

GEOPHYSICAL AND ASTROPHYSICAL INSTRUMENTATION OF SOVIET SPUTNIKS I, II, AND III

SUMMARY

The recent development of Soviet artificial earth satellites as carriers of instruments in sustained flight above the shielding effects of the earth's atmosphere represents a major technical advance potentially of great importance in the geophysical and astrophysical sciences and to the successful achievement of manned space flight. All three Soviet sputniks placed in orbit to date are important in contributing knowledge of the physical environment and communication conditions for subsequent astronomical efforts of the USSR.

The Soviet Union has obtained an advantage over the United States in geophysical and astrophysical research because it has placed in orbit much larger satellites capable of carrying more varied and heavier instrument payloads. With the exception that Soviet satellites have not penetrated as far into space as U.S. satellites, the near-polar orbits of the Soviet satellites offer more advantages than the near-equatorial orbits of the U.S. satellites.

Although Sputniks I and II were not outstanding in their geophysical and astrophysical instrumentation, Sputnik III represents a scientific achievement of considerable magnitude because of the large number of significant observations that are conducted simultaneously. The equipment for detecting primary gamma rays is apparently unique and, if successful, would provide data of considerable scientific significance. The numerous cosmic

ray and auroral particle experiments are of special value because Sputnik III traverses the auroral zones. Instruments included in Sputnik III, not duplicated in the U.S. satellite program, for the IGY, are magnetic and ionization manometers, mass spectrometers, flux meters, and ion traps. Sputnik III apparently is similar to advanced U.S. satellites in that it employs solar as well as chemical batteries and has telemetering systems that probably store data for release at a later time when the satellite is interrogated* as it passes over a receiving station. Sputnik III also may contain equipment that has not been described by the Soviets. On the other hand, Sputnik III apparently lacks a means of orientation control; therefore, it probably contains no elaborate earth-scanning device, such as a television camera. The Soviet instrumentation generally is heavier and less refined than similar U.S. equipment; but some miniaturization has been noted, and much of the equipment in Sputnik III appears to be transistorized. There are indications that the Soviets have copied some U.S. instruments.

Soviet ground equipment for optical and radio tracking of satellites appears to be adequate but less elaborate than U.S. equipment. The Soviets are steadily expanding and improving their capabilities for precision tracking and are placing considerable emphasis on this phase of their observations.

* In response to a radio signal from the ground, the satellite transmits stored data.