Though designed and built in Canada, CTS is a co-operative effort with NASA providing some advanced components and doing some pre-launch testing as well as the actual launching. The European Space Research Organization (ESRO) has also provided vital components. The vehicle was constructed and assembled at Canada's Communications Research Centre at Shirley Bay, on the outskirts of Ottawa. The main sub-contractors were RCA for electronics and Spar Aerospace for structure.

CTS is the seventh Canadian satellite to go up since the launching of Sputnik began the space race in 1957. Following the Russian "first," two Canadian Prime Ministers in quick succession — John Diefenbaker and Lester Pearson — declared Canada's commitment to seek peaceful ways of participating actively in space research, in spite of limited resources. Responsibility for the first satellite project was given to scientists attached to the Defence Research Board, because they had the requisite knowledge of electronics, radio physics and communications systems. Their establishment at Shirley Bay was transferred to the newly formed Department of Communications in 1969 and became the Communications Research Centre.

The foundation of a separate Ministry was an important milestone in the space programme. It marked the realization by politicians of the importance of having a national policy for communications, particularly in a country as large and varied as Canada. To quote Christopher Lorenz in *The Financial Times*, October 6, 1975, "The Department's work has given Canada an international reputation for seeing communications in the round, rather than dealing in isolation with its component parts, like many other countries. Particularly evident has been the Department's concern with the social aspects of telecommunications, an aspect often neglected in Europe."

Commercial company

Canada's official entry into the use of satellites for general communication began in 1969 with the incorporation by act of Parliament of a private commercial company 50 per cent owned by Government, Telesat Canada. Its brief was to "establish satellite communications systems providing, on a commercial basis, telecommunications services between locations in Canada; also, subject to agreement by the appropriate governments, between Canada and other countries."

Before this date, Canada's involvement in space was scientific and experimental. Its main early objective was to improve understanding of the ionosphere, which can be at its most disturbed in the region above northern Canada. The phenomenon which creates the visual effect of the *aurora borealis*, or "northern lights," is also responsible for the unreliability of short-wave radio links in that region.

When the first satellite, Alouette I, went up in 1962, Canada became — after Russia and the United States — the third nation of the world to have a satellite in space. Designed and built in Canada, it was launched in the United States by NASA, an arrangement that has been repeated for all Canada's subsequent launchings.

The main experiment on Alouette involved sending radio waves at various frequencies into the ionosphere and monitoring their reflection by the layers of charged particles, giving a sort of radar map of the ionosphere from above, which would complement further studies from the ground. This required far longer antennae protruding from the main body of the satellite than had ever been put in space — 150 feet from tip to tip for one, 75 feet for the other. The idea of an antenna stored up rolled, like a carpenter's steel tape, and formed into a tube as it unrolled, had been developed 20 years earlier by the National Research Council for use in tanks. It was just the thing for Alouette. These long, extendible antennae have since become standard elements in every nation's satellite. Spar Aerospace of Toronto, which developed them commercially, have sold C$12 million worth to foreign space programmes.

Incredible life-span

Alouette was put together at a time when most satellites had a useful lifespan of a few months. That it could still send back data after 10 years seems an almost incredible feat. Its builders expected it to last a year; their most optimistic prediction was five years of declining usefulness.

Research with Alouette I resulted in some 400 scientific papers, giving the first global information about the upper regions of the ionosphere. Previously, knowledge had been limited to the region below 200 miles. Sounding the ionosphere with radio from above, measuring cosmic noise, listening to very low-frequency radio signals, counting the charged particles, scientists could now determine better how plasma particles and radiation from the sun react with the earth's atmosphere and magnetic field, how this "solar wind" affects radio transmission and causes such phenomena as the *aurora borealis*.

The satellite's unexpectedly long life added the bonus of comparable measurements over almost an 11-year cycle of solar activity. Following this success, Canada and the United States agreed to build a series of International Satellites for Ionospheric Studies (ISIS). The Canadian Government saw this as a great opportunity to involve industry in advanced space technology: a great part of the design and building of satellites from now on was subcontracted to industry, with Government providing management supervision, setting specifications and contributing special technical knowledge.

The first of the ISIS series was Alouette II, a carbon copy of the original satellite, which had been built at the same time and kept on stand-by in case the first launching failed. This was now modified and rebuilt for a new mission. Where Alouette I was in circular route 625 miles above the Earth, Alouette II was placed in an eliptical orbit