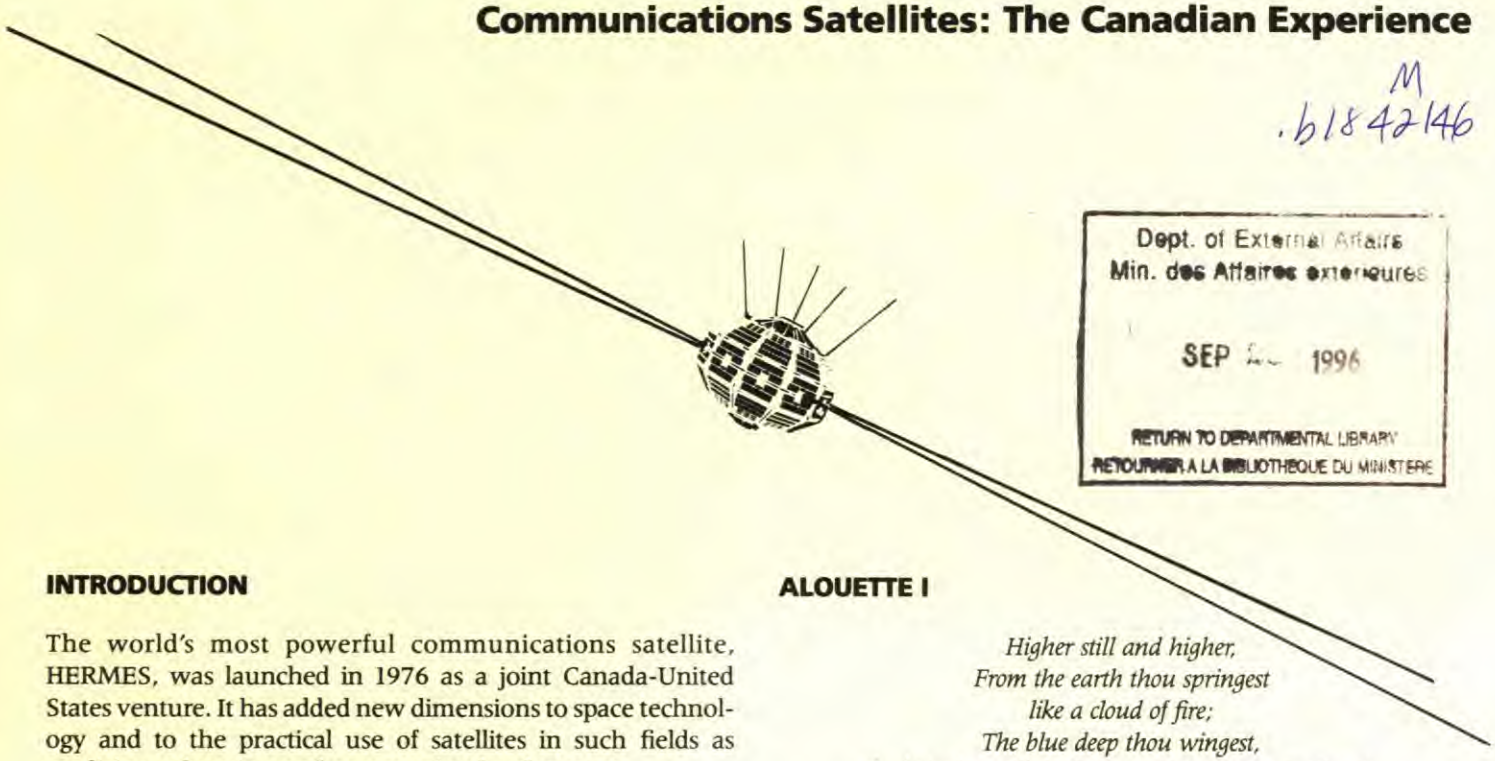
Communications Satellites: The Canadian Experience



INTRODUCTION

The world's most powerful communications satellite, HERMES, was launched in 1976 as a joint Canada-United States venture. It has added new dimensions to space technology and to the practical use of satellites in such fields as medicine, education and community development.

Canada's focus on the use of space for man's practical benefit centres on two basic areas: (1) the study of the ionosphere and (2) the development of satellite technology to improve communications. From the beginning, Canada and the United States have cooperated in these areas by launching Canadian-built satellites from U.S. facilities.

Canada's first satellite, Alouette I, was launched in 1962. The information it provided about the earth's upper atmosphere was used, in part, to improve Canada's high-frequency radio communications, especially in the North. The ISIS series of ionosphere-probing satellites followed.

As space technology advanced, Canada recognized that satellite relays could provide communications services to its widely scattered population. In less than ten years it developed one of the finest domestic communications-satellite systems in the world, Telesat Canada.

The Telesat system began offering commercial satellite service in 1973. Four Anik communications satellites compose the space segment of the system. Anik A-I was the first satellite in the world to be placed in geostationary orbit for commercial domestic service. Geostationary satellites travel above the equator at the same speed as the earth rotates, so that from earth they appear to be stationary. Each of the three Anik A satellites offers total territorial coverage of Canada. Each has 12 microwave channels, and each channel can transmit a single television program or up to 960 voice circuits. Anik B, launched in December 1978, incorporates six higher frequency channels tested by HERMES, bringing its total to eighteen.

The earth segment of the Telesat system has expanded from four initial stations in 1973 to a hundred in 1978. Using a unique system of computer controls, the Telesat system can position and hold each satellite precisely on station. This has enabled the Canadian system to become the first domestic one to use less-expensive fixed non-tracking communications earth stations.

ALOUETTE I

Higher still and higher,
From the earth thou springest
like a cloud of fire;
The blue deep thou wingest,
And singing still dost soar, and soaring ever singest.
The Lark, PERCY BYSSHE SHELLEY

Canada's first space satellite, Alouette I, was placed in a circular orbit at an altitude of 1,000 kilometres on September 29, 1962. It was designed and constructed by the Canadian Research Telecommunications Establishment of the Defence Research Board * and launched from the National Aeronautics and Space Administration's (NASA) Western Test Range in southern California. Its mission was to gather information on the physical properties of the ionosphere.

The ionosphere contains electrically charged ions and electrons, which affect long-distance radio transmission. This upper atmosphere has daily and seasonal variations; and disturbances in it make long-range high-frequency radio communications difficult and sometimes impossible. Such disturbances are particularly frequent and unpredictable in the region above northern Canada, where they are visible as the aurora borealis. For Canada, one of the practical benefits of a better understanding of the ionosphere is an improved ability to bring dependable radio communications to the people spread thinly throughout the vast North.

Before Alouette I was launched, ground-based balloons, rockets and satellite-borne sensors had provided information about some features of various regions of the atmosphere. Alouette I contributed the first global information about the upper regions of the ionosphere. It performed four kinds of measurements. The main one sounded the ionosphere with radio waves. This produced a kind of radar map from above the ionosphere, which was complemented by similar studies from the ground. The equipment included two special antennas measuring approximately 46 and 23 metres, the longest antennas that had ever been flown on a space vehicle. They were stored rolled up inside the spacecraft and deployed once the vehicle was in orbit. The antenna design was later adopted for many U.S. space vehicles. The satellite also measured cosmic

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