

Apollo 16 Back from Descartes

Apollo 16, launched on April 16, splashed down on target in the Pacific Ocean at 2:45 p.m. EST on April 27. The successful eleven-day mission, the fifth to land on the Moon, was marked by minor equipment problems and some unexpected scientific findings about the Moon. Astronauts John Young, Charles Duke and Thomas Mattingly returned in good health with some 214 pounds of lunar material from the Descartes highlands.

At Goddard most systems ran smoothly throughout the mission. "The operations of the network went beautifully," reports Joseph P. Garvey, Prime Network Director for Apollo 16. Contact with the astronauts and spacecraft was maintained by 11 ground stations, an instrumented tracking ship and four instrumented aircraft of the Spaceflight Tracking and Data Network. Additional support was provided by the DSN station in Goldstone, California. Communication and data flow between the stations, Goddard and Mission Control in Houston was maintained by the NASA Communications Network.

Also from Goddard, experimenters were busy with first results from experiments conducted from the Command Service Module. Dr. Isidore Adler of the Theoretical Studies Branch reports that they had "tremendous results from his X-Ray Fluorescence Spectrometer. By the time the mission ended, he and his team had processed enough data to plot some 1350 data points on a preliminary map showing compositional variations along the ground track of the lunar surface. Dr. Jacob Trombka, Co-investigator for the Gamma-Ray Spectrometer Experiment, says they have excellent data on the distribution of radioactive elements around the orbital track of the Moon and from gamma ray astronomy observations made during the return trip.

A second Goddard experiment, the Gegenschein from Lunar Orbit, was conducted by Mattingly reports Principal Investigator Lawrence Dunkelmann, Head of the Astronomy Systems Branch. Experiment results, which include pictures taken of the faint Gegenschein while the Command Module was in total darkness, will be available shortly.

The six hour delay in landing on the lunar surface and the shortening of the mission by one day by an indication that there was a problem in the Thrust Vector Control backup system in the Service Propulsion System did not detract from the success of the mission. The astronauts spent a record 71 hours on the Moon and returned some interesting finds. Among these was a higher than expected lunar magnetism reported by Young and Duke, and a distinctive lava flow on the Moon's far side seen from orbit by Mattingly.

THE APOLLO 16 Saturn V space vehicle carrying Astronauts John W. Young, Thomas K. Mattingly, II, and Charles M. Duke, Jr., streaks skyward past Florida landscape at the start of NASA's eighth manned voyage to the Moon. Liftoff was recorded at 12:54 p.m. EST on April 16, 1972. Splashdown occurred 11 days later at 2:45 p.m. on April 27 in the Pacific Ocean.

Meet Robert N. Lindley New Director of Projects

Robert N. Lindley was appointed Goddard Director of Projects on April 17, 1972. He replaces Robert E. Bourdeau who has been assigned to the post of Director of Space Applications and Technology following a reorganization last month (see story on Page 2).

Mr. Lindley came to Goddard from NASA Headquarters where he was Director of Engineering and Operations in the Office of Manned Space Flight. As Director of Projects, he is responsible for the development and management of large observatory-class spacecraft. Projects under his direction are the Orbiting Astronomical Observatory, the Atmosphere Explorer, the Earth Resources Technology Satellite, Nimbus, the Orbiting Solar Observatory, the Applications Technology Satellites, the Synchronous Meteorological Satellite, the Operational Satellites, and the Delta launch vehicle.

Born and educated in England, Mr. Lindley was Chief Engineer of Avro Aircraft in Toronto, Ontario, Canada, before joining McDonnell Douglas (then McDonnell Aircraft) in St. Louis, Missouri. During his tour with McDonnell Douglas, he was responsible for the management of the engineering on the Gemini program, and was program manager on the Airlock Module of the Skylab project (formerly AAP). At the time he elected to join NASA in November of 1969, Mr. Lindley was Vice President — Program General



ROBERT N. LINDLEY

LINDLEY--From Page 1

Manager, working on the Space Shuttle Program for McDonnell Douglas. Mr. Lindley joined NASA as Special Assistant to the Associate Administrator for Manned Space Flight.

He is a member of the American Institute of Aeronautics and Astronautics, and the Royal Aeronautical Society, England.

Mr. Lindley is married to the former Christabel Hewetson of Cumberland, England. They have four children and live in Alexandria, Virginia.

Key Personnel Changes

On April 10, 1972, Dr. Michael J. Vaccaro and Daniel D. Mazur were appointed to two newly established positions in the office of Goddard's Director. Dr. Vaccaro, formerly Director of Administration and Management, became Associate Deputy Director for Management. Mr. Mazur, formerly Director of Space Applications and Technology, became Associate Deputy Director for Engineering.

During the same reorganization, Samuel W. Keller, formerly Dr. Vaccaro's Deputy, succeeded him as Director of Administration and Management. Robert E. Bourdeau was transferred from the post of Director of Projects to that of Director of Space Applications and Technology, replacing Mr. Mazur.

On April 17, Robert N. Lindley, formerly Director for Engineering and Operations in the NASA Office of Manned Space Flight, arrived at Goddard to take over the post of Director of Projects in place of Mr. Bourdeau.



GIL GATES, a member of Goddard's Amateur Radio Club receives a special certificate from Ozro M. Covington, Director of Networks, in behalf of all club members who participated in the commemoration of last year's Apollo 15 launch. Each participating club member later received a copy of the award.

Radio Clubs Active for Apollo 16

Members of Amateur Radio Clubs at four NASA Centers manned their stations during the launch, splashdown and other highlights of the Apollo 16 mission. Clubs involved in the commemorative effort were the Huntsville Amateur Radio Club K4SFT, the JPL Radio Club W6V10, the Goddard Amateur Radio Club WA3NAN, and the Space Center Amateur Radio Society WH4ICJ.

Although the Goddard and KSC clubs have participated in past Apollo commemorative events, this is the first time all four NASA clubs pooled their efforts.

Goddard alone made around 2002 contacts during the event. Our call sign for this and other special events is WG3SFC.

The Johannes Kepler Award

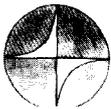
presented by

The American Geophysical Union

to the

National Aeronautics and Space Administration

for achieving an unprecedented accuracy in the guidance, tracking and control of rocket propelled spacecraft. The placing of spacecraft into predetermined earth orbit, a precision landing on the moon, or an accurately controlled planetary encounter are, in a true sense, feats that represent an ultimate extension of the lifetime work of Johannes Kepler.



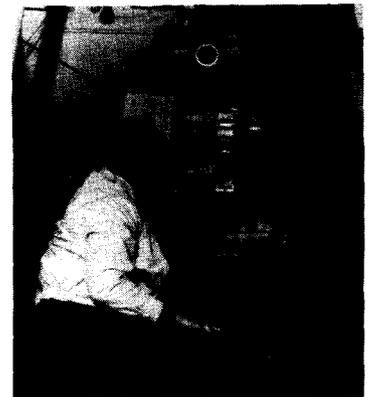
James C. Fletcher
Director



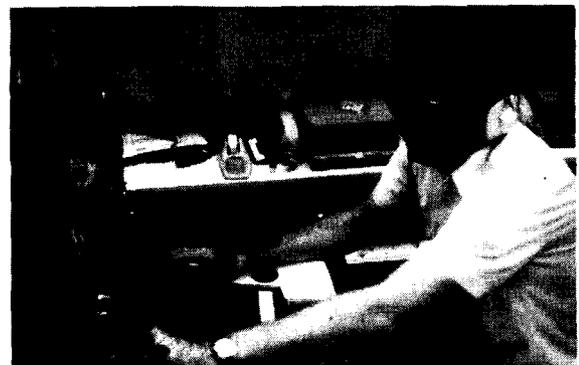
AGU AWARD. On December 7, 1971, NASA had the honor of receiving the Johannes Kepler Award of the American Geophysical Union. A framed representation of the award was sent to Goddard by NASA Administrator Dr. James C. Fletcher in recognition of the Center's contribution to the achievements for which NASA received the award. The copy is now on display in the Building 1 Lobby. The award citation reads: "To the National Aeronautics and Space Administration for achieving an unprecedented accuracy in the guidance, tracking, and control of rocket propelled spacecraft. The placing of spacecraft into predetermined earth orbit, a precision landing on the moon, or an accurately controlled planetary encounter are, in a true sense, feats that represent an ultimate extension of the lifetime work of Johannes Kepler."

Goddard Mourns

William D. Richardson, age 39, died April 14 of cancer. Mr. Richardson came to Goddard as a mathematician in 1962. He was formerly with the Operational Computing Branch of the Computation Division and was currently working in the Orbit Systems Program Section of the Orbital Operations Branch. Mr. Richardson was active in the Goddard Softball League and the Goddard Men's Thursday Night Bowling League.



MEMBERS of Goddard's Radio Club man their stations for Apollo 16.



NASA AUDIO NEWS SERVICE provided over 15,600 reports tailored for broadcast from MSC and over 850 summary reports from the GSFC Public Affairs Office during Apollo 16. Goddard PIO Jim Kukowski supervises the service at MSC during Apollo missions. Since its inception during Apollo 9 over 100,000 reports have been used by radio and TV stations.

DATA TOPICS

ISABELLA COLE, a Mathematician/Data Analyst in the Trajectory and Dynamics Branch, came to Goddard in April of 1963. She received her BS from Shaw University in Raleigh, North Carolina and did graduate work in applied mathematics at the University of North Carolina in Chapel Hill. She came to Goddard from the Naval Propellant Plant in Indian Head, Maryland. Prior to this, she worked for NACA at Langley Field, Virginia.



Automatic Tracing of Computer Programs for Numerical Significance

by Isabella Cole, Trajectory Analysis and Geodynamics Division

With the continual growth of computer power and productivity, increasing management attention is being given to overall effectiveness of computing service. Thus, modern executive systems provide improved responsiveness to many kinds of user demands, even though additional "overhead" consumption of machine resources is required to provide such responsiveness.

In scientific support programming, on the other hand, inordinate attention is often given to speed and economy of calculation, while inadequate attention is paid to the validation of numerical results.

A machine method for tracing numerical calculations program execution which provides explicit indication of the effects of finite-precision machine arithmetic on the significance of results has been developed in the Trajectory Analysis and Geodynamics Division. The actual work was done under contract by Computation Planning, Inc. Darrin Gridley, James Fleming, Jerry Liunekin and Isabella Cole were active supporters of the effort.

The significance package program (SIG PAC) provides a means for the user of existing programs, to trace the significance effects of input and generated error on intermediate and final computational results.

SIG PAC is intended to provide a means for:

- Observing the end results of significance itself when input data is changed or the significance of the input is changed.
- Observing intermediate significance effects of program parameter changes (iteration count, etc.)
- Observing significance effects of precision order (single or double).
- Localizing numerical procedures which result in excessive error growth.

In human-controlled calculation, especially using fixed-point arithmetic procedures, whether by hand or by machine, all data transfers are subject to inspection. Certain major arithmetic faults due to machine precision limits are visible to the observant user. To a lesser extent, this is also true of calculations performed by automatic computers using fixed-point or integer arithmetic, especially if the user builds into his procedure appropriate test processes such as printout of critical intermediate results.

With most modern scientific applications of high-speed computers for numerical calculations, however, use is made of built-in automatic normalizing floating-point arithmetic. This feature, while providing to the user the great convenience of completely automatic scaling, completely obscures from him the internal loss of significance which may occur because of the finite precision (i.e., limited number of digits in each number stored and processed) of the equip-

ment. The results can be disastrous; even for programs which may be logically correct and which may have operated for long periods of time without observed error.

Some errors are sufficiently gross (e.g., a denominator of a fraction approaching zero), to cause arithmetic fault indication by the hardware to warn the user of trouble. More subtle difficulties (e.g., the numerator of the same fraction approaching zero but with little numerical significance) are obscured from the user by the basic fact that arithmetic processes are invisible.

SigPac consists of a source-program processor (SIGSCAN) which translates the user program and its service requests (known as pseudo-operations) into an artificial language version which can be compiled by a FORTRAN compiler, together with an execution-support system (SIGLIB). The system uses internally the notation of Gray and Harrison for keeping track of an index of significance for each quantity which is involved in or results from a calculation step. The kind of arithmetic used is *significance* or *significant digit* arithmetic, as used by Cheydleur, Ashenhurst and Metropolis.

The result of execution under SigPac is numerical output which is identical with normal execution, plus the added output of information on the number of significant digits in each quantity on which such information is requested by the user.

The system is stored on the 360/95 and 360/91 at GSFC. It has been used successfully to trace programs of which the traced segments totaled several hundred statements in size.

The primary step in SigPac usage is source program examination and planning of the testing process. Prior to actual usage preparation, the user program is compiled and executed normally in order to assure that it is grammatically and otherwise acceptable to the production software. Potentially data-sensitive aspects of the program are then identified, and desired test output is planned. Special attention must then be given to particulars of the programmed process, in order to assure that service requests lead to meaningful results. For example, in iterative procedures it is often true that numerical significance may be degrading while mathematical accuracy is improving; in such processes, local significance behavior may be irrelevant to the test information desired and it may be appropriate to dynamically reinitialize "significance" each time the iteration loop is reentered. No overall rule of thumb for such processes can be given although it should be said that thoughtful examination of these portions of programs is required.

Examination of SigPac test output is often found to yield surprising results. Many cases have been observed in which the user was unaware that his mathematical formulation was inadequate for the results desired, until he was presented with SigPac output which was sharply at odds with known accuracy of results. Like any other program testing tool, this kind of system is limited in effectiveness by the imagination and care with which it is applied by the user.

Additional information and aid in the use of SigPac is available from the Programmer Assistance Centers (PAC) in buildings 3-14 and 1, Frank Pajerski, ext. 6710 and William Gorman, ext. 6796.



FRANK PAJERSKI (left), of the Computer Systems Branch, and William Gorman, of the Programmer's Assistance Center, read a description of SigPac.



GODDARD'S NEW QUEEN Linda Veitch receives her crown from Teresa Ricketts, 1971 Goddard Queen. Watching are Dr. John F. Clark, Goddard Director, and Paula Cutler. Linda was elected Queen at the annual spring dance held April 7 at the Indian Spring Country Club. Ann Patterson, an Aerospace Engineer in the Spacecraft Structures Branch, was elected First Runner-up and Laurrie Weimer of the Laboratory for Space Physics was Second Runner-up. Master of Ceremonies for the dance was Bob Baumann, and music was by the Buddy Gayle Orchestra. Linda Veitch came to Goddard in June of 1971 as a clerk-stenographer in the Network Simulations Branch. She is a graduate of Laurel Senior High School where she was Captain of the Varsity Cheerleaders and a member of the National Honor Society. For the past four years, Linda has been instructor and leader of the Laurel Volunteer Fire Department Auxiliary Majorettes.



RED CROSS AWARD. Robert M. Porter receives an award from Michele Erhgott, Miss Maryland for 1971, in behalf of all Goddard blood donors who helped the Center go over its quota last year. In 1971 Goddard's quota was 900 pints of blood, and our donors gave 923 pints. Charles Reichelt, member of the Prince George's County Red Cross Board of Directors and Vice-Chairman of the Blood Program, watches the presentation that took place during the annual awards dinner of the Prince George's County Chapter of the American Red Cross. Mr. Porter, of the Data Techniques Branch, is one of Goddard's top blood donors having given over 11 gallons of blood during his career.



COST REDUCTION. Paul Murdock receives a Cost Reduction Award from John C. Lyons, Head of the Microelectronics and Packaging Branch, while Harold J. Peake, Chief of the Electronics Division, looks on. Mr. Murdock earned the award for devising a new and inexpensive technique for evaporating metal connections onto integrated circuits.

Calendar Photo Contest

The Goddard Photo Club and the NASA/Federal Credit Union are sponsoring three photo contests to choose pictures for the 1973 Credit Union calendar. The contests will be limited to pictures taken in Maryland, Virginia, the District of Columbia, and the Chesapeake Bay area covering sports, scenery, industry, and daily activities.

Two contests for black and white prints will end June 15 and July 17 respectively. Prizes will be \$20 for first place, \$15 for second place, \$10 for third place, and \$5 each for three honorable mention awards.

A single contest for color will end with judging on July 17. Contest awards for color will be \$30 for first place, \$20 for second place and \$10 for third place.

All black and white pictures will be eligible for calendar selection regardless of contest standing. Final choice of pictures for the 12 months of the year will be made by an independent judging board with a cash award of \$10 for each month. The first prize picture from the color contest will be used in the calendar cover.

Contest Rules:

1. Contests are open to all Goddard and Headquarters Civil Service and contractor personnel.
2. Photographs of Maryland, Virginia, D.C., and the Chesapeake Bay area are eligible.
3. There is no limit on when a picture is taken.
4. All black and white prints are to be 8x10 inches unmounted.
5. Color entries may be slides or prints 5x7 inches or larger.
6. Original negatives or transparencies must be available on request.
7. Entries are limited to six black and white pictures per contest. Entries in color are limited to four.
8. All entries must be accompanied by the following information: Your name, home address, mail code, and office phone number. In addition, caption material must include: Where photo was taken, suggested title, any additional information of interest, and model release where required.
9. A self-addressed envelope is required for the return of entries.
10. Entries must be submitted or mailed to your respective Credit Union Office.

For additional information, contact: Fran Stetina on extension 2357, Richard Buehler on extension 2486, or Dan Wittgartner on extension 4650.



MARV MAXWELL, President of the Goddard Photo Club, uses a 1910 vintage camera in an effort to shoot a prize-winning picture for the Calendar Photo Contest.

Women in Goddard's Co-op Program

There are now eleven women taking part in the Goddard Cooperative Work Study Program. While they may not look like champions for women's liberation, each of them is doing a man's job and doing it well.

Gladys Chasnoff, Co-op Coordinator for the Employee Development Branch, is proud of the interest women are showing in the program. "The girls now enrolled represent a gradual build-up from two female students in just a little over a year," she says. There are presently a total of 66 students taking part in the program.

Students in the Co-op Program are chosen on the basis of academic records, maturity, leadership ability and personal achievement. As Goddard co-ops, they gain valuable job experience by alternating work periods here on Center with semesters at school.

On this page are pictures and profiles of four women at Goddard at this time. Others enrolled in the program are: Arlene K. Lutes, a mathematics major from Indiana State University; Rosmarna Sapanic, a mathematics major from the University of Southern Florida; Isabel B. Tomaszewski, a mathematics major from Pratt Institute; Barbara J. Mueller, an electrical engineer from Northwestern University; Ann B. Bomfors, a mathematics major from the University of Southern Florida; Garolyn D. Carter, an accounting major from Northeastern University and Georgia Mae Benford, a business administration major from Rust College.



CHARLOTTE ANN BERRY, a freshman electrical engineering major at the University of Tennessee, became a co-op student to gain some working experience. She began her first work period this spring in the Parts Branch of the Quality Assurance Division, and says "My working experience at Goddard has been very informative and enjoyable." Besides engineering, Charlotte's interests include bicycling, music, and clothes design.

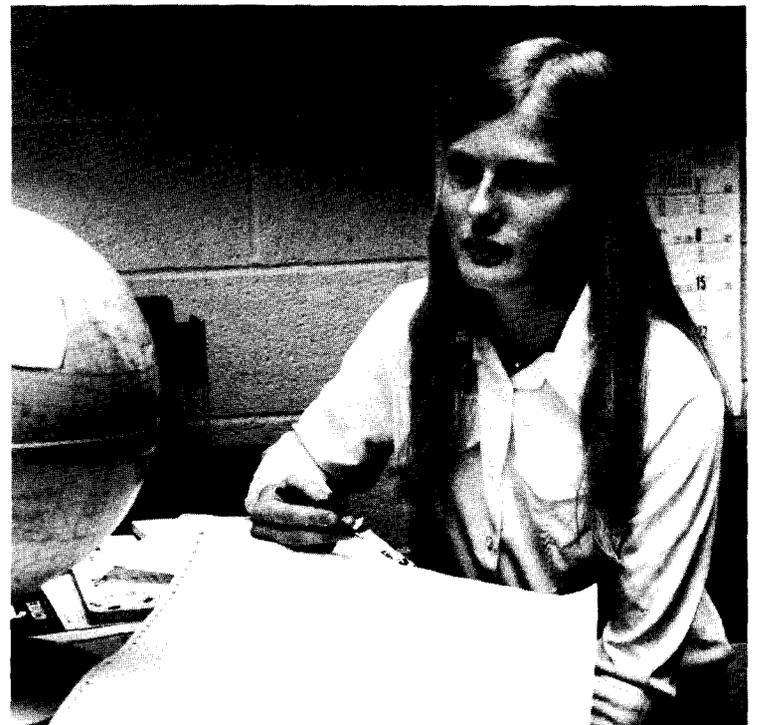
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JANET D. MORRELL, a mathematics major at Virginia Tech (VPI), is presently in her first of six planned co-op work sessions at Goddard. During this first session, which will last 10 weeks, she is working in the Delta Project Office. Her tasks involve the application of her mathematics and computer background in analyzing orbital mechanics problems related to future Delta missions. She finds her co-op experience quite challenging and, she says, a definite complement to her studies. Besides her interest in applied mathematics, she is an avid sports fan, both as a participant and spectator. At school she plays intramural softball, volleyball and this past fall was quarterback of her intramural football team. As a native of the Philadelphia area, she is an ardent Eagles fan and also follows professional golf.



JANE CAROL CASS, a sophomore at Purdue University, is an aeronautical engineering major who hopes to graduate in June of 1975. She is currently in her second co-op session here in the Sounding Rocket Division. She says, "As a member of the Analysis Section of the Flight Performance Branch, I'm involved in flight trajectory analysis. Much of my work involves the use of computers. This co-op session I've become involved in activities related to the general Co-op Program. I'm co-editor of the "Co-op Memo" which is to be published this spring. Also, I participated in a panel discussion about co-oping for the 1972 Youth Science Congress."



CAROLYN Y. BANKS came to Goddard for the first time this January as a co-op in the Space Plasma Branch of the Laboratory for Extraterrestrial Physics. She is a junior mathematics major from Virginia State College in Petersburg, Virginia who enjoys sewing and dancing. In spite of the fact that she is new to the Co-op Program, Carolyn was one of four students to talk about "College and University Work-Study Programs" during a panel discussion for the 1972 Youth Science Congress held here at Goddard.





MARVIN LIEBERMAN, Peabody High School, Pittsburgh, Pennsylvania, receives his medallion and certificate of outstanding achievement from Elva Bailey, Goddard's Educational Programs Officer, while Dr. James Latham, Co-Director of the Congress for the National Science Teachers Association, presides at the Thursday evening Awards Banquet. Over 100 scientist advisors and their spouses attended the banquet together with visiting educators and other Goddard people involved in support of the Congress. The banquet was held at the Adult Education Conference Center of the University of Maryland.



FORTY SENIOR HIGH SCHOOL STUDENTS attended the 1972 Goddard Congress. They represented Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island and Vermont. Also attending the Congress were six teacher advisors: Edwin Gosnell, Towson Senior High School, Towson, Maryland; Edward Lalor, Bureau of Science Education, New York State



THE CONGRESS PARTICIPANTS were counseled by Goddard technical consultants before and after they presented their research projects to an audience of Prince George's County students, teachers, scientists and fellow Congress participants. Here Joseph Wachter, Nativity BVM High School, Pottsville, Pennsylvania, is describing his chemistry research for advisors, Dr. Arthur Doan and Dr. Philip Cressy, Planetology Branch.

Congress Participants

Robert F. Fisher, Westmont Hilltop High School, Johnstown, Pa.
 Mary Agnes Boitano, St. Dominic Academy, Jersey City, N. J.
 Daniel J. Repeta, Rutland High School, Rutland, Vt.
 Laura J. Schumacker, Westbury High School, Westbury, N. Y.
 Michael D. Culler, Gov. Thomas Johnson High School, Frederick, Md.
 Debra L. Schweikert, Neshannock High School, New Castle, Pa.
 Theodore R. Schatzki, Lexington High School, Lexington, Mass.
 Richard Zimmerman, Bronx High School of Science, Bronx, N. Y.
 Karen M. Russell, Bishop Gerrard High School, Fall River, Mass.
 Charles S. Palmer, Jr., Gateway Senior High School, Monroeville, Pa.
 Anna P. Pacelli, St. Dominic Academy, Jersey City, N. J.
 Joseph A. Walker, Ocean Township High School, Oakhurst, N. J.
 Maria S. Marcocci, St. Dominic Academy, Jersey City, N. J.
 Theodore Plemenos, Lexington Senior High School, Lexington, Mass.
 Rhonda L. Millett, Oxford Hills High School, South Paris, Me.
 William E. Hurford, Bethel Park High School, Bethel Park, Pa.
 Mark M. Schilansky, Far Rockaway High School, Far Rockaway, N. Y.
 Mark H. Nicholas, Cumberland High School, Cumberland, R.I.
 Daniel Brookoff, Bronx High School of Science, Bronx, N. Y.
 Jeffrey M. Chinsky, Bronx High School of Science, Bronx, N. Y.
 Robert J. Fechter, Martin Van Buren High School, Queens Village, N. Y.
 David T. Sowa, Christiana High School, Newark, Del.
 Martin A. Katz, Freehold High School, Freehold, N. J.
 William P. Teubl, Bronx High School of Science, Bronx, N. Y.
 Leonard J. Rabinow, Midwood High School, Brooklyn, N. Y.
 Joseph P. Wachter, Nativity BVM High School, Pottsville, Pa.
 G. David Kolsun, St. Elizabeth High School, Pittsburgh, Pa.
 Andrew D. Silver, Francis Lewis High School, Flushing, N. Y.
 Marvin B. Lieberman, Peabody High School, Pittsburgh, Pa.
 Michael F. Delaney, North Quincy High School, North Quincy, Mass.
 Susan E. Landau, Bronx High School of Science, Bronx, N. Y.
 Sanford R. Climan, Bronx High School of Science, Bronx, N. Y.
 Gene M. Grossman, Bronx High School of Science, Bronx, N. Y.
 David A. Harmin, Midwood High School, Brooklyn, N. Y.
 Yoe Itokawa, Francis Lewis High School, Flushing, N. Y.
 Barbara A. Haage, Reading Central Catholic High School, Reading, Pa.
 Joseph H. Abeles, Bronx High School of Science, Bronx, N. Y.
 Mitchell G. Tyson, Bronx High School of Science, Bronx, N. Y.
 Samuel R. Rod, The Bullis School, Potomac, Md.
 Ira C. Spector, Parkland Senior High School, Orefield, Pa.

1972 Youth S

Forty outstanding high school students from the District of Columbia and nine northeastern states participated in the NASA-National Science Teachers Association Youth Science Congress at Goddard on April 19, 20 and 21. This was the eighth Congress conducted here since 1963.

Highlights of the three-day program included: a reception for participating students, consultants and advisors; presentations of research papers by Congress participants; a panel discussion; awards banquet; special briefings at Goddard on the Apollo 16 mission; and visits to selected Goddard laboratories.

Other highlights included presentations by John Bannister, Educational Programs Office on "Living in Space"; Dr. Bevan French, Planetology Branch on "Apollo 16 - Science at Stone



MITCHELL TYSON, Bronx High School of Science, Bronx, New York, describes "A Model of the Space-Time Universe on Field Theories in Geometrodynamics."



BARBARA HAAGE, High School, Reading, "The Development of Concepts in Children."



Department of Education; Henrietta Mazon, Bronx High School of Science, Bronx, New York; William Shortall, Lansdowne Senior High School, Baltimore, Maryland; Sandra Stone, Lexington High School, Lexington, Massachusetts; and Sister M. Eucharista, St. Dominic Academy, Jersey City, New Jersey. Harvey Goodman, Science Research Instructor, Francis Lewis High School, Flushing, New York, was the official observer for the National Science Teachers Association.



JAMES BARROWMAN (center), Flight Performance Branch, chaired the Wednesday evening panel discussion topic "College and University Work-Study Programs" for the Congress participants at the Adult Education Conference Center of the University of Maryland. Goddard COOP panelists (from left to right) were Donald Haefner, Pratt Institute; Carolyn Banks, Virginia State University; Jane Cass, Purdue University; and Kenneth Rush, University of Tennessee.

Science Congress

Mountain"; William D. Green, Skylab Program Office on "An Overview of the Skylab Program."

Dr. Cyril Ponnampereuma, Director of the Laboratory of Chemical Evolution at the University of Maryland, spoke on the topic "The Search for Life Beyond the Earth" at the awards banquet held at the Adult Education Conference Center of the University of Maryland. Dr. Norman MacLeod, Laboratory for Meteorology and Earth Sciences, introduced Dr. Ponnampereuma to the Congress participants and about 100 of their scientist and educator guests.

Student representatives from each of the eighteen high schools in Prince George's County attended concurrent sessions at Goddard on Thursday, April 20, where Congress participants presented procedures and results of their research projects.



DR. CYRIL PONNAMPERUMA, Director, Laboratory of Chemical Evolution, University of Maryland, responded to many questions from Congress participants following the Awards Banquet where he spoke on the topic "The Search for Life Beyond the Earth." This is an area of science in which his work has been internationally acclaimed.



Reading Central Catholic Pennsylvania, reports on "Antititative and Numerical



MARK NICHOLAS, Cumberland High School, Cumberland, Rhode Island, researched "A Bacterial Growth Inhibitor Produced by Fish Cells in Culture."

Technical Consultants

- Hans Bremer, Space and Earth Sciences Computing Center, Goddard Space Flight Center
- Dr. Philip Cressy, Planetology Branch, Goddard Space Flight Center
- Dr. Arthur Doan, Planetology Branch, Goddard Space Flight Center
- Dr. Miklos Faust, Crops Research Division, Agricultural Research Center
- Loyal Goff, Planetary Programs, NASA Headquarters
- Dr. Lawrence B. Hall, Planetary Programs, NASA Headquarters
- Dr. Dora Hayes, Pesticide Chemical Research Bureau, Agricultural Research Center
- Dr. Andrew F. Hegyeli, Biochemical Evaluation Division, Walter Reed Army Medical Center
- Alvin N. Hewing, Pesticide Chemical Research Bureau, Agricultural Research Center
- Dr. Frank Jones, Laboratory for Space Physics, Goddard Space Flight Center
- Dr. Thomas Kelsall, Laboratory for Space Physics, Goddard Space Flight Center
- Dr. Hwa Ping Lee, Test and Evaluation Division, Goddard Space Flight Center
- Dr. Fred Leonard, Neurobiology Program, National Science Foundation
- Dr. Norman MacLeod, Laboratory for Meteorology and Earth Sciences, Goddard Space Flight Center
- Edward Monasterski, Laboratory for Space Physics, Goddard Space Flight Center
- Dr. Joseph Saunders, Office of Life Sciences, NASA Headquarters
- Allan Silver, Laboratory for Space Physics, Goddard Space Flight Center

Know Your Print Shop

The Printing and Duplicating Section of the Graphic Arts Branch, TID, is directed by Section Head Charles V. Hardesty. Located in the basement of Building 8, the shop is responsible for all Goddard's printing needs. This includes the duplication of items that range from simple announcements and one-page "Tech Briefs" to the latest Nimbus catalog containing hundreds of weather pictures printed in sharp detail.

Of the thousands of jobs reproduced each year, some such as the "Director's Weekly" and the "Bulletin" are printed on a weekly schedule. Others such as award ceremony programs and Goddard "X Documents" are printed as required.

Working from camera-ready copy, the shop does much of the Center's printing on its own offset presses. Other larger and more complex jobs are contracted to outside printers or the Government Printing Office.

On this and the following page are pictures of the team that "keeps Goddard's presses rolling."



REVIEWING A FINISHED JOB. Charles Hardesty (seated), Head of the Printing and Duplicating Section, and Printing Specialist Donald Ellis check a recent edition of the Nimbus Catalog. Large jobs such as this are sent out to contract printers or to the Government Printing Office for completion.



SHOP FOREMAN Leon Ringler is responsible for all on-site printing.



RAYMOND LEE operates a 1250 Multilith press.



WILLIAM LOCKAWAY operates a collator.



THE PHOTO OFFSET CAMERA is operated by Carl Geiger.



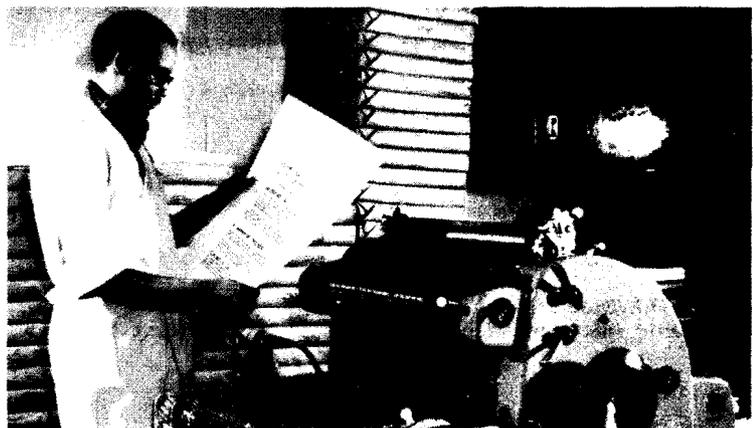
PRINTING ASSISTANT Catherine Butler and Thomas McBroom, Printing Specialist, discuss a contract job which will go to the Government Printing Office.

THE GODDARD DATELINE, hot off the 17 by 22 inch press, is checked by John Jones.



A NEGATIVE LAYOUT for the cover of a Goddard "X Document" is checked for flaws by Carolyn Hanna (left) and Georgia Williams.

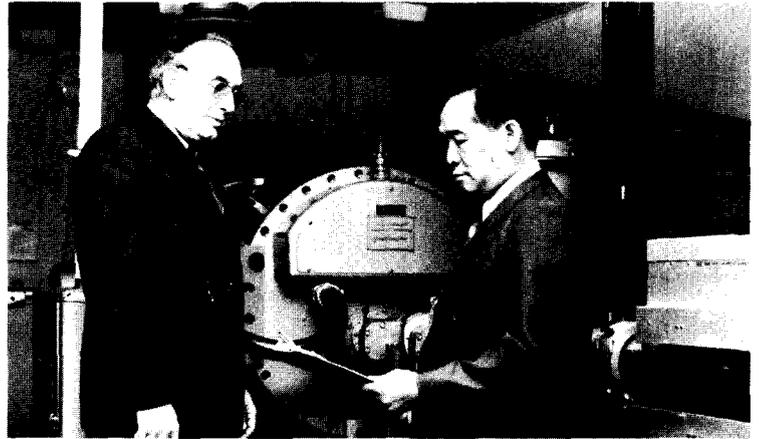
IN THE MAIN SHOP AREA, press operators (from left) James McKinly and Luthur Tate operate the 1250 Multilith presses while Charles Lee checks the finished product.





PRINTING CLERK Rita Mills (left) receives the camera copy for the *Goddard Dateline* from Pat Ratkewicz of the Public Affairs Office. The last job of the day, the *Dateline* is blown up from a typed page to poster-size and printed in time to make bulletin boards throughout the Center by the morning of the following workday.

Sufferin' Sam The Conservation Man



SAM TARLTON and H. K. Lee investigate water using equipment at Goddard.

By David G. Lewoc, Assistant Chief, POMD

The cooling season is upon us, and Malcolm J. Tarlton, better known as "Sam," is starting to have his problems. Sam is in charge of the Power Plant which can provide GSFC with some 12,000 tons of air conditioning. He's the man who keeps you cool.

Sam is also the conservation officer and is therefore charged with cutting down on utilities usage. So, the division office "beats on" Sam to conserve utilities, and the rest of Goddard "beats on" Sam for more cooling or heating. That's how he became "Sufferin' Sam."

Sam and his Central Power Plant crew, headed by Bill O'Connor, generate the heating or cooling; and the Building Engineers, headed by Hay K. Lee, try to see that it is distributed properly. This is a very challenging task, especially when people decide to prop doors open to deliver equipment or material and then leave them that way. Buildings 21 and 23 loading docks and Building 8 are prime examples of the open-door-syndrome. In the worst case, doors are kept open because the occupants want fresh air. Fresh 85° air sure raises havoc when you are trying to maintain a 74° temperature in the building. Mr. Lee also finds it difficult to cool a room when the blinds are left open to let in sunshine. Hay K. is a very ingenious person, but this is a real touchy.

Another disconcerting problem is trying to maintain an adequate winter temperature for everyone. Some girls wear flimsy, sleeveless summer dresses and find 72° or 74° too cool. So they bring in an electric heater. This is when Sufferin' Sam really starts babbling and becoming incoherent. Electricity is the most expensive type of heating. Our FY 71 electric bill was \$1.53 million, and \$1.59 million is budgeted for this fiscal year. \$1.77 million has been budgeted for FY 73 in anticipation of rate increases. That electric bill is why Building 8 "beats on" POMD at budget time.

Sam was also getting a lot of flack about the dirty #6 fuel oil he was burning. Number 6 fuel oil is a black goopy mess that has to be heated to flow and is sulphur laden; it's also cheap. So the boilers were modified to burn either natural gas or oil. Now there's a gas shortage -- just can't win.

Water conservation is also Sam's bailiwick. This Center pumps clean water into the sewage system during off hours at the rate of 100 gallons per minute (gpm). It used to be 200 gpm until Sam made a personal appeal to users last fall. This clean water is used to cool equipment, and Sam finds that people just don't like to shut off equipment. The turn-down process is too troublesome. Reading that instruction on the equipment that says, for example, that .5 gpm is all that is required is also troublesome; it's easier to plug it in and turn the valve than to measure the water and adjust the valve.

So keep up the good work, ya'll, and maybe we can send Sam to finger painting school for a couple weeks in July so that he can last through the rest of the summer.



OLIVER CAIN operates a tandem press that cuts paper and prints finished sheets in one quick process.



JAMES DILLINGHAM cuts paper to size on the power cutter.



SHOP LEADER Albert Moore (left) and Pressroom Leader Arthur Gilbert plan a printing job.

JAMES FLEMMING prepares a plate for the 17 by 22 inch press.



PRESTON POPE runs a tandem press.



Goddard's First Charter Trip A Fabulous Success

Everyone had fun on the special vacation trip during the week of April 13 to 21. The trip was sponsored by the A&M Entertainment Committee and included a round-trip flight to Spain for 210 people from all Goddard directorates and accommodations at the modern Playamar hotel in Torremolinos. Vacationers enjoyed tours of the Spanish coast, Malaga, Seville, Granada and North Africa. Some people and scenes from the trip are shown below.



Dick Blumenthal Receives Community Award

Richard Blumenthal, of Goddard's Mechanical Division, and his wife Anita have recently been awarded an engraved plaque by the Beacon Heights Citizens Association in recognition of their many years of dedicated community service. This is the first time this award has been presented.



RICHARD BLUMENTHAL

At Goddard Dick Blumenthal is an electronics technician in the Electro-Mechanical Section. At home both he and Anita devote their time to community activities that range from fighting for new zoning regulations to teaching boating classes.

When the Blumenthals and other residents moved into the newly-built Beacon Heights 15 years ago, there was no snow-plowing or sanding on bad winter days. As president of the Citizens Association, Mr. Blumenthal succeeded after several years of effort in getting the County to give the community regular snow removal service.

Like so many other communities, Beacon Heights has been plagued with rezoning problems. On two occasions, Dick and Anita drew up the community's legal case concerning the rezoning for apartment buildings. Dick presented the cases before the rezoning hearing and won in favor of the community.

Mr. Blumenthal's other activities in the Beacon Heights area include initiating the idea of block captains to bring better and more efficient organization to the Citizens Association; working for the building of a new elementary school; working to obtain new stop lights and widen Riverdale Road; and carrying around petitions for new street lights.

Along the way, Dick, who has no children of his own, managed to find time to be Cubmaster for Troop 712 in nearby East Pines, and later for Troop 1731 in Beacon Heights.

In addition to his community activities, Dick Blumenthal is an avid boating fan. He has a home on Chalk Point on the West River in the Annapolis area. Here he docks his 27-foot cabin cruiser and 14-foot speedboat. He is a member of the U.S. Coast Guard Auxiliary and is currently Courtesy Examining Officer. Both he and Anita use their cruiser to go out on Search and Rescue Patrols with the Coast Guard Auxiliary. Mr. Blumenthal is also Safety Officer for the U.S. Power Squadron, Prince Georges Group.

Because he is so interested in boating and wants others to enjoy it as much as he does, he teaches safe boating classes for both the Power Squadron and the Coast Guard Auxiliary.

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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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