ESSA II: Satellite Launch Marks New Departure and New Management

At 0858 on the NASA clocks at Cape Kennedy on the morning of 28 February a Delta rocket was launched flawlessly after a clockwork countdown. The skies over central Florida were cloudy that morning, and watchers a few miles down the beach saw a fireball rise rapidly from the horizon, appear intermittently through rifts in the clouds, and then disappear before the rumble of the launch reached them. About 18 minutes after lift-off the announcement came that the ESSA II weather satellite had been successfully put into a slightly elliptical orbit more than 800 miles out.

At the Cape the launch was treated as rather routine, although preparations by the project personnel and the launch crew were anything but perfunctory. It is true that the Delta launch vehicle which carried the satellite into space was number 37 in a series which has suffered only three failures, and the performance of weather satellites has been generally exemplary. But the capabilities of the new satellite made the launch worthy of special notice.

The 285-pound (130-kilogram) ESSA II satellite, which is in a near-polar orbit, will take pictures continually over sunlit portions of the earth and transmit them almost immediately. Any ground station within range which has the relatively simple equipment needed to receive and translate the satellite's signals can produce cloud-cover pictures covering a 4-million-mile area in a matter of minutes. Taken together, ESSA II and its immediate predecessor, ESSA I, which was launched in early February, make up what has been dubbed the TIROS Operational Satellite System (TOS).

The name ESSA II (which derives from environmental survey satellite) echoes the acronym of the satellite's sponsoring agency, the Environmental Science Services Administration (also called ESSA) of the Department of Commerce. The TOS system is financed by ESSA, with NASA acting as a contractor responsible for procurement, launching, and initial checkout of the satellite. (ESSA also financed ESSA I and an earlier TIROS which was a prototype of ESSA II.)

The TOS system currently employs two satellites with different camera systems. ESSA I is equipped with an Advanced Vidicon Camera System (AVCS), which takes and stores global cloud pictures and then transmits them when the satellite is within range of either of two "command and data acquisition stations," one near Fairbanks, Alaska, and the other at Wallops Island, Virginia. ESSA II's two cameras constitute an Automatic Picture Transmission (APT) system. ESSA II will transmit pictures continuously while it is over illuminated portions of the earth. Anyone with suitable equipment can make use of these pictures. The United States now has about 45 stations so equipped around the world, and 20 more are projected. Foreign nations are known to have about 30 stations already in operation. A station in Poland is the only one known to be operating in Red-bloc countries, although it is very likely that there are others. Receiving equipment of the type used by the federal government costs above $30,000, but it appears that workable receivers can be improvised for much less. One electronics engineer in Moorestown, New Jersey, was reported to be receiving pictures of acceptable quality with equipment costing about $600. (The quality of AVCS's pictures is supposed to be better than that of APT's, but ESSA officials say they are pleased with the cloud-cover pictures from ESSA II.)

ESSA II will come within the 2100-mile receiving range of any station on two or three orbits each day. Two or three pictures, each covering about 4 million square miles, can be received on each orbit. The APT system does not store pictures, and ground stations will receive only "local" pictures transmitted while the satellite is within receiving range.

This "local readout" feature is what makes the TOS system operational in a sense in which the previous ten TIROS satellites were not. The TOS system provides global data on a continuous basis. And the faster rate of delivery of data to weather forecasters around the world should make the data more useful for putting out severe-weather warnings in fast-developing situations and for providing information to guide the selection of aircraft and shipping routes.

The TOS system is the latest and perhaps most significant American contribution to the "world weather watch" concept which began to develop when the United States orbited the first TIROS in 1960. TOS fits in well with the United Nations' prescriptions for the peaceful uses of outer space, and the system has been enthusiastically endorsed by the World Meteorological Organization and other international scientific groups.

As an American enterprise, the TOS system is really the first installment of the National Operational Meteorological Satellite System authorized by Congress in 1961. Details of the system were agreed on in 1964 by the Department of Commerce, NASA, and the Department of Defense, which is an avid consumer of weather information.

Financing of the overall TOS system, which will require an estimated $30 million a year for the total program, has been assigned to the Department of Commerce's Environmental Science Services Administration. ESSA was created last year by the merging of the Weather Bureau, the Coast and Geodetic Survey, and the Central Radio Propagation Laboratory.

Actual management and operation of the system is to be handled by ESSA's National Environmental Satellite Center at Suitland, Maryland. Under the present arrangement, NASA acts as contractor to ESSA. The center was scheduled to take over full control of ESSA II and supporting ground systems this week.

The National Meteorological Center of the Weather Bureau has the job of integrating the cloud maps with data obtained by conventional means around the world and of relaying the results to field stations in the United States and abroad.

Further technical improvements in the TOS system are anticipated. Combination of AVCS and APT camera systems in a single satellite is one expected refinement, and use of so-called High Resolution Infrared Radiometer

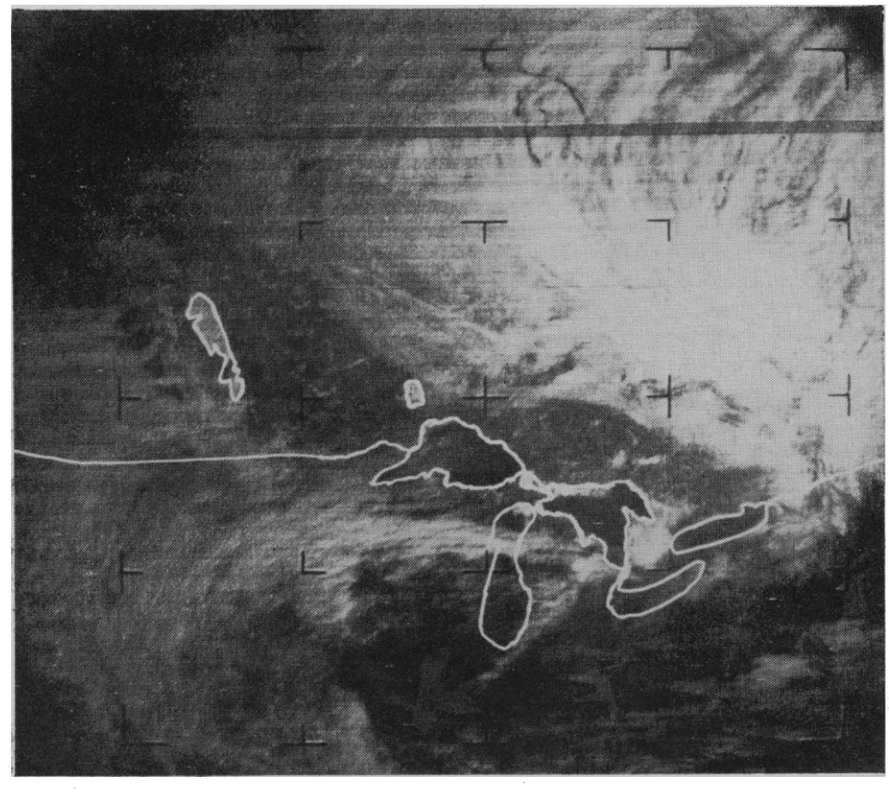
(HRIR) equipment developed for the Nimbus satellite series is another. HRIR gives promise of providing cloud pictures in darkness operationally.

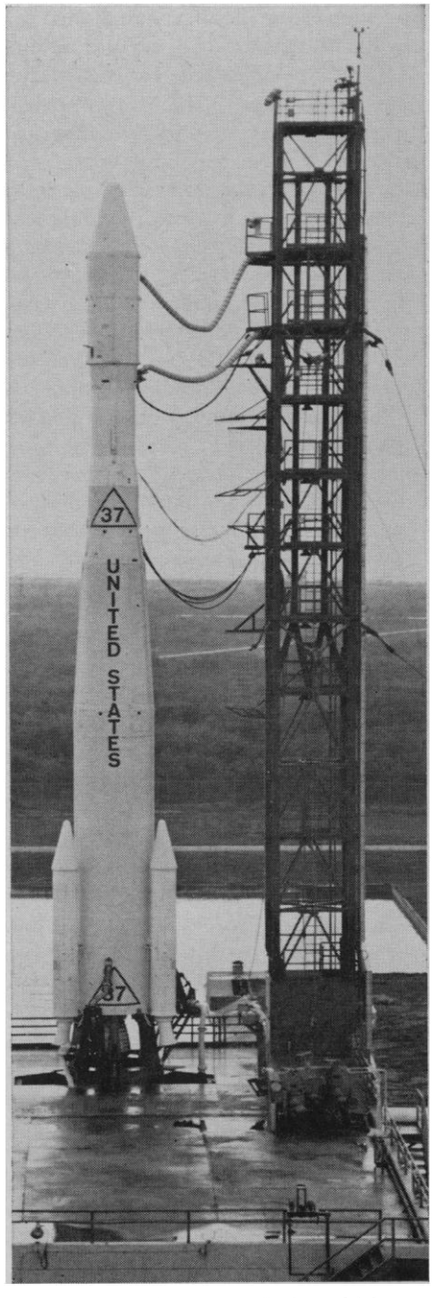
While weather satellite development has been fairly fortunate in getting funds and has progressed satisfactorily, it has occupied a quiet corner of the space program and has attracted only moderate interest from the press.

For example, 2 days before ESSA II was lofted into orbit, the first test launch of the huge Saturn IB rocket, bearing a prototype of the Apollo moonship, drew a big press contingent to the Cape. The cliff-hanging countdown and the successful ballistic flight which sent the spacecraft 5500 miles

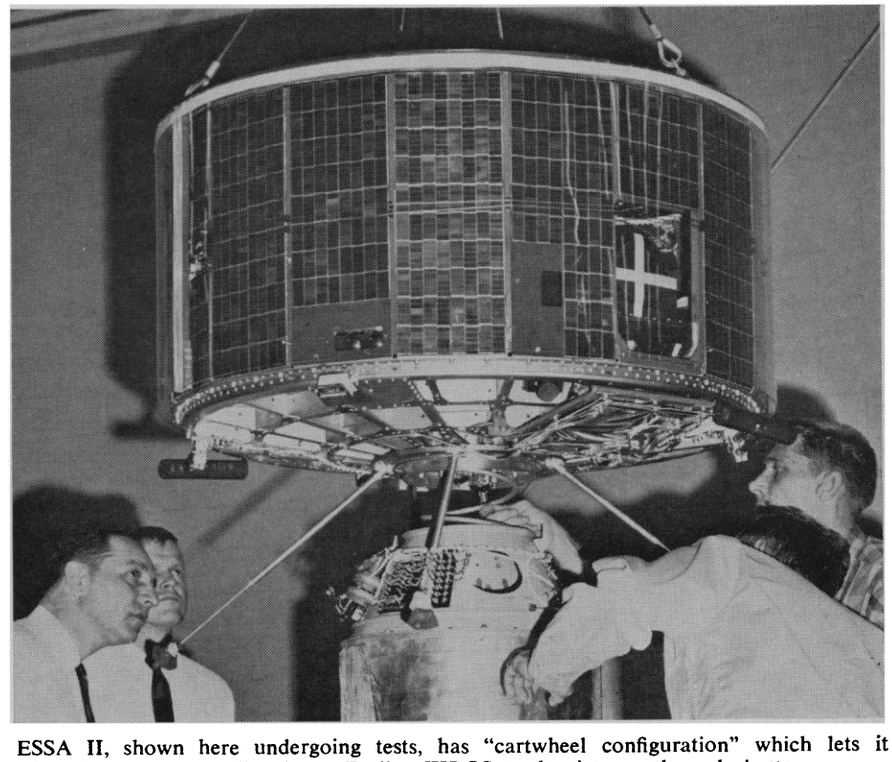
ESSA II

(Right) First picture transmitted from ESSA II satellite over Canada and central United States, showing heavy cloud over Hudson Bay. Picture covers 4-million-square-mile area extending from northern Hudson Bay to Tennessee and from the Dakotas to the East Coast. (Great Lakes, boundary outlines added.)





The 92-foot, three-stage Delta which carried ESSA II into orbit on 28 February.



ESSA II, shown here undergoing tests, has "cartwheel configuration" which lets it take pictures as it rolls along. Earlier TIROS took pictures through bottom.

to a landing in the South Atlantic near Ascension Island were given page-1 treatment.

A much smaller group of newsmen saw ESSA II off, and the event landed on the inside pages of the newspapers and was given fairly short shrift in the aerospace trade press. It was clear that interest in Saturn IB was generated not only by its size but also by the awareness that astronauts one day will be up there on the end of one.

Moreover, ESSA II was put in the shade the day after its launch by the Soviet announcement that one of its unmanned spacecraft had hit Venus and another had recorded a near miss. The "Venik" which scored the hit, the Russians now indicate, was a failed attempt to make a soft landing.

The Venus landing puts the Soviets one up in interplanetary marksmanship. American space program officials point out that, while the Soviets have scored a measure of success with two spacecraft out of an estimated 16 aimed at Venus and Mars, the United States score stands at two successes, with data-producing flybys of Mars and Venus, out of four attempts. The scoresheet on interplanetary exploration is, therefore, not clear at the moment, but the Soviet success in achieving a soft landing on the moon and what appears to be the Russian intention to continue to put much heavier emphasis on unmanned exploration of Venus and Mars (*Science*, 25 February) than the United States has, would seem to augur more Soviet firsts.

In nearer space, very solid if less spectacular American advances seem to be in the offing. In the next month or so the first orbiting astronomical observatory (OAO) is scheduled to be put into an earth orbit. The OAO has been called by NASA the "primary instrument of space astronomy for at least the next decade." The first one, which weighs nearly 2 tons, would be the largest and bulkiest scientific payload yet to be put in orbit by the United States. OAO-A1, as it is called, will carry four telescopes of 8-inch (20-centimeter) aperture and one of 16-inch aperture, and ultraviolet, gamma-ray, and x-ray experiments. A third orbiting geophysical laboratory (OGO) is also being readied.

Scheduled for launching within the next 6 months, also, are two other satellite "firsts" for NASA. Both are designed to contribute directly to the moon-landing mission. A lunar orbiter is intended to photograph the moon's surface to provide information necessary in the selection of a landing site. A first "biosatellite" is to be "a recoverable orbiting biological laboratory designed to study the effects of radiation, weightlessness, and other stresses of space on plants, animals and other forms of life."

Comparisons between U.S. and Soviet programs in respect to scientific investigations in space are perennially unsatisfactory because the Russians are so rigorously noncommital about their efforts and because the United States is equally uncommunicative about some of its own space activities, particularly Air Force launchings.

The moon race, however, remains the main event, and while sustained rendezvous achieved by the United States the last time out is regarded as a significant accomplishment, there seems to be a feeling current that the Soviets may be planning a new extravaganza in their manned program fairly soon.

It is worth noting that the space programs of the two countries have grown so large and so highly ramified that it is becoming increasingly hard to define what being "ahead" means.

One thing that can be said is that, in the field which NASA calls "satellite applications," the United States is continuing to do well. This country is credited with having launched the first weather satellite, the first active communications satellite, the first passive communications satellite, and the first navigation satellite. We also put up the first missile-detection and nuclear-explosion-detection satellites, which have practical uses of a different order. Now we have inaugurated the TOS system. These satellite applications, in addition to representing a remarkable technological effort, rate also as probably the most palpable evidence of a utilitarian payoff from the space program.—JOHN WALSH

Pollution Abatement: President Seeks River-Basin Approach

Public awareness of water pollution as an ugly despoiler of the environment has been rapidly increasing, as evidenced by the quickening evolution of federal policy and legislation in the water-pollution field. Events of the next few years should indicate, however, whether the citizenry—and the politicians whom they elect—are ready for the giant steps toward better pollution control which the Johnson Administration is now advocating.

Administration strategy for combating water pollution has been drastically revised. President Johnson recently outlined much of the new strategy in his proposals for coordinated regional attacks on pollution within each river basin. Major structural changes in governmental machinery are prescribed.

The new Federal Water Pollution Control Administration (FWPCA) would be transferred from the Department of Health, Education, and Welfare (HEW) to the Department of the Interior. The transfer is at least mildly controversial, but it seems unlikely that either house of Congress will surprise Johnson by voting down the reorganization plan within the 60 days allowed.

The President also seeks a fundamental and far-reaching structural change in the administration of anti-pollution programs at the state and regional levels. President Johnson hopes that the states, instead of trying to cope piecemeal with pollution problems, will work through river-basin agencies (such as interstate "compact" commissions) amply endowed with authority to build and operate treatment facilities, levy service charges, and obtain compliance with water-quality standards. The objective is to create local and regional pollution-control systems which eventually will become self-sustaining and will not be dependent on massive federal grants.