor. Note horizon and hill at upper right.*



***PICTURE FROM THE SURVEYOR** 600-scan-line television camera, showing the #2 landing foot resting on the lunar surface. Note depression formed by foot and granular nature of the lunar material.*

The nature of volcanic eruptions on the moon's surface was then considered. The process of ash deposition was discussed with possible illustrations of the end result as given by the Muong Nong tektites.

Finally, the available Surveyor photographs were shown. From penetration of the landing pads, estimated from the photographs, Dr. O'Keefe presented a simple algebraic calculation which indicated a bearing strength on the order of 2 tons per square foot for the lunar surface. This resembles that of ordinary terrestrial soils, rather than solid rock. Combining this with previous radar data, Dr. O'Keefe concludes that the lunar surface in this area consists of strongly welded tuff, or sintered volcanic ash.

The next Goddard Scientific Colloquium will be held on September 9.

Ground Breaking Held At Dr. Goddard Library

Ground breaking ceremonies for the $5.4 million Robert Hutchings Goddard Library at Clark University will be held on June 4 as a major event of the University's commencement weekend activities.

The four-story building has been designated an international tribute to the late Dr. Goddard, America's pioneer rocket and space scientist who today is widely acclaimed as the Father of the Space Age.

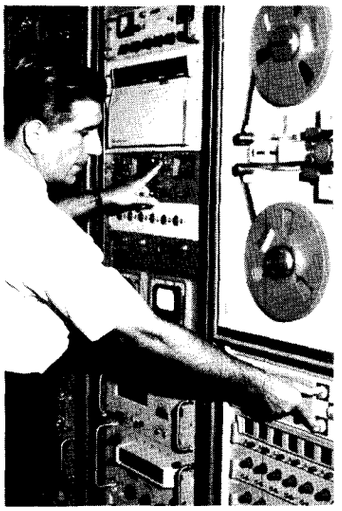
Dr. Goddard, who died in 1945, earned his master's and doctorate degrees at Clark and was a member of the Clark faculty from 1914 to 1943.

The Goddard Library will also be the site for a national memorial to the famed rocket pioneer. Created by Congress and signed into law by President Johnson last November, the national tribute is expected to be a non-representation piece of sculpture.

When completed, the library will be the permanent repository for Dr. Goddard's historic scientific and personal papers and other memorabilia. These papers were given to the University in September, 1964 by Mrs. Goddard, and will be housed in a special Goddard Collection area on the ground level of the building.

Cost Reduction of the Month

The STADAN was being updated and automated, and it became necessary to be able to automatically select certain groupings of tracking equipment without being restricted by equipment incompatibility.



***DONALD F. TINARI** operates the new STADAN Dual Remote Control Unit.*

Through the years, as newer models of Magnetic Tape Instrumentation Recorders were placed in STADAN, a situation of remote control incompatibility was encountered.

Donald F. Tinari, of the Control Equipment Branch, was aware of this problem and had given the matter a great deal of thought.

There were 116 magnetic tape recorders affected by this problem of incompatibility. The commercially available Remote Control Units required to correct this problem, at a cost of $931 each, would have cost a total of $107,000. Mr. Tinari designed a Dual Remote Control Unit, costing $470 each. One of these Dual Remote Control Units will perform the functions of two of the commercial units.

Fifty-eight Dual Remote Control Units were manufactured at a cost of $28,000. Thus, the new design reflected a cost reduction to Goddard of $80,000. The units are presently in use and have proven quite successful.

How to put your name on a Freedom Document

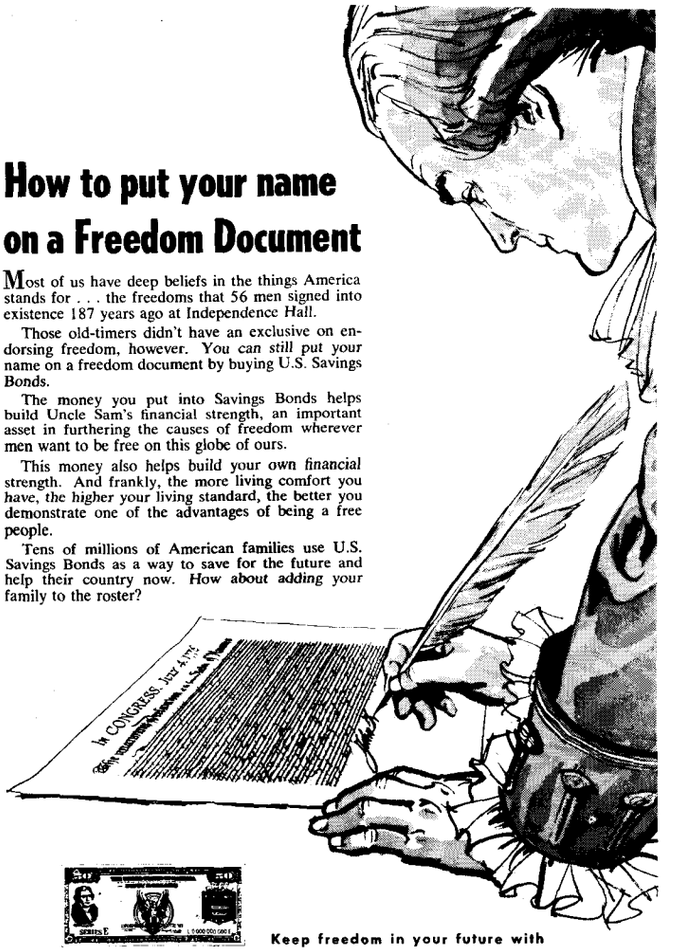
Most of us have deep beliefs in the things America stands for . . . the freedoms that 56 men signed into existence 187 years ago at Independence Hall.

Those old-timers didn't have an exclusive on endorsing freedom, however. You can still put your name on a freedom document by buying U.S. Savings Bonds.

The money you put into Savings Bonds helps build Uncle Sam's financial strength, an important asset in furthering the causes of freedom wherever men want to be free on this globe of ours.

This money also helps build your own financial strength. And frankly, the more living comfort you have, the higher your living standard, the better you demonstrate one of the advantages of being a free people.

Tens of millions of American families use U.S. Savings Bonds as a way to save for the future and help their country now. How about adding your family to the roster?



Keep freedom in your future with

U.S. SAVINGS BONDS

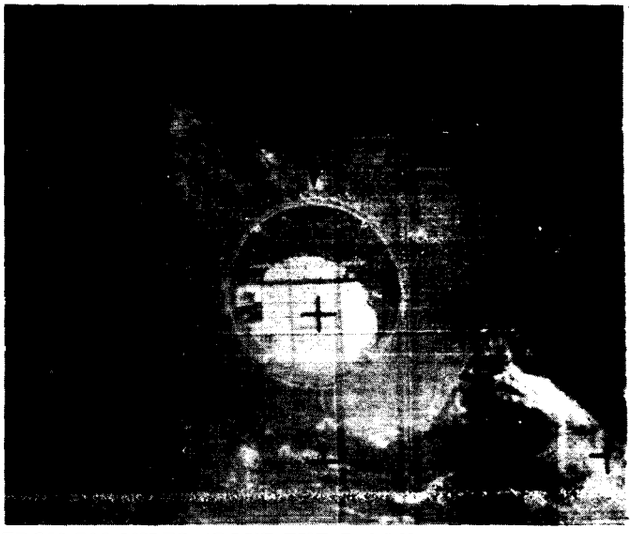
NASA Patent Awards

Several patent cash awards were recently presented to the following inventors (from left): Thomas Sciacca, Joseph Conn, John Paulkovich, and Luc Secretan.

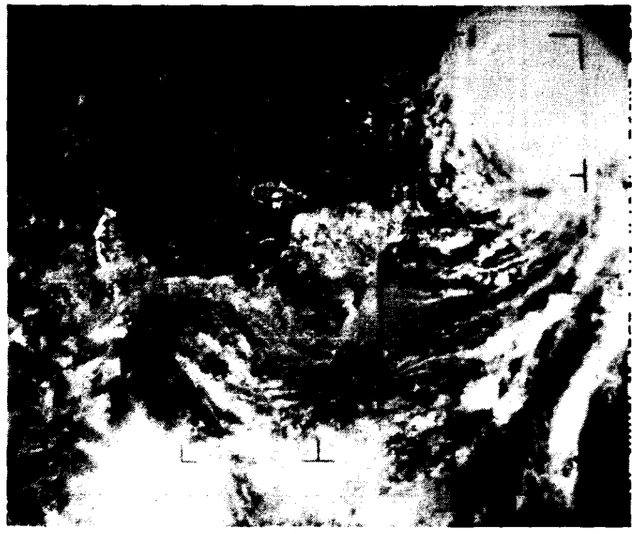
NAME(S) OF INVENTOR(S)	PATENT TITLE	DESCRIPTION	CASH AWARD
Luc Secretan	Rotary Bead Dropper and Selector	An automatic or semi-automatic method and apparatus for calibrating a micrometeorite detector by accurately dispensing, in a serial manner, a plurality of spherical beads for subsequent impact upon a momentum transducer.	$400
Thomas P. Sciacca & Alfred G. Eubanks	Device for Measuring Electron-Beam Intensities and for Subjecting Materials to Electron Irradiation in an Electron Microscope	A method and apparatus for irradiating specimens with particles of the type encountered in space research, the simulation being carried on by the bombardment of the specimen while positioned in a conventional electron microscope.	$400 (divided)
John Paulkovich	Ampere-Hour Integrator	An ampere-hour integrator incorporating a novel current-to-frequency converter utilizing a saturable core transformer wherein the effect of the magnetizing current of the transformer is eliminated resulting in an output which is substantially error free even when measuring small currents.	$300
Joseph H. Conn	Moment of Inertia Test Fixture	A test fixture for simplifying the determination of the moment of inertia of irregularly shaped bodies about more than one axes.	$200
George A. Rinard & John D. Watson	Tumbler System to Provide Random Motion	A method and apparatus for imparting random motion to objects positioned within an electromagnetic demagnetized field.	$200 (divided)

NIMBUS . . .

Successfully launched on May 15, this weather-eye-in-the-sky has sent back to Goddard thousands of revealing photographs. Two photographs of unusual interest consist of one which was taken just 2.5 seconds after Nimbus entered its orbit, and the other which shows the first hurricane of the year.



FROM 700 MILES ABOVE THE EARTH, *a camera eye in the* ***Nimbus II*** *weather satellite looks down into the adapter section (center of Photo) of the Agena B rocket that hurled* ***Nimbus II*** *into orbit. Goddard engineers calculate that the picture was taken 2.5 seconds after separation. The Agena is about 10 feet below Nimbus. Partially obscured by Agena is the Malagasy Republic (right, center), and the southeast coast of Africa (upper left). The picture was unplanned and was obtained in the following manner: When the explosive device which causes the 8-foot-tall solar paddles to unfold fired, an electrical transient triggered the shutter of the Automatic Picture Transmission camera. Although the camera was not turned on, the image was stored on the vidicon tube and played back some seven hours later on the fifth orbit over the Caribbean.*

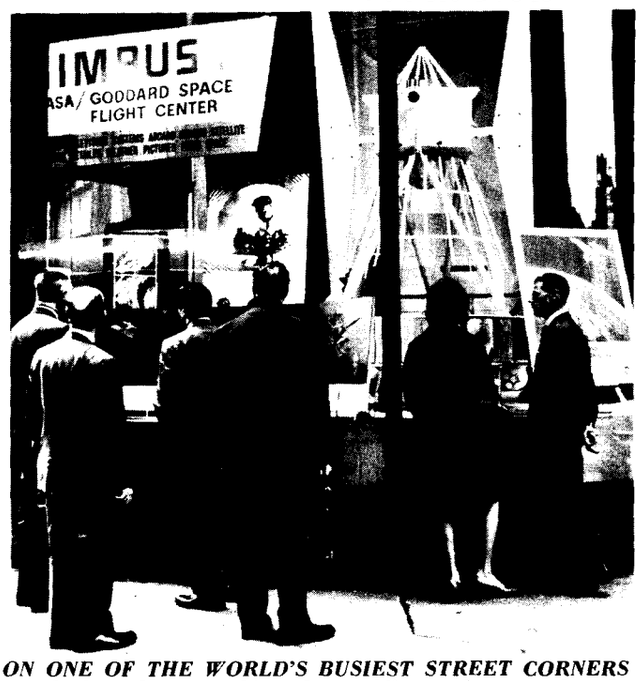


GODDARD received this "live" photo of Hurricane Alma (large white mass, upper left) at 1:12 P.M. EDT, June 8. Nimbus first photographed the tropical disturbance on June 5, and again on June 6 when she had reached hurricane force. Other details in the picture are a cloud mass (white mass, lower left) and the Mexican coastline (upper left). In the center of the picture is the Yucatan Peninsula. The versatile, experimental satellite is also photographing Alma at nighttime using infrared cameras.

. . . at pre-launch activities

GODDARD PERSONNEL INVOLVED in the pre-launch activities of Nimbus II, successfully orbited on May 15, at the Western Test Range. From left: Charles Bolton, John Meehan, Gilbert Branchflower, Stanley Weiland, James Taylor, Charles Thienel, Andrew McCulloch, Moe Schneebaum, Wilma Evans, William Woodward, Jack Sargent, Edward Baden, Brice Miller, Rosemary Ershaw, Philip Crossfield, John Lovelace, Jr., L. Foshee, Wilber Huston, Richard Devlin, David Beiber, James Strong, Jr., Gene Delio, and Ali Arman.

. . . in New York



ON ONE OF THE WORLD'S BUSIEST STREET CORNERS people have been watching the world's weather pass by. In the shadow of Rockefeller Center, on the corner of West 49th Street, live APT facsimiles of Nimbus II are being readout for New York window shoppers. In addition to the readout equipment, in the RCA exhibition hall, there is a full scale Nimbus model, and other related explanational items of general interest.