THIRD CANADIAN SATELLITE

ISIS "A", the third space satellite of Canada's Defence Research Board and the second in the joint DRB/U.S. National Aeronautics and Space Administration's (NASA) ionospheric studies programme, which involves up to four Canadian-built spacecraft, was launched at the Western Test Range in California on January 29.

Successor to the *Alouettes* I and II spacecraft, the latter of which was accompanied by NASA's *Explorer* XXXI for complementary experiments, the the *ISIS* "A" was injected into a near-polar orbit from an improved Thor-Delta rocket provided by NASA. This third Canadian satellite was fabricated by RCA Limited, of Montreal, the prime contractor, with monitoring throughout by the Defence Research Telecommunications Establishment in Ottawa.

The *ISIS* "A", presents the first opportunity to instrument a single spacecraft to measure most, if not all of the important ionospheric parameters at the same time and in the same location in space.

Heavier than its predecessors *Alouette* I and *Alouette* II, *ISIS* "A" weighs about 525 pounds and is considered a medium-sized research spacecraft. Like its predecessors, it is spheroid in configuration. Its outside surface is covered with more than 11,000 solar cells to power the batteries within.

ISIS "A" is fitted with two extendible antennae, 240 and 62 feet long respectively, to sound or probe the upper levels of the ionosphere. Four telemetry antennae project from the base of the spacecraft to accept commands from the ground and to transmit data gathered by the satellite to ground stations. Quadraloop antennae are mounted around the satellite's equator to radiate beacon transmissions, and two antenna-like booms support probes for use in several of the onboard experiments.

The satellite's ten experiments and expanded facilities have necessitated power requirements increased considerably over those used in its predecessors. A new feature, designed for the *ISIS* spacecraft series, is a spin-and-attitude system to control spin action in space and also, to control the attitude of the spacecraft relative to the sun and the earth.

The cost of Canadian participation in the *ISIS* "A" project during the design, fabrication and testing phases of the past four years, totals about $13 million.

Canada's successful experiment in satellite design and fabrication, and in the designing of "onboard" experiments, was initiated about ten years ago by the Board in support of military ionospheric research.

During the past two years, Canadian civilian satellite technology interests have turned towards the usefulness of satellites as a means of improving national communications in all its aspects.

Because of the skills and knowledge developed at the Board's telecommunications establishment, the Ottawa laboratory is being transferred to the federal communications department now being organized. The new department, which will play a key role in developing a national communications satellite system, has taken over from DRB responsibility for Canada's partnership with the U.S. in the programme known as International Satellites for Ionospheric Studies (*ISIS*).

THE IONOSPHERE

Scientists from many countries are using data obtained by the satellites in the *ISIS* programme for upper atmosphere investigations. They are particularly interested in plasma resonances, ionic composition, ion and electron temperatures and their distributions and fluctuations.

The topside-sounder technique developed by the DRB is the only one known that can provide world-wide electron-density profiles synoptically above the height of maximum electron density of the ionosphere. These soundings permit the investigation of the physical properties of the ionosphere as a function of time and geographical location.

In addition to its scientific value, the increased knowledge gained about the ionosphere can be applied directly to communications and tracking operations. The importance of the ionosphere to terrestrial radio communication is well-known. Predictions of ionospheric storms and disturbances are often unsatisfactory because they are based on inadequate information. Because a thorough understanding of natural phenomena is a prerequisite to their intelligent use, improved knowledge of the entire mechanism should lead to more precise forecasts.

The present prediction of maximum usable frequencies for communications purposes is based on ionosondes from ground-based ionospheric stations. This information was considered of sufficient importance to justify the establishment of about 150 ground-based ionospheric sounding stations throughout the world. This number of stations however, is not sufficient for accurate world-wide mapping of the bottom-side ionosphere.

Two of the most important observations obtained by these stations are the height and density of maximum ionization in the ionosphere. In principle, several topside-sounder satellites should provide this information synoptically and with substantially improved geographical coverage. Hence, the collaborative DRB/NASA ionosphere probes by Canadian-designed and fabricated satellites.

"ALOUETTE" SATELLITES

Alouette I, launched into a circular orbit at the California range on September 29, 1962, was the first satellite to be designed and constructed in Canada.

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