



ART ANDERSON conducts ground truth survey of a reclaimed coal strip mine in the Mill Run Area of Garrett County. The area appeared as an operating or unreclaimed mine on the satellite photos because it had not been revegetated due to recent rainfall.

AIDSAT Telecast from GFSC

Live, two-way video discussions by United States officials are being broadcast from Goddard as part of a demonstration by Goddard's Applications Technology Satellite 6 (ATS-6) of how space and other advanced technology can benefit the people of developing countries. The spacecraft began a four-month journey back to an orbital location over the Western Hemisphere on August 1 after completing its year-long role in India's Satellite Instructional Television Experiment.

This effort is a joint undertaking by the Agency for International Development (AID) and NASA to demonstrate direct broadcasting to public officials, scientists, educators and other decision makers in more than two dozen developing countries. Known as AIDSAT (AID Space Age Technology) the three-month demonstration is illustrating how the application of space communications, remote sensing, and high-resolution aerial photography can help with food production, health and nutrition, and land management.

The first 12 programs of the demonstration were broadcast from August 1-26 to 11 countries and one international conference. After an initial greeting by President Ford, the demonstrations featured three films on uses of communications technology for national development, environmental applications of Landsats 1 and 2, and technologies for disaster prediction, assessment, and relief.

Following the filmed portion, the host country transmitted a 30-minute presentation on the role of science and technology in their develop-

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Canadians Present Book

Representatives from the Canadian Embassy presented Goddard Director Dr. Robert S. Cooper with a copy of *Between Friends*, a book published and prepared by Canada for the United States Bicentennial. The book consists largely of photographs of activities along our common border with Canada, emphasizing the peaceful and cooperative contacts of the two nations over the years. Premier Trudeau gave the first copy to President Ford on a visit to Washington earlier this year.

In attendance at the August 4 presentation were (above, from left) Al Jones, Deputy Director of the Engineering Directorate; Mr. Lee Brittney, Canadian Embassy; Dr. J. H. Greenblat, Counselor, Defense Research and Development Office, Canadian Embassy; Dr. Robert S. Cooper, Goddard Director; and Mr. Robert Goss, Delta project.

Aerobee Fired in Reusability Test

Goddard technicians fired an Aerobee sounding rocket on July 27 in a test expected to lead to Aerobee reusability. The Aerobee 170A lifted off from White Sands Test Facility, New Mexico at 10 a.m. MDT for a flight which went according to plan.

This is the 100th Aerobee fired by all users since the first flight of this type sounding rocket in 1947.

The test was the second in the series planned for development of the reusable Aerobee. The first firing was conducted July 13 at White Sands.

The reusable Aerobee would be fired, recovered, refurbished, and flown again one or more times for all payloads whose weight would accommodate the 70-pound recovery equipment. This second test used a refurbished rocket.

The recovery group consists of a fin severance system (to cause the rocket body to tumble, rather than plummeting straight down, thus creating more drag and less velocity), a parachute and impact shock absorbers.

The price of an Aerobee

170A, built with additional structural strength to withstand impact, is about \$80,000. A conservative refurbishment cost is \$20,000. Substantial savings are expected. It is planned to extend this recovery scheme to cover Aerobee 150's, 170A's and 200A's.

The Aerobee has been the workhouse of the United States' sounding rocket program since its first firing on September 25, 1947. Its relative simplicity, low cost, and ability to carry sizeable payloads—100 lbs. and upward—have made the Aerobee and its various versions attractive to many U.S. and foreign users.

Sounding rockets explore a region of space not feasible for other vehicles—beginning at about 40 miles altitude—higher than aircraft and balloons and lower than orbiting satellites can safely fly. They also afford a practical, low-cost means of testing, in the space environment, hardware which can then be confidently flown on satellites. An additional advantage is payload recovery.

Solar Cells Power Vehicles on Mall

Plugging into the power of the Sun—that's what researchers have been doing this summer on the Mall in Washington, D.C. Solar cells, once used only to power satellites in space, are charging the batteries used to power two electric vehicles during Bicentennial celebrations in the nation's capital.

The vehicles, belonging to the National Capital Parks, resemble golf carts and are equipped with six standard traction batteries. One vehicle, fitted with a vacuum cleaner, is being used for transportation of workers in the area. Both vehicles will be used through September at the Festival of American Folk Life on the Mall.

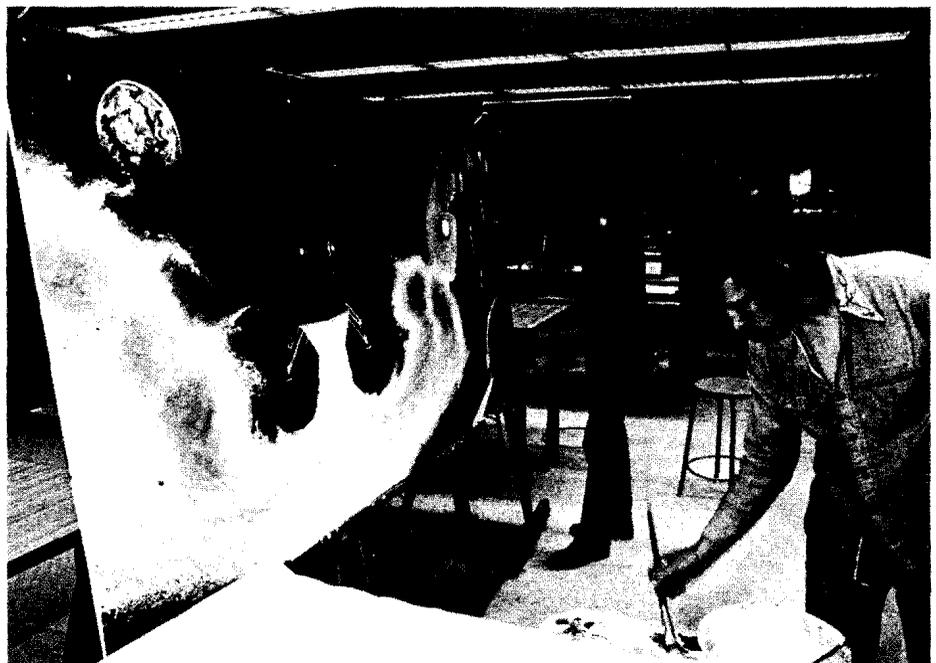
During peak daylight hours the batteries are charged by the array of photovoltaic cells which convert the Sun's light directly into electrical energy. The photovoltaic array, which provides about 1.7 kilowatts of electricity during the peak sunlight hours, was prepared by NASA's Lewis Research Center in Cleveland. The Jet Propulsion Lab in Pasadena, California, provided the photovoltaic cells.

Solar cell power is already competitive in cost with the electric power systems such as batteries and gasoline engine-generators for applications in remote areas. By the mid-1980's solar power systems could be operating in the 1 to 10 megawatt range. By the turn of the century solar cell arrays may be in wide use, powering both homes and factories, Lewis scientists believe.



Student Art Work Exhibited at Visitors Center

Junior and senior high school students from 51 Prince Georges County schools recently participated in a Student Art Project. Goddard provided the boards and the paint, and the students set to work in teams to produce 53 paintings that give the student's impressions of space and space-related subjects. The paintings are now on display at the Visitors Center along the walkway leading to Building 14. They will be returned to the schools in October.



ATS-6 Completes India Test

The world's most advanced communications research satellite is returning to the United States after a year on loan to the government of India to evaluate the role of television in promoting national development there.

Goddard's Applications Technology Satellite-6 (ATS-6) began the four-month journey westward on August 2 from a station over the East Africa equator in view of the Indian continent. Its move was commanded from the ATS Control Center at Goddard through a mobil ATS ground station near Madrid, Spain.

For the Indian test, called the Satellite Instructional Television Experiment (SITE), special programs developed in India were daily broadcast from a ground station near Ahmedabad, India, to the overhead ATS-6.

Serving as a powerful re-broadcasting station in space, the satellite automatically relayed the instructional television programs directly to some 2400 remote villages never be-

fore exposed to television. These villages were equipped with small ground terminals, including inexpensive chicken-wire mesh antennas, all built in India.

Another 2600 of the small ground terminals, located near conventional television transmitting stations, received the same instructional material via the ATS-6. These stations re-broadcast the material to many cities and their nearby villages.

Subjects vary

An estimated five million people throughout India viewed programs dealing with basic subjects in agriculture, health, hygiene, family planning, and national integration. Other programs dealt with science for youth and teacher education. Due to cost consideration, all programs were in black and white.

After seeing a SITE program, a group of young men in Nandikeshwara moved a washing stone from near the com-

munity well and re-installed it some distance away for health reasons. No one bathes near the village now to prevent dirty water from seeping into the well.

Programming for SITE was created by ALL India Radio of the India Ministry of Information and Broadcasting in collaboration with ISRO. The programmers found it necessary to keep the program content and format 40 percent of India's children remain in school through the fifth grade.

The presentation of dental hygiene had to do more than explain why the regular brushing of teeth was a good health practice. A significant practical tip in the program was a demonstration of how to make toothbrushes from thin tree branches. Too many of the villagers do not own toothbrushes.

In a lesson on how to plant rice, the width of a man's fist was shown as the proper distance between plants. Use of inches or centimeters would have been meaningless.

ISRO is the primary Indian organization responsible for the satellite experiment. NASA's role was limited to provision of the satellite on station in view of India for one year.

As a follow-on to the ATS-6 experiment, the Indian government is currently constructing ground transmitters to continue the educational television programs by early 1977. Because of their limited range, these transmitters will reach only about 40 percent of the SITE audience.

Over 1200 hours of diversified programs were developed and broadcast via the ATS-6 during the experiment. This is more time than has been devoted each year to the production of feature films in India, the largest producer of such films in the world.

Benefits revealed

Considerable difficulty was experienced in locating appropriate villages due to the lack of electricity. Thus, a number of villages had to be supplied with power—a valuable side benefit of the SITE.

Numerous incidents noted during the year-long SITE revealed some of the beneficial effects of the programming on the village people. Children's programs, for example, were received enthusiastically. School attendance improved as a result and many students brought along younger brothers and sisters to view the programs.

A boy in a village in Karnataka now insists that greens be added to his flour chappatis to make them more nutritious. Bread-like, the chappatis is a staple food in India.

A teacher in a Madhya Pradesh village said "the children are keen to see moving images of places that they had only imagined until now. The geography lesson sinks in better this way."



Indians watch television via ATS-6.

Landsat Monitors Maryland Strip Mines

The State of Maryland has found a new way of looking at its coal strip mining activities.

The new perspective is a result of a recently completed NASA-Maryland project to assess the monitoring of surface coal mining using data from Goddard's Landsat earth resources satellite. Circling the Earth 912 kilometers (570 miles) out in space, Landsat has sent back imagery showing that 25 to 30 percent more acreage was affected by the mines than anyone had realized. Consequently, the State has modified its mine inventorying procedures to include the additional acreage involved.

Arthur T. Anderson of Goddard's Space Applications Division analyzed the images in the Center's Information Transfer Laboratory. He was able to identify, classify and measure the effects of coal strip mining in the state's western area by comparing Landsat imagery taken over a three-year period ending in 1974.

About 93 percent of surface area distributed by the mines was identified in the Landsat images. This accuracy was somewhat better than that attainable by aerial photography and Maryland's improved field inspection techniques.

"Our cooperative study clearly demonstrated the feasibility of monitoring coal strip mines by satellite remote sensing. While this method cannot replace ground surveying, it can provide valuable information to complement the State's present field inspection program," Anderson said.

Location and extent of orphan mines (mines abandoned before 1967) are not accurately known. Hence, Maryland has initiated an inventory and mapping program of all strip-mined land in its coal-producing area. Officials want to determine the extent, cost and procedures necessary for reclaiming disturbed land.

A number of other states across the country have undertaken similar Landsat data projects for inventorying areas surface mined for coal and

other non-metallic materials. Some of these are Ohio, Tennessee, West Virginia, Kentucky, Pennsylvania, South Carolina, Florida and the Great Plains states bearing energy resources.

Two Landsat satellites presently circle the globe in polar orbits at altitudes of about 927 kilometers (575 miles). Coverage of a given area is repeated every nine days, due to the earth's rotation beneath the satellites which are spaced about a quarter of the globe apart.

Data recorded by the satellites is telemetered in digital format to a ground station where it is recorded on magnetic tapes. These can be manipulated directly by a computer to develop special images such as those used in the Maryland study.

Recorded information also can be converted into conventional negatives by computer for printing black-and-white or false-color images. Green, red and infrared are normally combined to reveal healthy vegetation as bright red.

Cooperating State agencies include the Maryland Bureau of Mines and the State's Geological Survey.



A DRAGLINE BUCKET sits idle near an operating coal strip mine in the Franklin Hill area of Garrett County near Westernport, Md.



ART ANDERSON (left) and Monte Nock view an operating coal strip mine in the Franklin Hill area of Garrett County. The state's only known coal deposits are in Garrett and Allegany Counties.

OSO Spots Solar Activity

Earthquakes on the Sun?

Not very likely. But there is some sort of activity in the solar atmosphere observed by Goddard's Orbiting Solar Observatory-8 that suggests there may be something akin to seismic activity on the Sun.

What has been observed by a French team of experimenters using the very-high-resolution ultraviolet sensors on the spacecraft is an oscillation of the Sun's atmosphere every 14 minutes. During this time it apparently moves up and down some 1300 kilometers (800 miles).

Goddard Project Scientist Dr. Roger Thomas says, "It was expected that the improved instrumentation on OSO-8 would detect a relatively small oscillation lasting about 300 seconds, but no one expected this huge movement of gas which might well involve the entire solar atmosphere." He added, "We really have no idea what is going on. It's a completely unexpected phenomenon brought about by some mechanism we do not understand. However, it may prove possible to use these waves to learn more about the Sun's interior, in a manner analogous to using seismic activity to study the structure of the Earth or Moon."

This discovery could well be one of the most important results from the French instrument on OSO-8 according to the Principal Investigator, Dr. Roger Bonnet of Centre National de la Recherche Scientifique, Paris.

OSO-8 was launched on board a Delta rocket June 21st last year from Cape Canaveral, Fla., carrying two of the most sophisticated and ambitious instruments for solar research ever flown, as well as the most comprehensive package of cosmic X-ray experiments.

Much scientific data on the Sun has been received, as well as data on cosmic X-rays from background radiation and important galactic X-ray objects such as possible black holes, pulsars, and neutron stars.

A summary of some of the preliminary scientific results from the eight onboard instruments indicated the spacecraft has accomplished its mission and it can be regarded as a scientific success.

Goddard has responsibility for the OSO project and Hughes Aircraft Co., El Segundo, Calif., built the spacecraft.



AU Sponsors Research Program

Eight high ability senior high school students concluded American University's seventeenth summer research program at Goddard on August 13. Each student was assigned to a research project under the supervision of a Goddard scientist or engineer. The program ended with seminars and reports given by the participants at American University. Bonnie Kaiser of the Employee Development Branch is the Goddard Coordinator and AU coordinators were Charles Spangler and Lynn Krupsaw.

Participants and their Goddard supervisors were (pictured above, front row from left): Lynn Krupsaw (AU coordinator), Michelle Wingard (Gilbert Mead, code 922), Dianne Parry (John Glaab, code 672), Bonnie Kaiser (Goddard coordinator), (back row from left) Jonathan Klein (Emil Hymowitz, code 704), Geoffrey Blake (Earnest Hilsenrath, code 912), Kelvin Brown (Walter Paroby, code 714), Joseph Nichols (Emil Hymowitz, code 704), William Powell (Peter Kenny, code 681), Kenric Malmberg (Edward Gaddy, code 711), and Pradeep Simlote (Donald Fairfield, code 692).

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ment. This live program originated from a transmit-receive terminal located in each nation's capital.

In the third part of the demonstration, U.S. officials knowledgeable about space technology and U.S. assistance programs spoke from Goddard in a live two-way discussion with representatives of the host country in their capital. The television receivers in the host country showed both ends of the conversation. Officials in the developing countries asked direct questions regarding all aspects of the demonstration, including U.S. assistance programs and the new space-age technologies.

The second set of programs

are scheduled to begin in late September.

ATS-6 is an extremely powerful communications satellite able to broadcast color television directly to any individual television receiver equipped with portable antenna and frequency converter.

One transmitter/receiver and two or three receive-only sets are being taken to each country for the demonstration.

After ATS-6 reaches its new position over the equator to command a view of the United States, it will be used for a variety of societal, communication, and scientific/technical experiments in the continental United States and Hawaii. At least 23 such experiments are currently under consideration.