Seasat Plumbs Ocean's Depths

The experimental ocean-monitoring satellite known as Seasat (SN: 6/10/78, p. 374) was successfully launched on the evening of June 26, receiving its final kick into orbit from the modified Agena rocket that is also the body of the satellite itself. But so complex are the huge device and its mission — using primarily microwave sensors to seek extremely high-resolution data requiring elaborate processing schemes on the ground — that it could be late September before Seasat begins making its observations on a routine basis. Once it does so, however, it will be addressing questions ranging from the heights of waves to the strengths of currents to the effect of the ocean's sheer weight on seismic activity. Much of its data, routed through the U.S. Navy's Fleet Numerical Weather Central in Monterey, Calif., will also add formerly unavailable input to sea-state and weather reports for numerous military and civilian users.

Seasat is run by the National Aeronautics and Space Administration, which is devoting the two weeks following the launch to fine-tuning the orbit and to turning on the sensors. After that come the critical tasks of calibrating the instruments and checking out the computer algorhythms that must make useful measurements out of the sensors' raw numbers. This is particularly important for Seasat, a number of whose investigations are being conducted by satellite for the first time, and NASA predicts that the job could take from 30 to as long as 90 days. It is only then that the real mission will begin.

• Waves: They affect weather, climate, erosion, shipping and marine life, yet data on wave heights come largely from the sparse coverage provided by ships. Seasat carries a microwave radar altimeter expected to read the wave heights to within half a meter, and the satellite's pole-crossing orbit will give it global coverage with about 7,000 observations per day. (The instrument also provides such accurate altitude data that there was some early non-NASA concern that it ought to be classified.) Seasat will also measure wave direction using a microwave synthetic-aperture radar (which also raised security questions), and will be able to photograph anomalous wave patterns (such as those caused by storms) both day and night with the aid of a visual/infrared imaging radiometer. Wave-direction data, says NASA, have heretofore been largely limited to that from four or five ships in the northern hemisphere and only one in the south.

• Sea-surface temperature: A microwave radiometer will measure temperatures to within 1°C, with the advantage over most present weather satellites of being able to read through clouds and light rain. A difference of as little as 2°C to 3°C in the water of a hurricane "gestation area" can make the difference between a relatively active and inactive storm season. Also, some ocean fish sometimes follow lines of constant temperature.

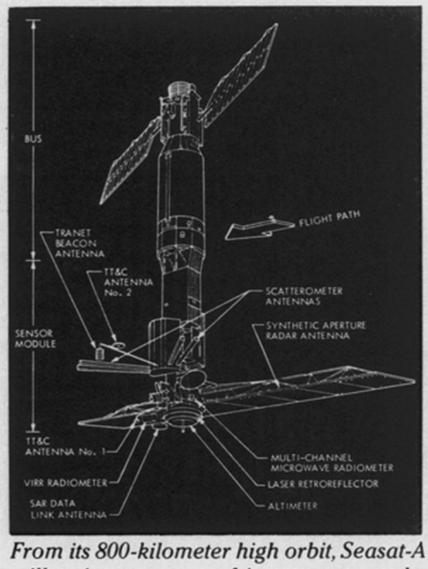
• Ice fields: Seasat will photograph, radar-scan and track icepacks, glaciers and lesser floes. This could be of obvious aid to shipping, but knowledge of the openings to unfrozen water in such regions could also aid weather studies, in view of estimates that heat transfer into the atmosphere takes place about 1,000 times more rapidly from water to air than from ice to air. Project officials say it is even possible that a properly configured imaging radar system — of which Seasat carries a version — may enable determination of the age and thickness of the ice in the polar caps.

• Currents and tides: Long-term analyses of Seasat data may enable the charting of deep-ocean currents and tides, which affect — and to an extent define — the mean general circulation of the seas. It should even be possible to detect tsunami — seismically excited waves — in the mid-ocean regions, where their graphic near-shore effects are far less visible, giving valuable hours of warning to threatened populations on land.

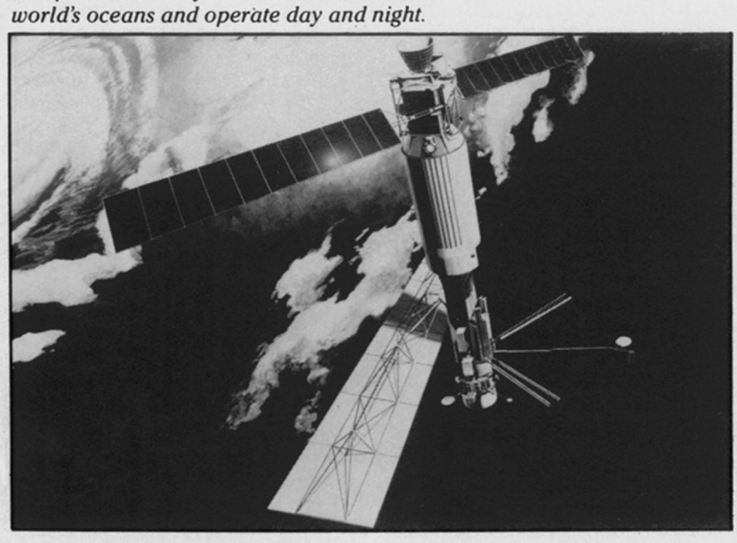
• The atmosphere: Seasat will play a significant role in the upcoming Global Weather Experiment, part of the Global Atmospheric Research Program. (In the tangle of jargon, the GWE is also known as the First GARP Global Experiment, or FGGE, pronounced "figgy.") Part of Seasat's contribution may be the ability to map the sea-surface winds every 24 hours at uniform, 1,400-km intervals, for speeds from 4 to 5 meters per second up to gale force or greater.

• The solid earth: The seas, heavy and sloshing, affect the planet that holds them, pressing down with great weight, eroding the continents and redistributing sediments. Understanding of the ocean's motions can help quantify these effects, and subtracting the tides of the sea can lead to otherwise unavailable knowledge of the tidal behavior of the earth itself.

• The whole earth: Seasat's accurate altimetry and tracking (by radar, radio and reflected laser beams) will help refine the picture of earth's overall gravity field, together with nongravitational perturbations such as atmospheric drag and solar radiation pressure. The mission, in fact, will in a sense come full circle — down to the oceans and back up again — by contributing to improved orbital predictions and determinations for other manmade satellites to come. □



From its 800-kilometer high orbit, Seasat-A will point an array of instruments at the world's oceans and operate day and night.



Photos: NASA