GODDARD NEWS June 1972 Vol. 20, No. 3

COOPER'S ISLAND, BERMUDA. What was once a depository for pirate's treasure, now bristles with antennas used to track spacecraft. Cooper's Island, actually a peninsula now, is brushed on three sides by the warm waters of the Atlantic. Secluded beaches provide an opportunity for splashdown parties following successful manned missions. The three buildings in the center house the NASA control room and communications equipment. From the radar site at the left, scientists also follow the fall migration of birds from North America.

Bermuda Scans the Skies for Birds, Bugs and Astronauts

Cooper's Island, Bermuda. A television screen monitoring monotonous sweeps of sea and sky – up, across, down and back – was the only visual contact with the outside world from the control room of this mid-Atlantic NASA tracking station. Fifty or so persons packed into the observation room, trying to catch a glimpse of Apollo 16 as it was fired into orbit, watched the screen intently. For them and for all 132 persons who man the Cooper's Island station, this was as close as they came to seeing the spacecraft until tapes of the television coverage were flown to the two commercial TV channels on this British resort colony.

"You won't see a big fiery blast here," said Keith Hill, station manager at Cooper's Island. Hill's voice came from two little speakers mounted on shelves at either end of the room: "Bermuda is green, all systems go. We are waiting for launch . . . stop all vehicular traffic – 90 seconds to launch. . . . "

And from Cape Kennedy, "All stations network, we have ignition sequence start, we have liftoff . . . Apollo has cleared the tower. . . . "

A television camera mounted on the big radio dish scanned the sky. On the screen you could see the clouds flash by and stop as the dish locked onto the Saturn rocket, invisible behind a thin layer of haze and clouds. "Well, we were watching the TV screen to see if we could see the S4B (the third-stage booster) burn, but not today. We're sorry about that," Hill apologized. "Even when we do see it, it's just a little puff of white – but too much haze today."

With the promise of a glimpse of the spacecraft gone, attention was focused on the seven men working in the control room, tracking Apollo as it climbed toward earth orbit. The only visible sign that the rocket was moving was a set of three backlighted plotting boards at the front of the room. A stylus inked a line across a piece of graph paper, and staring at it intently were two Air Force range safety officers, one of them the only man outside of the Cape Kennedy control center able to destroy the missile should it malfunction and begin heading on a dangerous course.

(See Page 9)

Adler and Trombka Win 1972 Lindsay Award

Dr. Isidore Adler and Dr. Jacob I. Trombka, both of the Theoretical Studies Branch, have received the 1972 John C. Lindsay Memorial Award for their contributions to the remote sensing of the moon's surface during the Apollo 15 mission.

The award was presented by Goddard Director Dr. John F. Clark during the final Scientific Colloquium of the season on June 9. Speaker for the occasion was Professor Anthony A. Hewish of the Cavendish Laboratory in Cambridge, England. His topic was "The Nature of Pulsars."

The Lindsay Memorial Award is presented annually in memory of Dr. John C. Lindsay, first head of Goddard's solar research team, who died in 1965. It is given to a Goddard employee or employees who have made an outstanding contribution to science or technology.

(See Page 2)

Goddard's FLASH Receives Major Patent Awards

Emmett W. Chappelle, Dr. Grace L. Picciolo, Burton W. Kelbaugh, and Maurice E. Colburn recently received a major award from the NASA Inventions and Contributions Board for their inventions (process and automated instrument) relating to quantitative measurement of bacteria in urine and other biological fluids utilizing the firefly luciferase assay for ATP. Mr. Chappelle of the Space and Earth Sciences Directorate and Dr. Picciolo, formerly of the same directorate and now in the Space Applications and Technology Directorate, developed the process. Through the efforts of these two Goddard scientists and the creativity of Mr. Kelbaugh and Mr. Colburn of the Administration and Management Directorate the process was ultimately implemented in the form of an automated feasibility model referred to as FLASH.

Design and construction of the feasibility model was accomplished completely in-house by Goddard's Experimental

(See Page 2)

LINDSAY AWARD .... From Page 1

LINDSAY AWARD WINNERS Dr. Isidore Adler (left) and Dr. Jacob Trombka, both of the Theoretical Studies Branch.

This year's citation to Dr. Adler and Dr. Trombka read "In recognition of their contribution to our understanding of the moon's origin through remote sensing from Apollo 15 which determined elemental abundances over large areas of the lunar surface. The observations clearly establish that the highlands are an aluminum-rich basalt and suggest that the moon's outer layers were at one time melted. Observed sharp changes in composition at mare edges refute ideas of mass transport across the lunar surface."

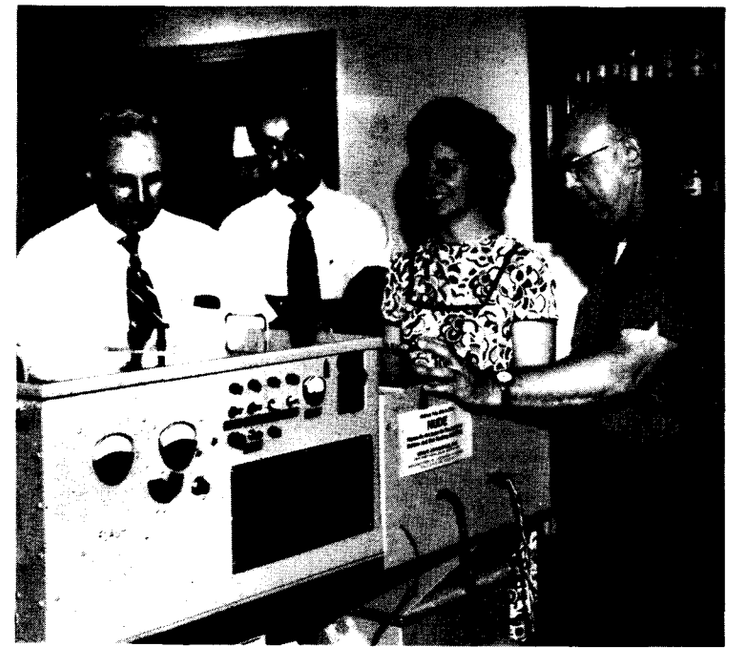
Dr. Adler was Principal Investigator of the Apollo 15 X-Ray Fluorescence Spectrometer experiment. Dr. Trombka, his co-investigator, was also co-investigator for the Gamma-Ray Spectrometer and the Alpha-Particle Spectrometer. Both men have recently received excellent results from similar experiments conducted during Apollo 16.

Dr. Adler came to Goddard in 1964 from the U.S. Geological Survey where he was a Project Leader in X-Ray spectroscopy. Born in Brooklyn, New York, he received his Ph.D. in chemistry in 1952 from the New York Polytechnic Institute.

Dr. Trombka, a native of Detroit, Michigan, received his Ph.D. from the University of Michigan in 1961. Before joining the Goddard staff, he was a senior scientist at the Jet Propulsion Laboratory and an AST in Program Management at NASA Headquarters.

LOUIS R. DOD (left), Head of the Radiation Systems Section of the Antenna Systems Branch, receives a check for $40.00 from Robert L. Owen, Chief of the Network Engineering Division, for an invention entitled "Plural Beam Antennas." The invention is an antenna system capable of deriving a plurality of beams from a single fixed aperture. George C. Keller and Marvin S. Maxwell are co-inventors.

FLASH .... From Page 1



FLASH INVENTORS (from left) Burton N. Kelbaugh, Emmett Chappelle, Dr. Grace Picciolo and Maurice E. Colburn inspect the machine that won them major patent awards. Development of the FLASH device for detecting bacteria in urine and other biological fluids was a coordinated effort by several Goddard directorates.

Fabrication and Engineering Division under the guidance of Maurice Levinsohn. The Space Applications and Technology Directorate was involved in this effort through the work of Dr. Albert J. Fleig who coordinated the project and Justin C. Schaffert and Michael J. Devett who provided the electronics.

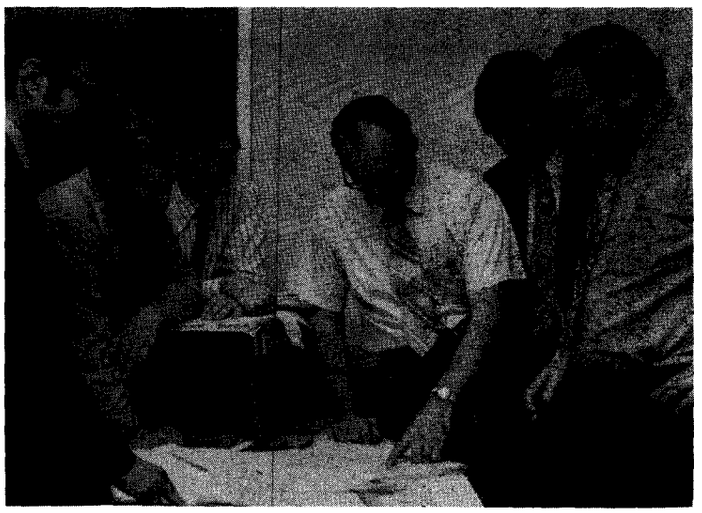
While FLASH was primarily developed to detect bacteria in urine, it is expected to find application in the detection of bacteria in other biological fluids. Goddard and the Children's Hospital, at Washington, D. C., are jointly exploring FLASH's potential for the rapid detection of bacteria in cerebrospinal fluid. If this endeavor is successful, the time required to determine whether or not an apparent case of spinal meningitis is associated with bacterial presence will be substantially decreased.

The Kidney Disease Control Program of the Public Health Service is currently sponsoring a clinical trial of FLASH in conjunction with Goddard and the Johns Hopkins Hospital. The project team is contemplating construction of a second instrument which will incorporate improvements suggested in the testing of the feasibility model and which will possess improved reliability and have additional operator convenience. The goals of this cooperative effort are to evaluate the existing instrument, provide clinical test data sufficient to justify its commercial adoption and exploitation, and perform such further development as may be deemed appropriate. It is hoped that this joint venture will result in FLASH being made available to the medical community at large through production and marketing by commercial firms.

Substantial interest in FLASH has already been exhibited by both the medical and commercial communities in the United States and abroad in their response to the Tech Briefs and back-up packages made available through the cooperation of Donald S. Friedman, Goddard Technology Utilization Officer. In addition, the Office of Patent Counsel has received numerous inquiries with respect to licenses in patent applications covering FLASH and has already granted some licenses.

This project serves as an outstanding example of the potential for transfering Space developed technology to the public sector for the direct benefit of mankind.

Computation's PAC Helps With Program Problems



COMPUTATION'S PAC TEAM members are (from left) Jack Balakirsky, Karl Swenson, John Daunis, Bill Gorman, John Wheeland and Ted Compton.

If you are having difficulty in preparing a program for Goddard's computers or are wondering why an existing program is not giving expected results, you may find the answer to your problem in the Programmer Assistance Center located in Room 133A of Building 3. The PAC was established in 1970 by the Computation Division to help computer users diagnose program trouble while getting their jobs into operational status on the computer, and to aid in the optimization of user programs for the M&DO 360/95, 75, and 65 computers in Buildings 3/14.

The center, one of two at Goddard, is operated by programmers from the Computer Sciences Corporation under the direction of William Gorman. Goddard's Technical Monitor for the center is Jack Balakirsky, Head of the Operating Systems Maintenance Section.

According to Mr. Balakirsky, more emphasis is now being placed upon making better use of existing computer resources. This is being done in all areas and the PAC, because of its close association with the users is in an excellent position to stimulate and promote this type of activity.

The PAC handles around 60 program-related questions a week, many of these brought in by people who are not programmers themselves but engineers and scientists. PAC personnel can usually find program problems in short order. The time spent on each may range from three minutes to hours or, in the case of stubborn problems, even weeks.

Specific problems handled may include the treatment of job and programming languages, those related to the remote terminal systems, and the diagnosing of software problems. In the area of program optimization, emphasis is given to obtaining the best results in the least amount of computer time.

"Our long-range goals," says Bill Gorman, "are to improve the through-put of the computers and to make them easier to use. To this end, we are monitoring the efficiency of operating programs in terms of time on the machines, resource demands and storage requirements. When a problem is found, we contact the programmer directly and work with him to find the best solution for all concerned."

Mr. Gorman and other members of the PAC staff may be reached on ext. 6768. A second PAC is located in Room 243 of Building 1 for users of the Space Science 360/91 and 75 computers. Contact for this center is Sheldon Hoenig on ext. 6406.

GODDARD MOURNS . . . .

We note with sincere regret the sudden passing of Justin C. Schaffert on Saturday, June 3, 1972. Justin was a Section Head in the Electronic Instrumentation Branch, Space Applications & Technology Directorate.

Justin C. Schaffert

Mr. Schaffert served three years in the Navy and was part of the nuclei of the original NASA Team that left NRL to form GSFC in 1959. He was involved in designing and providing flight hardware for almost every in-house spacecraft.

Mr. Schaffert was born September 9, 1915, in Meriden, Kansas. He attended George Washington University and received his degree in Electrical Engineering in 1949.

Justin is survived by his wife, Vera, son, Craig, and daughter Karen, who reside in Silver Spring, Md.

Justin was truly one of the most talented and dedicated people at Goddard.

Mr. Schaffert will be interned in Kansas. It is requested all donations be made to the Montgomery County Heart Fund Memorial through John K. Steckel, Code 712, X4901.

Hypertension Study

Under the direction of Goddard's Technology Utilization Office, a new arterial pulse wave detection system has been developed for use by physicians in the Hypertension Study Group at the Veterans Administration Hospital, Washington, D.C.

The system consists of two components: a pressure sensitive transducer encased in a fluid filled chamber, and an op-amplifier. The transducer is placed on the neck over the carotid artery, or on the arm over the brachial artery. As the artery pulsates the pressure exerted against the skin is measured by the transducer. The signal is transmitted through the op-amp and a plot of this measurement on an EKG recorder or oscilliscope indicates the relative elasticity of the artery, and the blood velocity between the heart and the measuring point. In turn this information may be used by the doctors to determine the overall effects of sedatives on the cardiovascular system.

Data will be gathered by the Group over a five week period beginning June 10. The performance of the system will be simultaneously compared to a commercially available and medically accepted system using strain gauges and elastic diaphragms. Preliminary results show that the Goddard system is easier to use, more reliable, and less expensive. For example, the cost ratio for the transducer portion and its commercial counterpart is $150 vs. $1,200.

The project was initiated at Goddard during the 1971 Summer Institute for Biomedical Engineering by two electrical engineering undergraduate students, Donald Gorelick and Chung Kim. Their advisor was Edward Devine, Code 721.2. The follow-on activities were supported by Maksim Aleksandrov, Code 663, and Wayne Chen of the TU Office, Code 207. Aleksandrov designed and built the two channel op-amplifier and Mr. Chen miniaturized the transducer system.

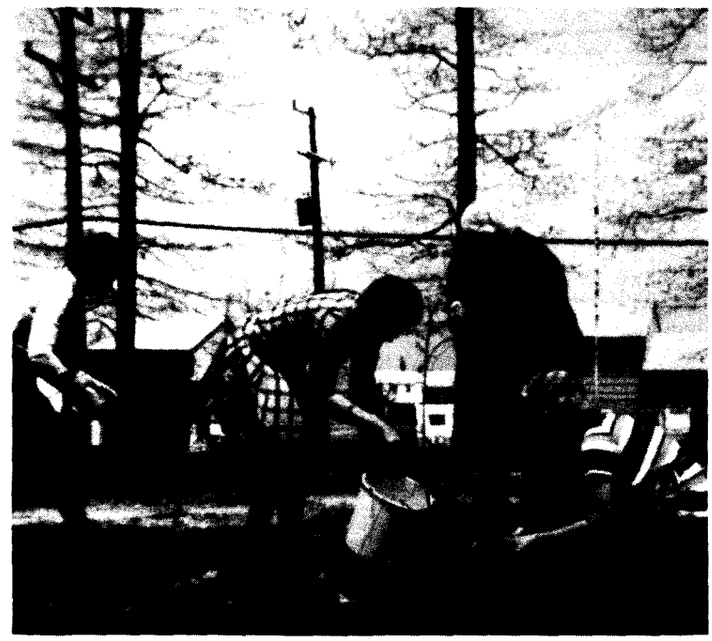
GCC Beats CSC 4-1 in Year's First Interclub Match

IN THE FIRST interclub match of the year, a five-man Goddard Chess Club team consisting of Bruce Bromberg, Dr. John Price, Larry Hull, Tom Vallee and Dr. Floyd Stecker emerged victorious over their counterparts from a Civil Service Commission team. GCC had four wins and one defeat for an excellent showing. The match was arranged through Dan Dembrow, the club's activities chairman, who hopes to arrange a rematch with CSC and matches with other clubs in the area.

Youngsters Win Bowling Trophies

YOUTH BOWLING. Children large and small received awards at the annual banquet of the Goddard Youth Mixed Duckpin League held at the Rec Center on May 6. Shown above are (from left) Richard Hultberg, Scott Monroe, John Nader and Tommy Neill of the Yo Yo's, first place team in the Juniors League. Below are Tod Perreton, Donald Sullivan, George Mohr and Laura Nader of the Rams, top team in the Midgets League. Handing out the awards are Mary Jean Brown (right) and her sister Stephanie Peacock. This year, 48 children played in 12 teams at the University Fairlanes on Saturday mornings for $1.55 per morning. The next season begins in September.

APOLLO TEAM. Ten members of Goddard's Government/Industry Apollo Team, who were chosen by their supervisors for outstanding contributions to the program, watched the Apollo 16 launch at the Cape and attended a special VIP reception in their honor. Here Goddard honorees and guests gather at the reception. From left are (standing) Mrs. Browning, Paul McGrath, Florence D. Kenny, James Deacon, Martha Miller, Evelyn Wiley, Robert B. Sofge, Martha Sade, Nancy L. Deacon, Goddard Director Dr. John F. Clark, Ramond J. Kot, Louis Litman, and Jack Dowling. Kneeling are Host Turner N. Wiley, Terrence L. Browning, and Richard S. Sade. The visit to the Cape is sponsored by the NASA Manned Flight Awareness Program.



THE GOODARD GARDEN CLUB presented a red oak to the Trinity Moravian Church in honor of the 100th anniversary of Arbor Day in a ceremony April 29. Here planting the tree are (from left) Vhsitmsn Billie Stansbury, President Elfriede Schmidt, Richard Szeluga and Doris Bickford. Richard Szeluga of the church helped plant the tree.

The NO-OPS Win Again

The GSFC Tuesday Mixed League completed its 1971-72 league season on Tuesday, May 16 with a playoff between the winner of the A Division, team A10 "The Rinkydinks" and the winner of the B Division, team B4, the "NO-OPS." The league championship was won by the "NO-OPS."

The first game, of a three game series, was won by the Rinkydinks by 2 pins; the second game was won by the NO-OPS by 2 pins; the third game was won by the NO-OPS by 6 pins.

This was the fourth year in a row that the NO-OPS have won their Division title and the second year of the last three the Rinkydinks have won their Division title.

Two years ago the Rinkydinks and the NO-OPS played for the league title which was won by the Rinkydinks by seven pins.

The NO-OPS have been league champions three of the last four years.

ERTS-A to Monitor Earth's Resources

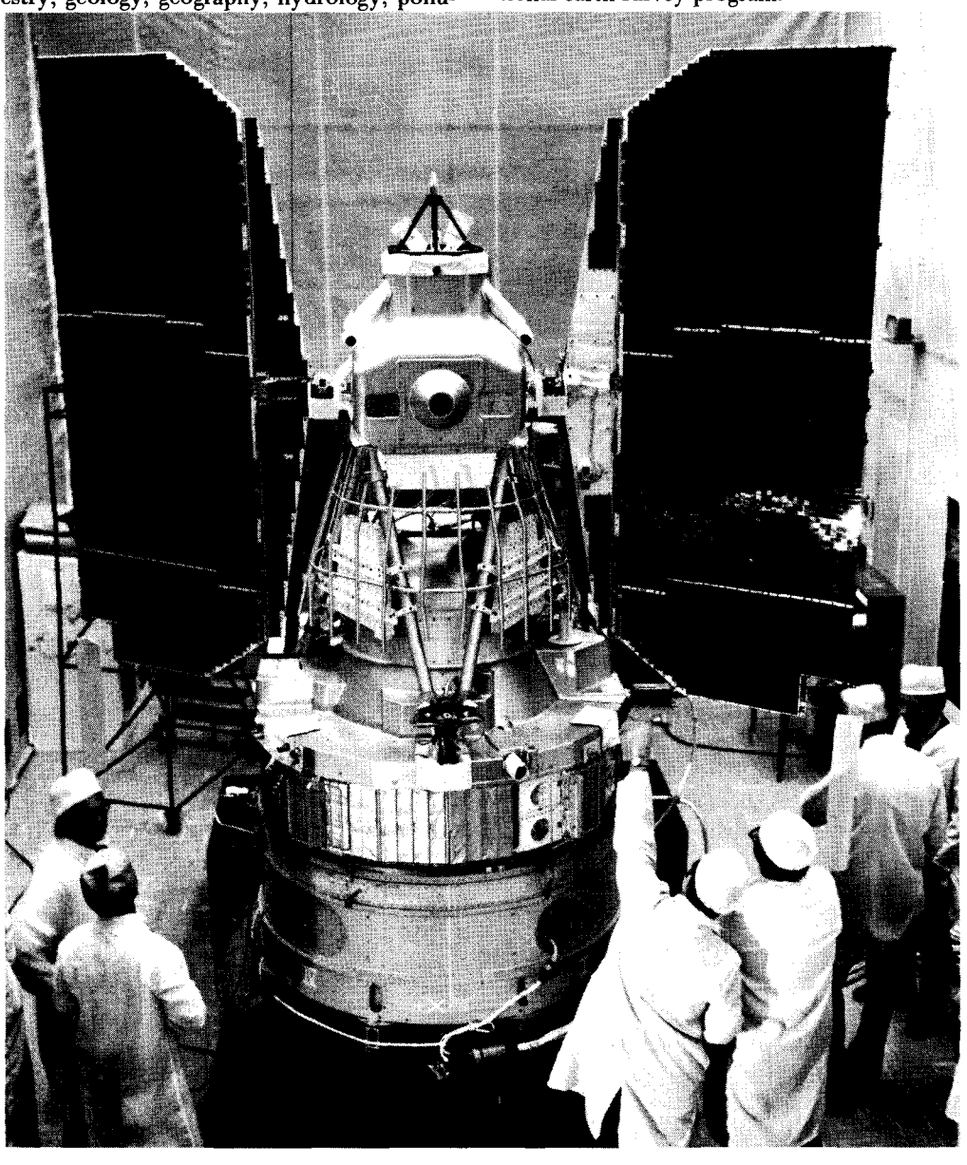
Man's first comprehensive inventory of the natural resources needed for survival will begin with the launch of Goddard's first Earth Resources Technology Satellite. This one-ton electronic "pathfinder" is scheduled for lift-off aboard a two-stage Delta rocket no earlier than June 30 from the Western Test Range Lompoc, California.

From its outpost in space some 907 kilometers high, the butterfly-shaped satellite will literally take daily EKG's of earth's health.

Although ERTS-A is an experimental mission, the observatory will carry remote sensors which may produce a technological breakthrough in the fields of agriculture, forestry, geology, geography, hydrology, pollution control, oceanography and meteorology.

Sensors aboard ERTS-A include three Return Beam Vidicon (RBV) Cameras and a Multispectral Scanner (MSS). Also aboard the spacecraft is a Data Collection System (DCS) for receiving environmental data of all types from small remote platforms. These three sensors will monitor earth's natural resources more thoroughly, and completely than ever before in the history of mankind.

The main purpose of the first ERTS mission is to determine what can be accomplished in remote sensing from an orbiting platform. The knowledge gained will help determine the type of sensors and ground handling techniques best suited for an operational earth survey program.



ERTS-A. The Earth Resources Technology Satellite is shown in flight configuration with solar panels deployed after tests at the General Electric Valley Forge plant. NASA is currently developing two experimental satellites (ERTS A and B); the first to be launched no earlier than June 30, 1972 and the second during the following year.

In the scientific community ERTS-A represents one of the most widely anticipated events of the space age. For the term earth resources means more than just minerals and other deposits, it covers all conditions on earth's surface which are of economic, social and cultural interest to humanity.

"The ERTS-A mission represents a fantastic 'team' effort," said Wilfred E. Scull, ERTS Project Manager. "Literally, thousands of scientists, engineers and administrators from NASA, Federal, State and local governments, leading universities and private companies and some 35 foreign countries have been instrumental in preparing for this launching."

In broad terms, the ERTS-A objectives are: to take an inventory of earth's vegetation and forests; to measure the condition of the soil and its ability to store water; to catalog surface rocks and mineral formations; to chart currents and other phenomena in the oceans; to establish the sources and spread of pollution; and to improve the mapping of the earth.

"The important thing to remember about ERTS is that the coverage is repetitive," said Dr. William Nordberg, ERTS-A project scientist from Goddard. "Every 18 days we will have an opportunity for a complete survey of any part of earth which is cloud free and we will then start over again. High altitude aircraft have already aided us in charting interesting features of the earth. But regular, repetitive coverage as we anticipate from ERTS-A will hold even greater promise of continually charting our planet and its resources."

ERTS-A's sun-synchronous, near-polar orbit was selected so that the equatorial crossing always occurs about the same time each day at about 9:30 a.m. local time. This means that ERTS photos of a given area will have almost the same solar illumination near the equator, making it simpler to detect changes in vegetation or water levels. The satellite's inclination angle to the equator will be 80.9 degrees retrograde and the orbital period will be 103.2 minutes.

ERTS-A will make about 14 revolutions of earth each day. The ground coverage will proceed westward until global coverage of overlapping image swaths is completed. At the end of 18 days, ERTS-A will begin to repeat its global imagery coverage of the earth.

The ERTS-A design has been based on the technology of the highly successful series of Nimbus meteorological satellites which have established many firsts since Nimbus 1 was successfully launched on August 28, 1964.

(More ERTS on Pages 6 - 8)

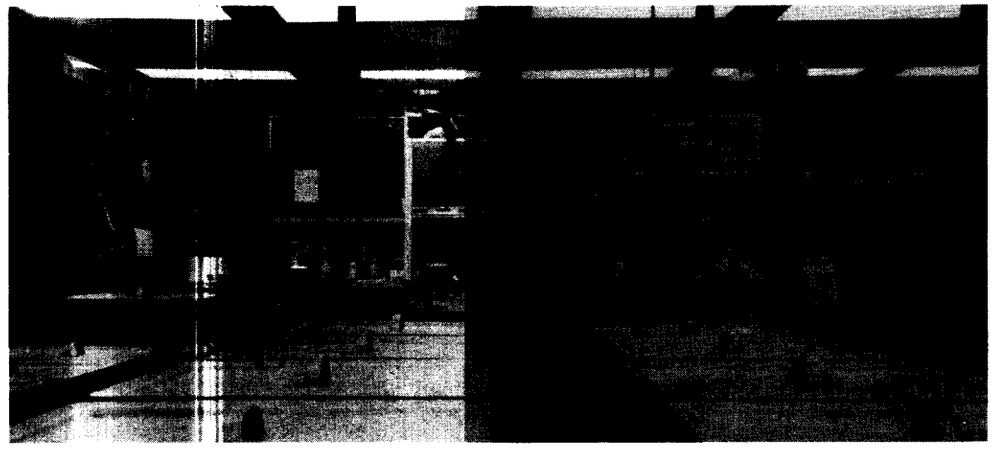
Goddard's

THE STATUS CONTROL and data area is part of the ERTS Operations Control Center. At work here are (from left) Terry Virts, Fred Siebert, Alex Sczahnowicz and Jack Lipiner.

The Ground Data Handling System (GDHS) for ERTS is located in Building 23 here at Goddard. The GDHS includes an Operations Control Center (OCC) for operating the spacecraft, and the NASA Data Processing Facility (NDPF) for processing and distributing film images from the ERTS sensors to users around the world.

The **Operations Control Center** is the hub for all ERTS daily activities. Operating 24 hours a day, the OCC will command the spacecraft as well as the observatory sensors. The center activities are geared to the operations timeline dictated by a 103 minute orbit and the network coverage capability. The OCC will be in touch with ERTS-A through the Alaska, California and Goddard data ac-

ARNIE PROEHR (standing) and Scott Hughes work in the NDPF Initial Image Generating Subsystem area.



CHEMICAL MIXING AREA in Goddard's ERTS "Photo Lab."

The Launch Vehicle

ERTS-A, weighing 1,965 pounds will be the heaviest spacecraft ever launched by a Delta Rocket. The launch vehicle is Delta #86.

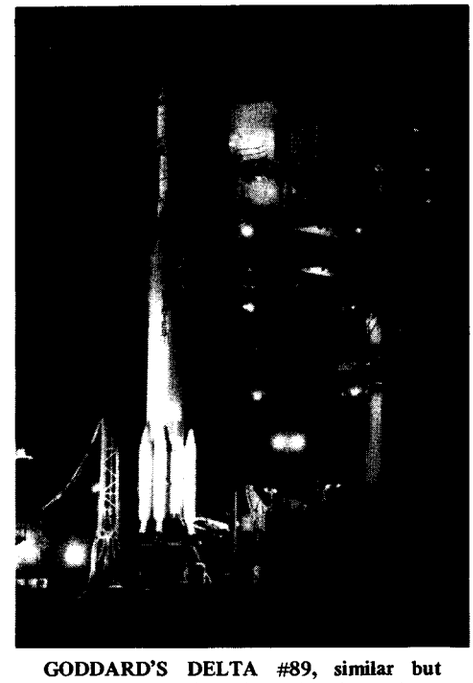
Delta has been a workhorse booster for 12 years. It first orbited the Echo 1 communications balloon in August of 1960. Since then it has orbited 81 major spacecraft in 88 attempts.

Delta has been constantly growing over the years to handle bigger spacecraft for more demanding space missions at economic costs. The various stages of the Delta have grown longer and fatter, the engines have become more powerful, and solid motors have been added to the first stage.

Changes added to Delta #89 include: a new Delta Inertial Guidance System; a new second stage engine; a new spring separation technique for the first and second stages; and a new S-band telemetry system.

Also, Delta #89 will carry nine solid motors strapped around the base of the Thor first stage for the first time (the rocket has previously carried six solid motors). Six of these motors will ignite on the launch pad and three at about six kilometers altitude.

MIKE KENNEDY at the Cloud Cover Assessment Station of the ERTS NDPF.



GODDARD'S DELTA #89, similar but more complex than the Delta shown here, will carry the first Earth Resources Technology Satellite into orbit.

ERTS Centers

quisition facilities on 12 or 13 of the 14 daily orbits.

The **NASA Data Processing Facility** has been designed to produce controlled quality data and photographic images and to distribute them to user agencies and ERTS-A principal investigators.

The NDPF has the capability of handling 10,000 black and white and color images weekly. All ERTS images will be forwarded to the Department of Interior's Geological Survey Facility in Sioux Falls, South Dakota, the National Oceanic and Atmospheric Administration in Suitland, Maryland, the U.S Department of Agriculture in Washington, D.C. and the selected ERTS investigators and users.

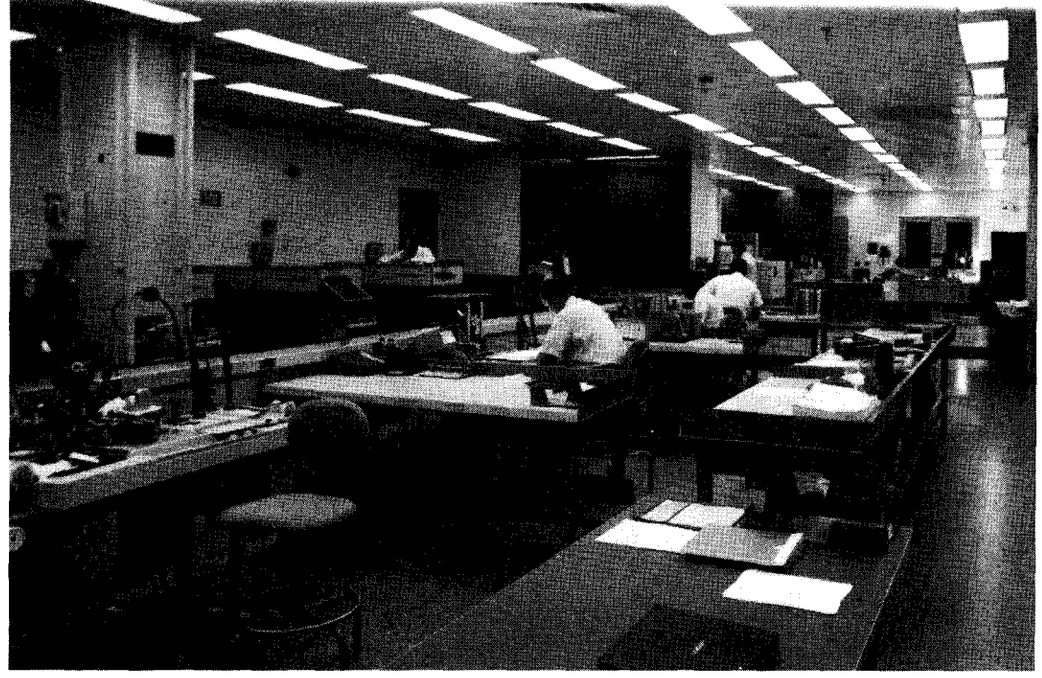
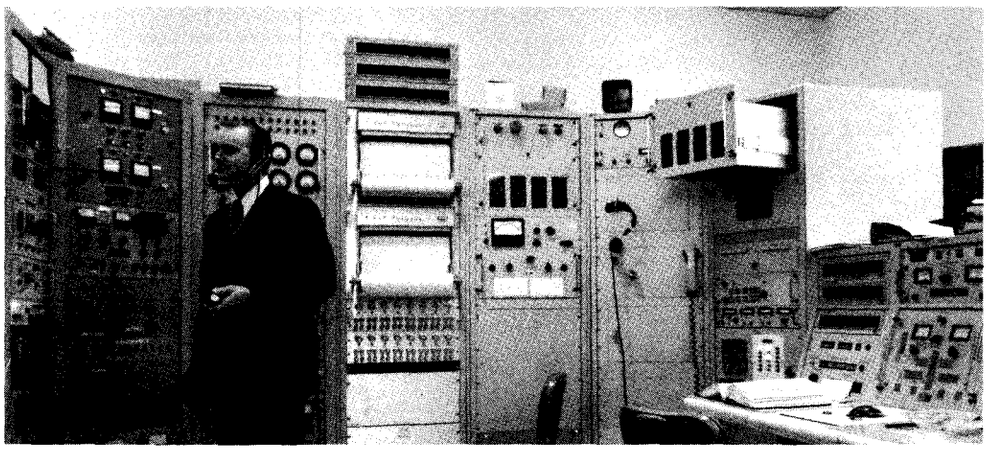
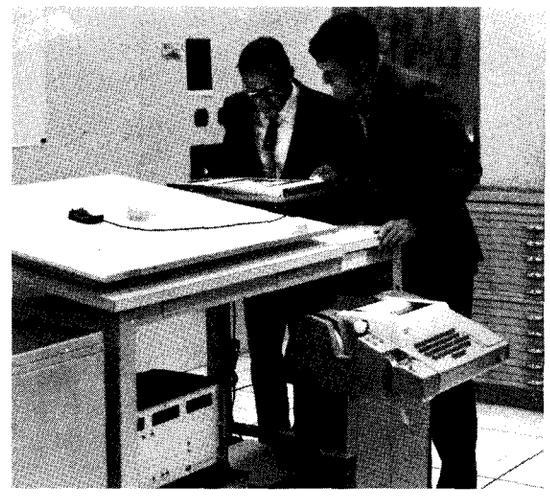


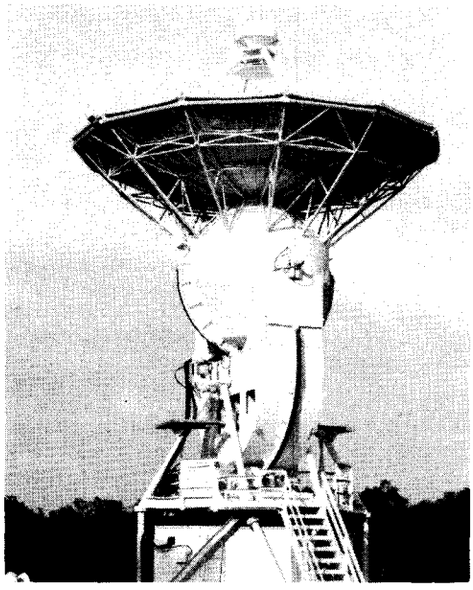
Photo Processing Facility for ERTS.



CHARLES ARBUCKLE, ERTS M&O Supervisor, is shown with the VHF Command Antenna System for ERTS at the NTTF.



BERNIE PEAVEY (left) and Bob Hermann check a transparency in the ERTS Ground Control Point Station of the NDPF.



30-FOOT USB ANTENNA at the Network Test and Training Facility at Goddard will receive ERTS RBV and MSS imagery data and transmit it to the ERTS OCC in Building 23 for processing. The NTTF is a key ERTS station along with Alaska and California.

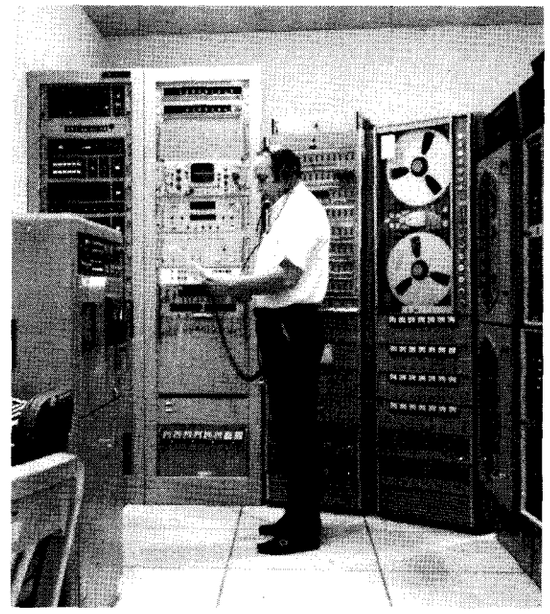
The ERTS Sensors

ERTS-A will carry two multispectral sensors, the Multispectral Scanner Subsystem (MSS) and the Return Beam Vidicon (RBV) Subsystem, and a Data Collection System (DCS). The two sensors will collect photographic images of the earth while the DCS will collect environmental data of all types from remote platforms. An advanced tape recorder, the Wide Band Video Tape Recorder (WBVTR), will store photo images for the RBV and MSS.

"The development of the MSS and RBV represents a tremendous technological achievement in remote sensing," said Moe I. Schneebaum, Chief of Goddard's Earth Observation Systems and Systems Engineering Division. "To meet the demanding resolution requirements of the ERTS-A mission with stringent spacecraft weight and power constraints was a major advancement in the state of the art."

The **Return Beam Vidicon Subsystem** is a three-camera system that will survey the earth via three co-aligned camera sensors, each viewing the same scene but in a different spectral band. When separate images

(See Page 8)



FRANK HOWARD, ERTS DCS/1218 Computer Technician at the NTTF checks the Data Collection System which will demodulate, decode and transmit the ERTS DCS data over hardlines to the ERTS OCC.

Earth Research

"We are exploring with ERTS-A," said Goddard's Dr. Norman A. MacLeod. Dr. MacLeod is responsible for an experiment to observe plant growth and annual flooding in the Niger River of West Africa and of a second experiment involving resource management in the Potomac River Basin.

He is one of over 300 ERTS-A principal investigators who will be making use of NASA-built sensors aboard the spacecraft to conduct research. Beginning with ERTS-A, investigators hope to make major breakthroughs in such diverse fields as learning the true extent of water pollution in the world's rivers, lakes and seas; detecting plant disease; detecting geological features that may indicate new mineral deposits; or compiling more accurate maps of the earth's surface.

Says Dr. MacLeod, "We are trying to find out what we can 'see' from space. How will our observations fit into a future operational system?"

"Although ERTS-A is experimental, some of the data it will collect could have immediate benefit. For instance, the terrible flood in West Virginia last year would have shown up in ERTS imagery. That flood just ripped the vegetation from the land. ERTS photography would have been helpful in determining the extent of the damage of that disaster.

"There have been substantial changes in agricultural research the last few years, and these changes should have a large impact on how man must grow his food and best live on his land in the future. I feel that ERTS-A will help man make the changes required for the survival of his race."

Another Goddard scientist, Dr. Nicholas M. Short, is principal co-investigator with the University of Wyoming for an experiment to examine ERTS-A imagery of Wyoming and evaluate the state's natural resources. Three prime aims of this experiment will be to conduct geological surveys, study surface soil patterns, and to compile a vegetation inventory to see what grows where and how it changes with the seasons and other factors.

Dr. Short said, "ERTS-A will have a resolution of about 300 feet in the pictures taken by the sensor systems. One aim of my work on this experiment is to see if we can extract information from single resolution elements by determining how different proportions of similar surface features contribute to the tonal patterns in ERTS photo-images."

THE PUNCH STATION is the first step in combining negatives from three ERTS spectral bands to produce a false color print. Here Dave Abuhove lines up a negative for punching.

Goddard's ERTS Officials

John F. Clark	Goddard Director
Robert N. Lindley	Director of Projects
Harry Press	Associate Director for Earth Observation Satellites
Wilfred E. Scull	Project Manager
Stanley Weiland	Deputy Project Manager
Wilber B. Huston	Assistant Project Manager
Thomas M. Ragland	Assistant Project Manager
Gilbert A. Branchflower	Spacecraft Manager
William Nordberg	Project Scientist
Stanley C. Freden	Chief Scientist for Meteorology and Earth Sciences
Joseph Arlauskas	Multispectral Scanner Technical Officer
Walter D. Bradley	Network Support Manager
Luis Gonzales	Ground Data Handling System Manager
John M. Hayes	Wide Band Video Tape Recorder Technical Officer
James L. Michael	Operations Control Center Manager
Earl Painter	Data Collection System Technical Officer
William R. Schindler	Delta Project Manager
John Y. Sos	Data Processing Facility Manager.
Mr. Oscar Weinstein	Return Beam Vidicon Camera Technical Officer

The Sensors . . . from Page 7

from the cameras (similar to cathode ray tubes) are processed and superimposed in their respective colors, they provide a single full-color image containing the radiometric and cartographic information required for the ERTS system.

The three spectral regions covered by the cameras are the green (0.475 to 0.575 micrometer); red (0.580 to 0.680); and near infrared (0.690 to 9.830).

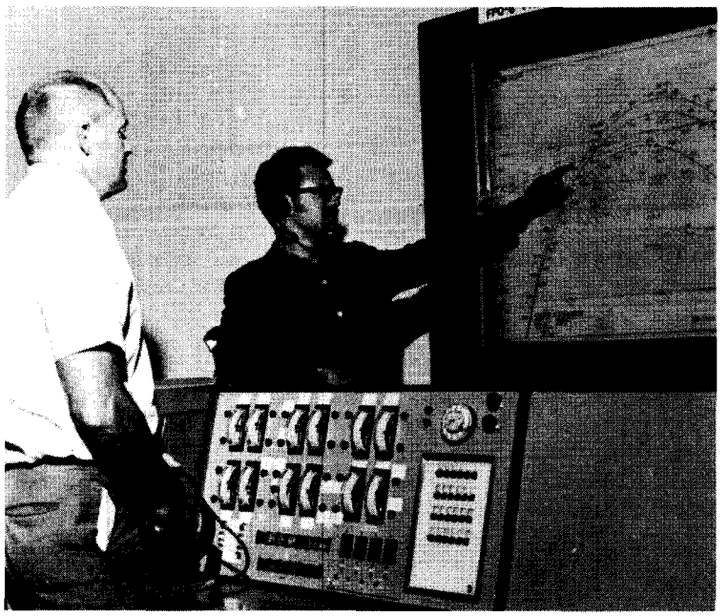
The **Multispectral Scanner Subsystem** is an optical-mechanical sensing system which will simultaneously detect optical energy in four spectral bands. The four bands are the visible green (0.5 to 0.6 and 0.6 to 0.7 micrometers) and two near infrared bands (0.7 to 0.8 and 0.8 to 1.1).

The MSS will scan a swath of earth 185 kilometers wide during each orbital pass. The width of the strip of earth scanned by the MSS will be identical to the swath of the RBV system.

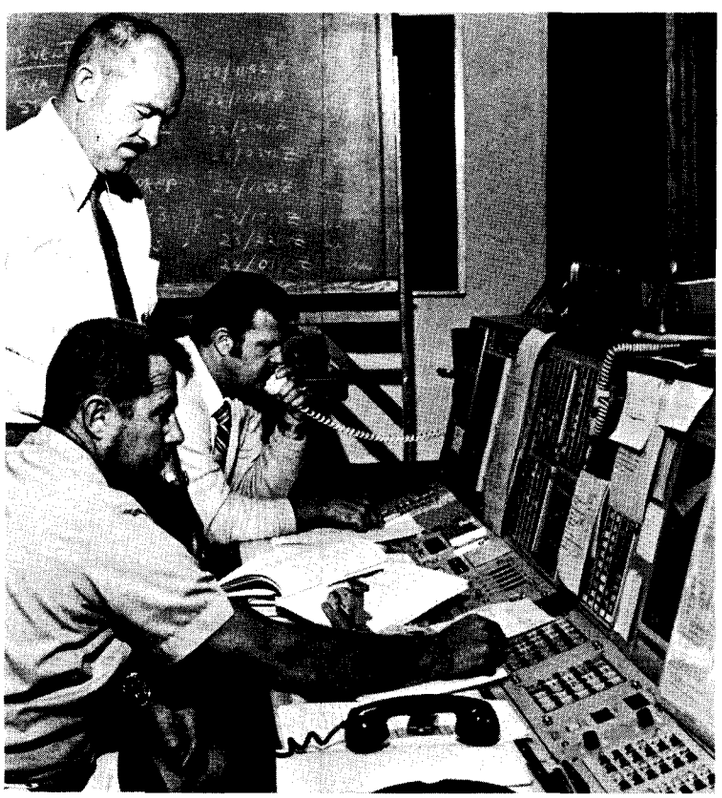
The **Data Collection System** will provide scientific users with near realtime environmental data collected from various remote platforms. The platforms are remote data gathering units which accept sensor data such as measurements of soil, water, air and other parameters, convert the data to a convenient form and transmit the data to the ERTS-A. The satellite immediately relays the platform data to the receiving sites, which in turn relays it to ground station at Goddard.

The **Wide Band Video Tape Recorder** will store images for later playback when the satellite is not in range of one of the three ground stations. There are two recorders and two transmitters aboard ERTS. The system can record data from both sensors simultaneously and can transmit two channels of wideband data at once. The WBVTR is the largest tape recorder ever flown in space (76 pounds) and has the highest capacity of any recorder ever orbited.

BERMUDA. . . . From Page 1



PART OF BERMUDA'S IMPORTANCE as a tracking station can be seen in the plot board in front of Wylie McMillan (left), station director, and Robert Burgess, a Bermudian technician at the site. One of the station's five computers determines, 10 times each second after launch, at what point the spacecraft would land or "impact" should the engines shut off at that moment. Two Air Force range safety officers sitting at the console in front of McMillan watch the inked line to make sure the vehicle stays within acceptable course limits. With the buttons at the bottom of the console, the range safety officer has the ability to destroy the Saturn boosters after the astronauts have safety ejected. Bermuda is the only tracking station outside of Cape Kennedy with the destruct ability.



THE CONTROL ROOM operations console is the nerve center of the NASA operations on Cooper's Island. From front to rear: Keith Hill, station manager; Wylie McMillan, station director, and Richard Borucki, data systems supervisor, as they waited for news of Apollo 16's splashdown in the Pacific.

The launch of Apollo 16 was the best ever, the control personnel in Bermuda agreed later. After only a few minutes, the range safety officer pressed one of the four red buttons on his console, disarming the destruction devices aboard the boosters. His 12 minutes and four seconds of work for the afternoon were over and he would soon fly back to his home station at Patrick Air Force Base.

Bermuda is considered one of the more important stations in the NASA Network because of its position in the North Atlantic 600 miles off the east coast of the U.S. It is the first station to acquire the spacecraft on radar after launch and the only one in the network having the ability to destruct the boosters – after the astronauts have safely ejected. The decision whether or not the spacecraft is "go" for earth orbit is made almost entirely on information which can be supplied only from the Bermuda station.

The station is on the southeastern tip of this British colony. Radar dishes and helical antennae bristle from an otherwise unadorned piece of coral known as Cooper's Island (once three islands, but now joined by coral and sand landfills). Station Director Wylie McMillan is the only NASA employee at the site; his subordinates are employees of the Bendix Corporation. Of the 132 persons on station, about 50 are non-Americans, most of them Bermudians.

All the local attention is focused on us during the manned missions," McMillan said, "but we are here the rest of the year fulfilling our other functions. Most recently, on a semi-permanent basis, we've been 'tracking' the ALSEP (Apollo Lunar Scientific Experiment Package) left on the moon by the previous Apollo flights. We gather all the data from the experiments and transmit back to the mainland. We also command the experiments to perform certain functions. This is really just a relay of commands on our part – most of the time we won't even know what we've told the experiment to do. There are some experiments that we do monitor here continuously, though."

Throughout the year, the Cooper's Island station also is called on to track and record data from orbiting scientific satellites such as OAO or various satellites seeking to collect geophysical data from the sky. Cooper's Island is under the jurisdiction of Goddard for all but manned launches.

"We even track migratory birds," McMillan said with a half-embarrassed laugh. "We really do! Scientists come down here to study their movements and their navigation. At first we had to determine what a bird looked like on our screen. Our operators are getting so good now they can even tell what species of bird it is – everything from geese to little ones the size of a sparrow or wren. That's pretty good from 25 or 30 miles away."

McMillan, whose background is in electronics, speaks with special pride of a feat accomplished last fall by his trackers: After the main fall migration had passed, the crew manning the radar screens actually picked up a swarm of two-inch-long insects following directly in the path of the birds. "Unfortunately, we couldn't get a positive identification on them," McMillan added, "but the scientists were surprised because they said they didn't realize insects migrated in the path of birds."

Confesses bird-watcher Darryl Bartlett, station public information officer: "It's usually OK with our wives when we say we're giving up a Sunday to watch Apollo, but when we tell them we're going to the station to watch migratory birds – that's something else."

Yet Bermuda affords compensations. After a successful Apollo mission, there is a splashdown party on a nearby secluded beach. "Last time it was something like four o'clock in the morning," Bartlett said, "but we still had our splashdown party on the beach. We barbecued two pigs and a goat, and had a generous supply of beer."

Story by Eric Johnson
Bermuda News Bureau

Twenty Complete STDN Safety Course

Twenty men from the stations of Goddard's Spaceflight Tracking and Data Network completed the second Loss Prevention Training Program at the Network Test and Training Facility on May 25, 1972. This is the second training program in safety techniques for men of the tracking stations. The first program took place at the NTTF in the summer of 1970.

The STDN Loss Prevention Training Program, conducted jointly by the staff of the NTTF and the Goddard Health and Safety Engineering Office, was designed to give the students a thorough understanding of basic safety techniques and practices so they can help set up and teach similar courses back at their home stations. The goal of the program is to achieve a uniformity of safety training throughout the Network.

Courses in the four-week LPTP included: Instructor Training taught by the NTTF staff; Fire Prevention and Control taught by George W. Morgan of the Goddard Safety Office and instructors from the University of Maryland; First Aid taught by Bruce Hursey of the NTTF and instructors from the American Red Cross; Cardio Pulmonary Resuscitation taught by Dr. Carlos Villafana, Director of the Goddard Health Unit, and instructors from the Maryland Heart Association; Pyr-A-Larm Detection and Systems taught by the NTTF staff; and Safety II taught by the Goddard Safety Office with the assistance of the NASA Safety Office and instructors from the Maryland Department of Labor. Each course included lectures, demonstrations and practice sessions that gave the students skills to help them cope with emergency situations and qualify them to teach emergency and preventative safety techniques to employees at their stations.

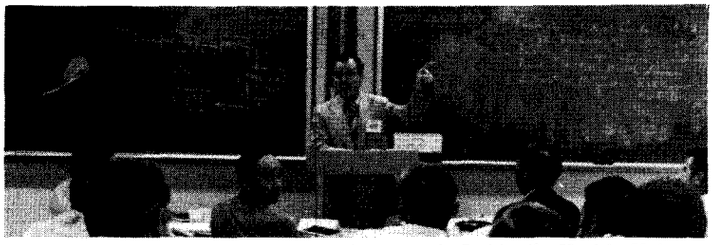
Upon graduation, the men received cards from the American Red Cross qualifying them to teach standard and advanced first aid. They also received certificates of completion from the NTTF, the Maryland Health Association, and the Maryland State Department of Labor and Industry.

PARTICIPANTS in the Loss Prevention Training Program are in first row (from left): Abel Gomez, Network Support Group (NSG); Ssylvain Ramlison, Tananarive; Roberto Prieto, Santiago; S. E. Emmons, Aircraft Operations; C. R. Merrill, Rosman; Austin Todd, Johannesburg; Carter Silcox, Health and Safety Engineering Office (H&SEO); Joe J. Lopez, H&SEO. Second Row (from left): Dean Farlow, Tananarive; Arthur Green, H&SEO; John Boucher, Guam; Dave McCabe, Merritt Island; Marcelo Nuñez, Quito; Leven B. Gray, H&SEO. Third Row (from left): Jim Suite, GSFC; John Rutt, Fairbanks; Eduardo Izurieta, Quito; George W. Morgan, H&SEO; James Benning, Corpus Christi; L. Haislip, NSG; Sydney Howe, Johannesburg; Dan Hayes, NASA; Fourth Row (from left): John Nimick, State of Maryland; Norm Murphy, BFEC; Bruce Hursey, NTTF; N. M. Kvasager, Quito; Harry Knight, NSG; Larry Bullock, NSG; and R. A. Malin, Ascension Island.

FIRST AID COURSE included practice in the application of bandages. From left in the above three pictures are N. M. Kvasager of Quito, Marcelo Nuñez of Quito, Abel Gomez of the Network Support Group, Roberto Prieto of Santiago, and (at top) John H. Rutt of Fairbanks and Eduardo Izurieta of Quito.

UNIVERSITY OF MARYLAND INSTRUCTORS watch as Roberto Prieto of Santiago puts out a trash fire during the LPTP course in Fire Prevention and Control.

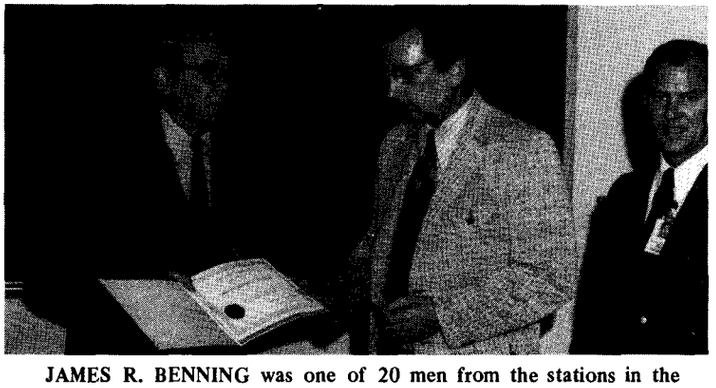
STUDENTS LEARN how to use a chair as an emergency stretcher during the Multi-Media First Aid Course. From left are C. R. Merrill of Rosman, S. R. Howe of Johannesburg, and John H. Rutt of Fairbanks. Instructor Bruce Hursey of the NTTF is in the background at left.



DR. CARLOS VILLAFANA, Director of Goddard's Health Unit, lectures on cardiopulmonary resuscitation techniques.

DAVE McCABE of Merritt Island checks Pry-A-Larm fire detection equipment like the fire detection equipment used at Goddard's tracking stations.

KEN DOOLAN, Goddard Industrial Hygienist, demonstrates the proper use of a water sampling kit during the Safety II course.

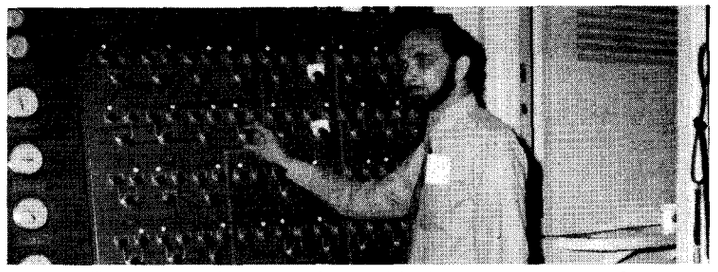


JAMES R. BENNING was one of 20 men from the stations in the Spaceflight Tracking and Data Network to graduate from the month-long Loss Prevention Training Program. Presenting the certificates of completion during the ceremony at the Network Test and Training Facility on May 25 was Daniel F. Hayes (left), Acting NASA Safety Director. At right is Leven B. Gray, Chief of the Health and Safety Engineering Office.

LPTP Graduates

John H. Rutt	Fairbanks, Alaska
C. R. Merrill	Rosman, North Carolina
Roberto Prieto	Santiago, Chile
S. R. Howe	Johannesburg, South Africa
Austin Todd	Johannesburg, South Africa
R. A. Malin	Ascension Island
John Boucher	Guam
D. McCabe	Merritt Island, Florida
S. E. Emmons	Bendix Corporation
James R. Benning	Corpus Christi, Texas
N. M. Kvasager	Quito, Ecuador
Marcelo Nunez	Quito, Ecuado
Eduardo Izurieta	Quito, Ecuador
Larry Bullock	Network Support Group
H. Knight	Network Support Group
L. Haislip	Network Support Group
Arthur Green	Health and Safety Engineering Office
Ssylvain Ramlison	Tananarive, Madagascar
Dean Farlow	Tananarive, Madagascar

POMD Support in Apollo Missions



AL HARRIS monitors the air conditioning systems console for the Building 3/14 complex.

By David G. Lewoc
Assistant Chief, POMD

The Plant Operations and Maintenance Division's Mission Support Group, headed by Al Harris, provides coverage around-the-clock in the Building 3/14 Complex. Chuck Little's Electricians are also on duty around-the-clock in the substation, and Bill O'Connor's Central Power Plant Group provides the heating, cooling, and diesel power in their usual reliable fashion.

The Mission Support Group was formed in March 1970 because the Building 3/14 Complex simply contains too many air conditioning systems and electrical load centers to adequately be maintained without a special group. There are twenty-three air handlers that operate from Central Power Plant chilled water, eighteen free standing air conditioning units which are electrically operated, and 150 and 250 ton air conditioning units which generates chilled water in emergencies. There are two diesel load centers and four commercial load centers in the Complex together with associated switch gear and 32 automatic transfer switches.

The main day-to-day problems are in providing proper air conditioning and humidity to an amazing number of computer systems in an amazingly small amount of space. However, this crew really gets to cracking during thunderstorms, and it seems that every Apollo mission has seen these storms. The crew is scurrying around checking and restarting fans and pumps, restoring switches, and, in general, tending to duties in a highly trained fashion.

The reliability of this support group is due to Al Harris who spends countless hours in training and simulations. One month prior to every Apollo launch, a power simulation is held, usually on a Sunday, and all three shifts of the Building Engineers, the Electricians, and the dispatcher practice orderly restoration of utilities. This also helps the computer operators to know what to expect when the real thing happens.

SAFE AWARD. John Parsons (left), an employee of the Brown & Root – Northrop Company supporting the Test and Evaluation Division, won the T&E SAFE Award for the month of April. The award entitled him to a month's reserved parking place in front of Building 7 in May. Here he is congratulated by Bruce Vernier, Company Project Manager. To win the award, Mr. Parsons submitted four suggestions to improve safety conditions around the control centers and large test chambers in Building 7.

Give Blood

The Gift that Saves Lives

There are few ways that a person can save the life of another without risk to himself – giving blood is one. Blood donated to the American Red Cross by volunteers is used by hospitals to replace blood lost by accident victims, to treat people in shock and those who have been severely burned, for those undergoing surgery, for anemia and for both the infant and mother in childbirth. Blood is separated into blood components for many medical purposes, and it makes possible new and advanced techniques such as open heart surgery.

At Goddard Civil Service and contract employees can give blood easily during the six visits each year of the Red Cross Bloodmobile to the Center. Last year Goddard donors did exceptionally well by giving 23 pints more than our quota. This year we are not doing as well; So far donors have given 436 pints. We need 464 more pints to meet our quota of 900 pints by the end of the year.

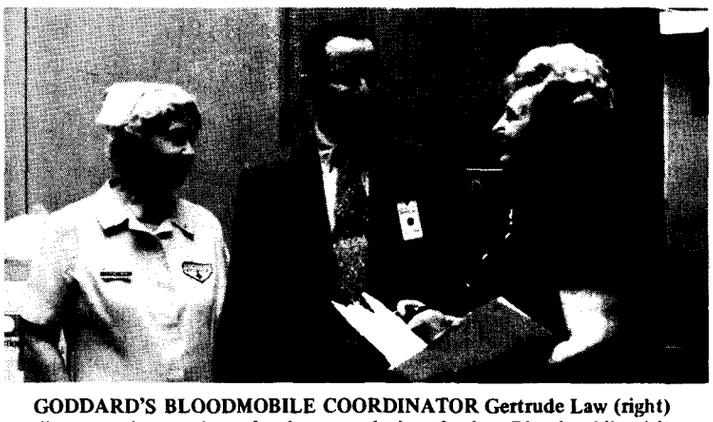
The next three Bloodmobiles will be here on July 5, September 6 and November 1.

Anyone who is healthy and between the ages of 18 and 66 can give blood once every eight weeks with a maximum of five pints a year. The six easy steps to giving blood are simple and should not take much more than an hour of your time.

First, before the Bloodmobile visit when you plan to give, call for an appointment or fill out the form sent to each directorate. Goddard's Bloodmobile coordinator is Gertrude Law who can be reached on extension 4757. You will be notified of the best time to come. Most Bloodmobiles will be in the Building 8 Auditorium from 9:00 a.m. to 2:45 p.m. on the appointed day.

On the day of the Bloodmobile, donations begin with registrations and a few questions for the record. Next comes a brief medical check in which a doctor will take your temperature to be sure you haven't any infection, and takes your blood pressure to be sure you are well enough to give. A blood sample will be taken. Next comes the actual donation which is usually painless and takes five or six minutes. They will remove one pint of your blood, which a normal body will replace naturally in about 24 to 48 hours. The last step is a brief rest and refreshments if you want them.

Your donation will help not only strangers, but yourself, your family and friends here on center. If Goddard meets the 900-pint quota by the end of the year, the Red Cross has arranged to have blood replaced free of charge for all Goddard Civil Service and contract employees and their immediate families. So give the gift that saves lives. Give blood.



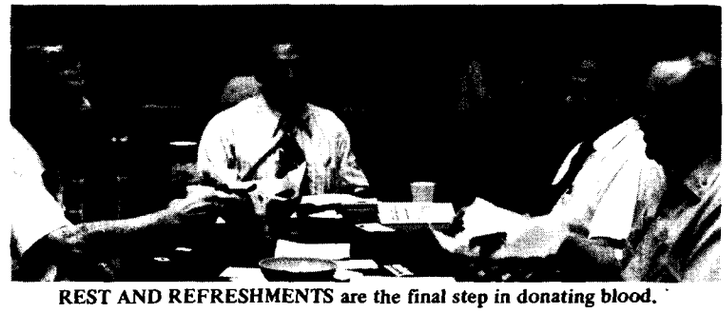
GODDARD'S BLOODMOBILE COORDINATOR Gertrude Law (right) discusses the number of volunteers during the last Bloodmobile visit with Mr. Sullivan of the American Red Cross and Red Cross Volunteer Janie Webb.

BLOOD DONATIONS begin at the registration table.

A MEDICAL CHECK includes taking a donor's blood pressure.

A BLOOD TEST helps determine your blood type and RH factor.

THE BLOOD DONATION itself takes about five minutes.



REST AND REFRESHMENTS are the final step in donating blood.

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GODDARD NEWS is published monthly by the Public Affairs Office of the Goddard Space Flight Center, National Aeronautics and Space Administration, Greenbelt, Md. 20771. Deadline for contributions is the last Thursday in the month.

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