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After a fairly mild winter up through December featuring more than enough rain to make up for the previous drought conditions, a heavier than usual downpour drenched the Washington metropolitan area day after day beginning the first week of January, which was abruptly followed by cold—bitter cold . . . then snow. It will have to go some to beat last year's severe winter, but it does remind us that a drop from 62

degrees F. to the teens in one day is not uncommon in Washington. Readings of 8 and 10 degrees with winds up to 50 miles an hour dropped the chill factor well below zero. Then came the snow, more snow, more high winds, heavy rain and bitter cold. This is *not* the time of year for Goddard people stationed in sunnier climates to make a trip back to Washington.

## IUE LAUNCHED

The National Aeronautics and Space Administration, in cooperation with the European Space Agency (ESA) and the British Science Research Council (SRC), launched an International Ultraviolet Explorer (IEU) spacecraft into a modified synchronous orbit on January 26. The satellite blasted off from Cape Canaveral, Fla., aboard a Delta rocket.

It is believed that more astronomers from the world scientific community will use the IUE than any previous satellite. Almost 200 astronomers from 17 different countries already have been selected to conduct observations with it.

Their studies will range from the planets in our own solar system to some of the most distant objects in the universe, and take aim at most of the major problems facing modern astronomy.

On the IUE study-list are:

- many of the wide range of stars that compose our galaxy and how they are born, live and die
- the material between these stars from which they are formed and are still forming
- many of the strange objects that are emitting radio waves or x-rays, or both
- the sedate nearby galaxies and the distant, violent quasars
- our planetary neighbors and their satellites.

Until 20 years ago, when the space age began, most astronomical discoveries were based on the visible light received by ground-based telescopes, even though radio astronomy became an astronomical tool alongside optical astronomy after radio waves were found to be bombarding Earth from space in 1931. Most other radiation is absorbed by the Earth's atmosphere.

With spacecraft, man for the first time was able to systematically examine other parts of the energy spectrum above the absorbing effects of the atmosphere. Within a few years astronomers moved from exploration to exploitation—the observation of objects and phenomena in much greater detail.

See IUE, Page Two

## GODDARD HAD ACTIVE LAUNCH SCHEDULE IN 1977

It was a busy year for Goddard's Delta rocket team in 1977 with an almost once a month launch rate. The same type of schedule faces the Delta team again in 1978.

Deltas carried only one Goddard payload in 1977, GSFC's International Sun Earth Explorer-1. It was placed in orbit October 22, in tandem with the European Space Agency's ISEE-2.

The two International Sun Earth Explorers are expected to provide detailed data on how solar wind particles control the boundaries between Earth space and interplanetary space.

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## NASA SCHEDULES 25 LAUNCHES IN 1978

Twenty-five launches, including 11 Delta launch vehicles and eight Atlas Centaurs, have been scheduled by NASA in 1978.

NASA personnel will also provide support in connection with three Atlas-F space launches from Vandenberg Air Force Base, Calif.

Most of the launches in 1977 emphasized the use of space for the direct benefit of people on Earth—such as communications, geodetic, environmental, navigation, meteorological and Earth resources.

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*IUE—From Page One*

## IUE FREES ASTRONOMERS FROM EARTH'S SHROUD

Dense objects, quasars, pulsars, neutron stars, possible black holes, etc., provide tempting targets for the IUE.

Quasars, for example, are found all the way in from the edge of the known universe some 13 billion light years away to galaxies 2 billion light years away. They are the most powerful and puzzling transmitters of energy known.

They are less than ten light years in diameter compared to 100,000 light years of the typical galaxy of 100 billion stars; yet, they pour out 100 times more energy. How this enormous energy is generated is a complete mystery. There is no known physical process to account for it.

### Answers in the Ultraviolet

It is expected that new knowledge may be obtained by examining in detail relatively nearby quasars in the UV and then comparing these data with those from the more distant quasars seen by ground observatories in visible light.

X-ray sources, especially those seen in binary star systems, will be examined intensively early in the IUE mission during a two-week period devoted exclusively to data gathering by scientists from the three agencies, NASA, ESA and SRC. At the same time IUE is looking at binary systems, two other satellites, NASA's Copernicus and the United Kingdom's Anik-5, as well as numerous ground observatories throughout the world will be observing in other wavelengths.

The objective is to gather more information on such intriguing objects as neutron stars or possible black holes that are believed to be part of some binary systems.

In visible light only the primary source is seen. But in the X-ray wavelength a small, very dense companion star's effects on the visible star is deduced simply by observing the X-rays which must be emitted when material is pulled from the visible star and accelerated into the companion by tremendous gravitational forces that could exist only if the companion were a neutron star or a black hole.

It is hoped that IUE will be able to see the material pulled from the visible star in transit to the black hole. This has never been seen before and if it is seen it will verify our deduction that these systems contain massive, highly condensed stars.

### The Monumental Question

Although IUE is not expected to answer the monumental question all science has been trying to solve, the oscillating versus steady state theories of the universe, it is possible it will get an indication of whether or not there is intergalactic material. None is known to exist, but IUE might detect the presence of intergalactic helium which could be confirmed or disproved by the later, more sophisticated Space Telescope (ST).

If indications of such material could be found, a means for solving the problem may be at hand.

The problem with the oscillating universe concept has been that there is not enough known matter in the universe to produce the gravitational effect necessary for the galaxies to fall back on themselves again, forming another unimaginably dense egg that would again explode, the primeval big bang, to repeat the entire process.

If intergalactic matter is found, then it could ultimately be examined as to mass and distribution. If there is matter between the galaxies it could account for the missing mass.

The steady state theory has it that as the galaxies fly apart, new and sufficient matter is being created between them to make new galaxies in a never ending process.

### Studying Our Galaxy

The Interstellar medium of our galaxy and even the planets of our own solar system will also come in for intensive study.



IUE Launched From Cape Canaveral, January 26

In our own galaxy the new spacecraft will look at hot star surfaces and the coronas and chromospheres of "cool" stars.

IUE will provide a rehearsal of one of the most important objectives of the ST which is to provide a system for observing the universe by astronomers of all nations while utilizing techniques with which they are familiar. In other words they will be able to operate much as they normally do in a ground-based observatory.

Goddard designed, integrated and tested the IUE spacecraft on Center. GSFC also provides the U.S. ground support facilities. ESA built the solar array and the Madrid ground facilities. In the United Kingdom, SRC in collaboration with University College, London, provided the four television camera detectors for transforming the spectral displays into video signals for transmission to the ground.

In accordance with agreements between the three participating agencies, viewing time will be allocated on a one third, two-thirds basis. NASA will have 16 hours viewing time and then hand the spacecraft over to ESA for an eight-hour viewing time to be shared equally between ESA and the United Kingdom.

Goddard directs the Delta rocket program for NASA and McDonnell Douglas Astronautics Co., Huntington Beach, CA., is prime contractor.

## GODDARD JOG-A-THON FOR THE HEART ASSOCIATION

February is National Heart Month. During this month, the Heart Association of Southern Maryland will be conducting its annual fund drive.

Heart Association activities include blood-pressure and cholesterol screening, testing for heart arrhythmia and heart health education. These and voluntary contributions are their only means of support.

Goddard runners are participating during February in a Jog-A-Thon to benefit the Heart Association fund drive. Sponsors pledge a donation for each mile a particular jogger runs that week.

## NASA 1977 HIGHLIGHTS

As the Space Shuttle Orbiter, Enterprise, easily passed two series of manned tests on earth last year, two Voyager spacecraft set out on a journey to the outer reaches of the solar system. These were the highlights of NASA's 1977 activities.

In February, the 10-month-long series of low altitude flights to verify the aerodynamic and flight control characteristics of the first Shuttle Orbiter began at NASA's Dryden Flight Research Center, Edwards, Calif.

Following several taxi tests of the modified Boeing 747 carrier aircraft with the Enterprise attached on top, the first flight of the mated pair occurred Feb. 18. This series of five captive inert flights (Orbiter unpowered and unmanned), which proved the flightworthiness of the combination, was followed by three captive active flights when the Orbiter systems were powered up.

On Aug. 12, the 75-ton Enterprise was flown to an unpowered landing on the Edwards dry lake bed runway. The maiden free flight of the Orbiter took 5 minutes 22 seconds.

Subsequently, the Shuttle Orbiter was flown for two more free flights with the final free flight on Oct. 26 landing the Orbiter on a hard surface runway rather than the huge expanse of the dry lake bed.

The Enterprise was being prepared at the end of the year for a cross country flight aboard the carrier aircraft to NASA's Marshall Space Flight Center, Huntsville, Ala., in March 1978.

NASA continued its systematic program of planetary exploration of the solar system with the launch in August and September 1977 of two Voyager spacecraft toward the outer reaches of the solar system. The 10-year odyssey will take the Voyagers past giant Jupiter, to ringed Saturn and probably to Uranus.

Carrying a dozen scientific instruments and television cameras, the spacecraft promise to return first-hand information on

the giant planets that will give us exciting new clues to the early history of the solar system and our own planet Earth.

Both Voyagers will depart the solar system to journey nearly endlessly among the stars. On the chance that someone is out there, each of the Voyagers carries a phonograph record containing "Sounds of Earth" and electronic information that an advanced technological civilization could convert into pictures and diagrams.

The oft-delayed launch of NASA's first High Energy Astronomy Observatories, HEAO-1, took place in August, inaugurating a three-mission program to study some of the most intriguing mysteries of the universe—pulsars, quasars, exploding galaxies and black holes in space.

In fact, HEAO-1 may already have discovered a black hole. Dr. Herbert Friedman, of the Naval Research Laboratory, Washington, D.C., says there is an object in the constellation Circinus which exhibits many of the characteristics of a black hole, but he feels more observations are necessary before he can come to a definite conclusion. HEAO also discovered a mysterious x-ray nova, a gigantic star whose x-radiation increases violently then returns to normal.

The beginning of 1977 marked the end of the normal missions of Vikings 1 and 2 on Mars, and the beginning of the "extended" missions that will permit scientific observations through an entire Martian year of 25 months. In February, Viking 1 orbiter cameras took the most detailed pictures yet of Mars' tiny moon Phobos from a distance of less than 48 kilometers (30 miles).

At year's end, plans were moving ahead for the late 1978 launch of Pioneer Venus, a multiprobe craft designed to provide the clearest pictures yet of the cloud-shrouded sister planet to the Earth.

## CAREER RESOURCE CENTER

Like to do it yourself? Then the Career Resource Center may be the answer for you.

The CRC is an individually directed career planning service. It contains materials and activities which help individual employees to collect information about their skills, abilities, interests as well as information about career models and paths at GSFC. Also, employees are aided in formulating and carrying out their own career action plans.

The Resource Center process is designed to meet individual needs. As a first step employees are directed to an orientation area, to view a short video tape and answer a series of questions. Based upon an employees answers to these questions, they are directed to one of three learning stations: Self Assessment, Environmental Assessment or Taking Action. At each of these stations employees read materials and engage in related activities.

Time spent in the Resource Center can range from 15 minutes to several hours.

The Career Resource Center is part of an integrated program of career planning and development services offered to GSFC employees by the Career Development Center. It is designed for all employees, clerical support personnel through management. Career Development staff people are available to work with employees when further help is needed. Also, the CRC houses an extensive collection of career related books which can be checked out.

The CRC is designed as an informal, confidential service for all employees. Employees completing the process will receive their own three dimensional career development pyramid. Managers may want to familiarize themselves with this resource so they can apprise their employees of its capabilities.

For more information call x6703 in building 99, 1st floor.



Stephen E. Klee of Hammond Elementary School, Laurel, MD, receives a gift as the 100,000th visitor at the Visitor Center, Goddard Space Flight Center, Greenbelt, MD. Shown presenting Stephen his gift is Glenn Pearson, Manager of the Visitor Center.

## TRACKING STATION MONITORS VOLCANO

The tallest active volcano in the world, almost six km. (3.75 miles) high Cotopaxi volcano in Ecuador, some 60 km (37.5 miles) south of Quito, is transmitting continuous information on its rumbles and grumbles as a result of Goddard concern about possible damage to the Spaceflight Tracking and Data Network (STDN) station located near Cotopaxi's base as well as concern for the thousands of people living in the nearby valleys.

Last May Dr. Richard Allenby, of GSFC's Geophysics Branch installed a geophysical monitoring system consisting of a single axis vertical seismometer and two tiltmeters. He worked with the Quito-STDN Director, Chester Shaddeau and Acting Director Salvador Rubio as well as Dr. Minard (Pete) Hall, a geology professor at Ecuador's Escuela Politecnica National.

According to Allenby, the project director, the data from the instrumentation are transmitted by radio to the STDN station where they are quickly reviewed and then sent daily to Dr. Hall for analyses. Any unusual volcanic activity that Hall might identify will be immediately relayed back to the station as well as to Ecuadorian authorities.

This is the only permanent volcano monitoring system in South America and was installed last year because of the long and frequent history of eruptions by Cotopaxi, some 50 since 1738. The last major eruption was 60 years ago, however, there has been minor activity off and on since then with definite signs of renewed activity in 1975.

In 1976, Dan Miller and Donald Mullineaux, of the United States Geodetic Survey, said they felt an eruption was possible within the next few years and talked about the desirability of an early warning system.

As a result of the director's concern with the safety of the 30 to 150 people at various times working at the STDN station as well as tens of thousands of people living in the valley, not to mention the STDN equipment, it was decided to install the equipment. It is located about 7 km. (4½ miles) northwest of the summit and 10 km. (6 miles) from the tracking station.

The seismometer and its pre-amplifier, encased in a sealed plastic tube, were set about a meter (three feet) underground. The rest of the field instruments and batteries were installed in special, buried 50 gallon oil drums. All connecting lines were buried and the transmitting antenna was placed on top of a 3.1 meter (ten foot) pipe set in cement. A fence was later placed around the antenna to protect it from wild horses rubbing against it.

So far there is no indication of any major activity from Cotopaxi, but there are frequent local ground motions of significant activity attributable to ground motions along a nearby active fault zone. Thus, the station is also proving valuable for studying an area where dangerous earthquakes may occur.



Installing a tiltmeter. Left to right are: Cesar Penafiel, Dick Allenby and Patricio Ramon. Behind them in the clouds is Cotopaxi, the world's tallest volcano. The volcano showed signs of renewed activity in 1975.

## MAGAZINE SEEKS SPACE STORIES

*Deadline Nov 1.*

*The Michigan Quarterly Review*, a University of Michigan publication, is seeking original material on the theme, "The Moon Landing and Its Aftermath."

The publication, which once was a literary magazine, is interdisciplinary in its focus and is devoting its entire spring issue to space consciousness.

According to Review editor, Laurence Goldstein, the magazine is looking for as many as 200 pages of essays, memoirs, interviews and graphics (especially previously unpublished photos).

"I'm looking for work that is thoughtful, original . . . a new perspective on a much publicized event," said Goldstein.

The journal promises \$5 to \$8 payment per printed page. The deadline for submissions is November 1, 1978. Papers should be under 30 pages in length, and mailed with a self addressed, stamped envelope.

This year the journal published works by Arthur Miller, Walter Perry, Joyce Carol Oates and Jorge Luis Borges, said Goldstein.

The magazine circulates to libraries around the world as well as to individuals.



"Ambassador Richard J. Bloomfield presents GSFC's Salvador V. Rubio, Training Supervisor at the Quito, Ecuador STDN Station, with the trophy signifying Sal's winning of the Men's Low Net in the Department of State's 24th. annual World-Wide golf tournament. (For all of you other sandbaggers—it was a new 71!)"

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## LANDSAT PICTURE-BOOK TAKES NATIONAL AWARD

Four Goddard scientists received a scientific literature award March 1 for their picture-book on Landsat.

Their work, *Mission to Earth, Landsat Views the World*, has been recognized by the American Society for Photogrammetry as "an outstanding exposition in imagery interpretation."

The national society, which has promoted aerial photography since 1934, presented Drs. Nicholas Short, Stanley Fredan, Paul Lowman and William Finch (now back at San Diego University) with an Autometric Award during its annual convention at the Washington Hilton Hotel.

The award is given for the year's best literature on earth photography in Canada or America, and includes \$100 and a plaque.

*Mission to Earth* was first published by the Government Printing Office last year in March, and was reissued again this month. To date, 50,000 copies of the book have been printed.

### A labor of love

According to Short, the book "began as a labor of love."

It was conceived about four years ago as Short, a Landsat 1 geologist, watched the first images taking shape from the satellite. "We'd better get started right now in picking the best to come for a picture-book!" he exclaimed.

Lowman, another Landsat geologist, and Fredan, a nuclear physicist in Missions Utilization, joined him in the effort of analyzing pictures and writing a text.

Finch tackled the caption writing. On sabbatical from San Diego University, he spent much of 1972 and 1973 as an associate in the Landsat program at Goddard.

Four years and some 100,000 pictures later, *Mission to Earth* was published.

Its purpose, said Short, was primarily to show the public what Landsat was trying to do. The authors intended the book to be useful to geologists, travellers, outdoorsmen, research professors and high school students. They included pictures of every corner of the world, explained how Landsat works and detailed its applications.

A companion "guide" to the book (for teachers) is being readied now by the Educational Office at Goddard.

*Mission to Earth* has been translated into Japanese and the Germans have expressed a similar interest. The Guinness Book of World Records wants to use some Landsat pictures for their next edition.

"I am very flattered by the (ASP) award," said Fredan. Lowman added that he was delighted by it. Neither have immediate plans for another book, they said.

But Short said he would love to do a sequel or a supplement. Perhaps a "computer guide to Landsat" using computerized pictures. So far, he reported, he has already received letters from Gerald Ford and the late Hubert Humphrey for his first effort.

## LANDSAT 1 RETIRES AT AGE 5

Landsat 1, the world's first spacecraft designed to monitor and discover the Earth's natural resources was retired by NASA Jan. 16, 1978, after operating five and half years in outer space. The multispectral scanner, a camera-like device carried by Landsat 1, has revolutionized the technology of observing the Earth from space.

Designed with a life expectancy of only one year, Landsat 1 was launched in 1972. The spacecraft "more than achieved its goals, in fact, beyond any stretch of the imagination," said Ron Browning, Landsat Project Manager at NASA's Goddard Space Flight Center in Greenbelt, Md.



Radio Club officer Hugh Turnbull (right) presents guest speaker Stuart Meyer with a Landsat photo. Mr. Meyer entertained club members with a talk on "The History of 2-Way Radio" accompanying a slide presentation.

## AMATEUR RADIO CLUB

By Susan Bennett

One of the most exciting facets of technology today is communications. And Goddard's Amateur Radio Club does communicate—to all areas of the globe!

Amateur radio is a very personal form of communications. It is listened to, and participated in, by people of all sexes, ages, and professions. The beauty of amateur radio is that it has something to offer everyone; from the non-technical to the highly complex, providing knowledge and familiarization of many parts of the world and it's people.

First organized in 1968, the Goddard Amateur Radio Club is affiliated with the American Radio Relay League, a member of the Foundation for Amateur Radio, and a member of the Amateur Satellite Corporation, a group the builds satellites for use by radio amateurs.

Activities are many and varied in Goddard's Amateur Radio Club. The members hold monthly meetings, conduct technical workshops to build and repair equipment, promote contests, feature guest speakers, and provide instruction to prospective new amateurs (hams) of all ages.

The Club has sponsored commemorative operations for special events such as Skylab, Apollos 16 and 17, and Apollo-Soyez by monitoring and relaying information. The numerous worldwide contacts during these events are confirmed with specially designed "QSL" cards featuring the commemorative event.

Goddard amateurs enhance their efforts even more by supporting the OSCAR (Orbital Satellite Carrying Amateur Radio) Satellite Program by relaying information during emergency situations such as floods, earthquakes, tornados, accidents, etc. and by doing so project Goddard's image around the world.

Amateur radio can hold fascination for all ages. Visitors are always welcome at the Club station (adjacent to the Goddard Transportation Center) and anyone interested in obtaining more information about the Club and it's activities is invited to contact any one of the Club officers. Mr. John South, the Club President, and Mr. Hugh Turnbull, the Publicity Chairman, can be reached on x 2392.

Year Past—From Page One

## ACTIVE DELTAS

The year started out with the launch of a communications satellite for the North Atlantic Treaty Organization, NATO-IIIB. On January 28 it was placed into the expected orbit by Delta. The same was true March 10 for PALAPA-2, the second communications satellite placed in synchronous orbit for Indonesia by NASA.

Then on April 20 ESA's Geodetic Earth Orbiting Satellite-1, GEOS-1, was launched on board Delta 130, but the third stage separated prematurely probably because of a clamp bolt failure causing the spacecraft to be placed into an improper orbit.

Everything went well with the next three launches. The National Ocean and Atmospheric Administration's GOES-2 meteorological satellite was put up in time to keep watch during the hurricane season.

GMS, Japan's Geosynchronous Meteorological Satellite, was placed in orbit over the Pacific Ocean July 14 to watch the weather from Hawaii to Pakistan.

### Italy Goes Into Space

Next came Italy's SIRIO satellite, launched August 25, the first Italian experimental communications satellite. A Delta third stage spacecraft separation system problem had cropped up causing a launch delay earlier in the month, but it was quickly solved and SIRIO was placed in precise orbit over the Atlantic Ocean.

Because of the GEOS failure, launch officials were taking no chances. Every time an anomaly would show up in prelaunch testing it would be followed down to the last digit to make certain it would not pop up again during the launch phase to endanger the mission.

During the next launch, September 13, ESA's Operational Test Satellite, which was scheduled to be the forerunner of similar spacecraft designed to serve European telecommunications in the 1980's, the booster exploded 55 seconds after liftoff. This was a severe blow. The Delta people went into around-the-clock investigations and simulations to trace the cause, which they quickly did, even as the next two spacecraft, NASA/ESA's ISEE-A&B were being readied for launch on the same rocket.



This picture shows Ms. Nitza Cintron and Ms. Dora Puleo, GSFC Spanish Speaking Program Coordinator, during a visit to the Air and Space Museum and NASA Headquarters. Ms. Cintron is a Puerto Rican woman finalist for the Mission Specialist Position of the Space Shuttle Program. She has a B.S. degree in Chemistry from the University of Puerto Rico and a PhD from the Johns Hopkins University in Baltimore. Ms. Cintron is very enthusiastic about her participation as a finalist and her visit to the Johnson Space Flight Center, where she underwent a series of tests, interviews and meetings. Ms. Puleo reports that Ms. Cintron was one of two minority women among the twenty-one women finalists.

The cause was traced to one of the solid propellant strap-on Caster IV rockets that apparently ruptured shortly after liftoff causing the booster stage to explode. The strap-ons for the ISEE mission launch vehicle were Caster IIs which had a long success record.

### Go-No-Go

Even as the ISEE payload was on the stand ready for launch the final go-no-go decision for the mission was being made by all concerned. Another factor providing even greater pressure was that an Atlas/Centaur carrying an INTELSAT communications satellite had exploded September 29, at the same time after liftoff as the Delta carrying OTS (55 seconds). From a technical standpoint there was no connection.

It seemed that everyone concerned with the ISEE launch held his breath during the countdown phase, came up for air at liftoff, and didn't breathe again until the spacecraft was placed in the correct orbit. "Right on the money," launch officials said. Delta Project Manager Dave Grimes in one of the year's best understatement told a post launch press conference, "It's much easier this way."

The next two launches should have been uneventful, a piece of cake, as they say. One of them was.

But ESA's Meteosat, Europe's contribution to a worldwide meteorological program, turned out to be a cliff-hanger of sorts too.

Scheduled for November 17 it was slipped to Sunday the 20th because a bipropellant valve in the 2nd stage had to be replaced. There had also been a spurious signal detected November 16. It was an extremely low signal, but at high enough power it would be capable of activating the Delta command destruct system.

### Scrubbed at T Minus Two

On Sunday, the valve was replaced, but the strange signal source had not been found. The launch was rescheduled for Monday and went right up to T minus two hours before it was scrubbed again. Spurious signals still not found. By this time the signal source was of great interest nationally and internationally.

On Tuesday morning the NASA officials had convincingly identified the source to be the Redstone Tracking ship in Port Canaveral and, after all other possibilities were ruled out, a definite decision was made to go. The announcement to go was made about three hours before liftoff. And go it did. Meteosat was placed in the right transfer orbit by Delta and finally kicked into the desired synchronous orbit by its onboard apogee boost motor.

The last launch of the year was CS, Japan's first communications satellite. Named Sakura or Cherry Blossom after Japan's national flower, it was placed in orbit December 14 by the Delta. It is scheduled for communications and television service among the Japanese islands on an experimental basis.

The only glitch in the launch phase was a 10 minute hold to allow a Liberian freighter to clear the area. But as Grimes said after launch, "Success is a nice way to end 1977."

—NASA—

## GENERAL INFORMATION

During the Spring semester of 1978, Prince George's Community College (PGCC), Bowie State College (BSC), and George Washington University (GWU), will present a number of college courses for Federal and contract employees of GSFC. PGCC and BSC will offer undergraduate courses, and GWU will offer two graduate courses in Engineering Administration. The classes will meet on-center, Mondays through Thursdays (one class per week), from 5:00 to 7:30 or 8:00 p.m. depending upon classroom breaks.



"The Quito STDN Station, with the help of Public Affairs Offices at GSFC, JPL and JSC, assembled and presented an exhibit at the "Expoferia", an industrial fair celebrating the founding of Quito, Ecuador, from 26 November to 4 December.

In the photo left to right are U.S. Ambassador to Ecuador, Chet Shaddeau, and Sal Rubio.

## 1978—From Page One

# NASA SCHEDULE

In 1978, plans call for missions virtually equally divided between emphasis on these applications and launches of spacecraft for primarily scientific and exploratory research.

Fifteen launches in 1978 will be for paying customers other than NASA. They include the European Space Agency (ESA), Comsat Corp., the U.S. Navy, Japan, the National Oceanic and Atmospheric Administration (NOAA), the United Kingdom and Canada.

During 1977 the Agency logged 16 launches—12 of them "reimbursables," for paying customers.

With 25 launches scheduled in 1978, the expendable vehicles workload will be heavy throughout the year. There were two January launches and three or more are scheduled in some other months.

Ten of the Deltas will be launched from Cape Canaveral, and one from a Western Test Range (WTR) launch pad at Vandenberg AFB. All of the Atlas Centaurs will be launched from Complex 36 at the Cape.

### First Launch of the Year

First launch of the year was Intelsat IV-A (F-3), Jan. 6, one of a series of International Telecommunications Satellite Organization spacecraft. A second, Intelsat IV-A (F-6), could be launched in February. Both go on Atlas Centaurs.

FLTSATCOM-A, the first of a series of geosynchronous orbiting spacecraft in a new Navy worldwide communications system, was launched February 9.

An International Ultraviolet Explorer (IUE) was launched on a Delta from Cape Canaveral, Jan. 26.

### Landsat-C Scheduled

Landsat-C is scheduled for launch on a Delta from Vandenberg March 5. The picture-taking satellite will join Landsat-2 in polar orbit to expand NASA's program for cataloging the Earth's resources and monitoring changing environmental conditions. Landsat-1 was turned off in early January.

Launch of an experimental broadcasting satellite, Japan-BSE, for research leading to the orbiting of future large-scale broadcasting satellites by the island nation, is scheduled on a Delta from Cape Canaveral March 23.

The launches of Intelsat IV-A (F-6) on an Atlas Centaur and a backup ESA Orbital Test Satellite (OTS) on a Delta from Cape Canaveral are scheduled in April. An earlier attempt to orbit an OTS failed when Delta-134 exploded shortly after liftoff Sept. 13, 1977.

### Heading for Venus

Pioneer Venus-A, the first of two missions to examine the Venusian atmosphere and the planet's weather, is scheduled for launch on an Atlas Centaur in May. Pioneer Venus-A's mission is to place its spacecraft in orbit to examine the upper atmosphere.

Pioneer Venus-B will be launched on an Atlas Centaur in August. A multi-probe, it is scheduled to enter the Venusian atmosphere six days after arrival of the orbiter. The spin-stabilized multi-probe spacecraft consists of a bus, a large probe and three identical small probes, each with scientific instruments.

The probes will be released from the bus 20 days prior to arrival at Venus. The large probe will conduct sounding of Venus' lower atmosphere, measuring clouds as well as atmospheric structure and composition. The smaller probes, entering at widely separate points, will provide information on the general circulation patterns of the lower atmosphere.

### June Backup Shots

A Japanese spacecraft that would be launched on a Delta from Cape Canaveral if an earlier Japanese mission is not successful, is on the schedule for June. If the Japanese spacecraft is not required, ESA GEOS-2, a scientific satellite, will be launched on a Delta in June. GEOS-1, launched from the Cape April 20, 1977, did not reach its intended orbit, although the spacecraft is transmitting data back to Earth and the mission is listed as partially successful.

Tiros-N, the first in a new series of polar orbiting weather satellites will be launched on an Atlas-F from the Western Test Range in July.

Also scheduled for July launch is International Sun Earth Explorer-C (ISEE-C) on a Delta from the Cape. ISEE-C will be orbited at the libration point between the Earth and the Sun, a point in space where the force of gravity and dynamic force exert an equal pull.

From there it will obtain data on solar wind similar to, but from a different location than, that obtained by ISEE-1 and ISEE-2. ISEE-1, developed by NASA, and ISEE-2, developed by ESA, were launched in tandem on a Delta, Oct. 22, 1977.

NATO-III-C, a North Atlantic Treaty Organization communications satellite, is on the launch schedule for September. Launch will be on a Delta from Cape Canaveral.

Telesat-D, a domestic communications satellite that will be renamed Anik-4 in orbit, will be launched for Telesat Canada in November. Launch will be on a Delta from Cape Canaveral.

### HEAO-B To Go Up

High Energy Astronomy Observatory-B (HEAO-B) is scheduled for launch on an Atlas Centaur during October. HEAO-B will maneuver and point for long periods of time at selected celestial X-ray sources mapped earlier by HEAO-A and other X-ray spacecraft. HEAO-1 was launched Aug. 12, 1977. Another FLTSATCOM spacecraft is scheduled for launch during November, also on an Atlas Centaur.

Scheduled for launch on Atlas-F launch vehicles from Vandenberg are Seasat-1, a NASA polar orbiting spacecraft for global monitoring of the oceans and ocean phenomena, in May; TIROS-N, a NASA polar-orbiting experimental weather satellite, in July; and NOAA-A, a polar-orbiting weather satellite for NOAA in October.

A possible Delta call-up launch is on the 1978 schedule. If required to replace a presently operational spacecraft, Geostationary Operational Environmental Satellite-C (GOES-C) would be launched from Cape Canaveral. In addition, Nimbus-G, a NASA research satellite for testing sensors for oceanographic and meteorological monitoring, is planned for launch from Vandenberg in August in a Delta.

## Goddard Mourns . . .

James McCann, Air Conditioning Engineer, Code 293, died January 6, 1978.

Date	Payload	Launch Vehicle	Launch Site	Reimbursable	Remarks
*Jan. 6	Intelsat IV-A (F3)	Atlas Centaur	KSC	Yes	Communications satellite for Comsat Corp.
*Jan. 26	IUE-A	Delta	KSC	No	International Ultraviolet Explorer, space science.
*Feb. 9	FLTSATCOM-A	Atlas Centaur	KSC	Yes	Fleet Satellite Communications for Navy.
March 5	Landsat-C	Delta	WTR	No	Polar-orbital ecological data satellite.
March 23	Japan/BSE	Delta	KSC	Yes	Experimental broadcasting satellite for Japan.
February	Intelsat IV-A (F6)	Atlas Centaur	KSC	Yes	Communications satellite for Comsat Corp.
April	HCMM	Scout	WTR	No	Heat Capacity Mapping Mission to produce thermal maps of atmosphere.
April	OTS-BU	Delta	KSC	Yes	Third in a series of domestic communications satellites.
May	GOES-C	Delta	KSC	Yes	European Space Agency Orbital Test Satellite.
April	Comstar-C	Atlas Centaur	KSC	Yes	Geostationary Environmental Satellite for Earth imaging.
May	Pioneer Venus-A	Atlas Centaur	KSC	No	Planetary mission to Venus, studies of solar wind.
May	Seasat-A	Atlas-F	WTR	No	Sea satellite for global ocean monitoring.
June	ESA/GEOS-B	Delta	KSC	Yes	ESA spacecraft to study atmospheric radiation, particles.
June	Japan-BU	Delta	KSC	Yes	Backup satellite for Japan.
July	UK-6	Scout	Wallops	Yes	United Kingdom satellite to measure radiation particles.
July	ISEE-C (TIROS-N)	Delta	KSC	No	International Sun Earth Explorer to work with A and B missions.
July	TIROS-N	Atlas-F	WTR	No	The first in a new series of polar orbiting weather spacecraft.
August	Nimbus-G	Delta	WTR	No	Weather and oceanographic satellite.
August	Pioneer Venus-B	Atlas Centaur	KSC	No	Venus multiprobe mission to study planet's atmosphere.
September	Navy-20	Scout	WTR	Yes	Navy navigation satellite, callup.
September	NATO-III-C	Delta	KSC	Yes	NATO communications satellite, second in series.
October	NOAA-A	Atlas-F	WTR	Yes	Advanced operational prototype weather satellite.
October	HEAO-B	Atlas Centaur	KSC	No	Second High Energy Astronomical Observatory to study space radiation.
November	Telesat-D	Delta	KSC	Yes	Canadian domestic communications satellite.
November	FLTSATCOM-B	Atlas Centaur	KSC	Yes	Fleet Satellite Communications for Navy (second).

\* Launched