Radarsat a sophisticated satellite aid

Shrouded in darkness half the year, choked with three metre thick ice floes, Canada's Northwest Passage is probably the most challenging shipping route in the world.

Yet, by the 1990s, it is possible this treacherous corridor will be traversed regularly, year-round, by tankers and supply ships *en route* to Arctic oil and gas fields. It is also likely that Arctic ship captains will be guided by one of the world's most sophisticated remote sensing satellites — Radarsat — now being developed through the Department of Energy, Mines and Resources Canada Centre for Remote Sensing.

The Radarsat project will cost an estimated $300 million over five years. But the investment will be worth far more to its users; the oil and gas industry alone could save roughly $100 million a year in shipping costs. It could repay its investors within its first year of operation.

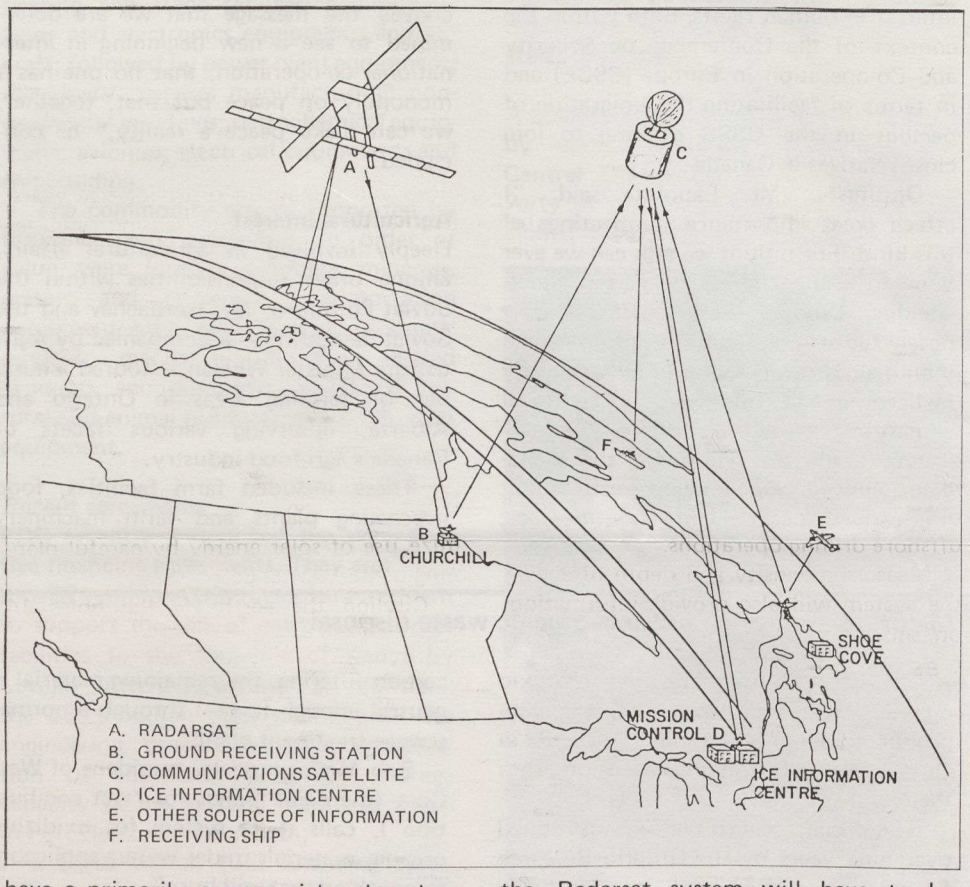
Scheduled for launching in 1990, Radarsat will carry a highly advanced radar technology, synthetic aperture radar (SAR) which can 'see' day and night in any kind of weather, and is especially effective in forecasting northern ice conditions.

SAR is a side-looking radar system transmitting microwave impulses obliquely at the earth's surface as it is carried along a path. The system then synthesizes images from the backscattered radiation. Relatively small, the SAR antenna functions as if it were extremely large by recording and combining, through computer, signals received at different positions along track.

The first satellite to carry SAR was the US Seasat, launched in 1978, which gathered vast amounts of information around the world through numerous experimental projects. The success of this mission convinced Canada, a major paritcipant in the Seasat program, to develop its own SAR-bearing satellite. In 1980 the Radarsat project was initiated.

First envisaged as a means of exercising Canadian sovereignty over newly extended offshore limits, the scope of the Radarsat project soon broadened to include a host of possible sea and land applications such as ice forecasting, crop monitoring, oil spill detection and resource exploration.

Unlike Seasat, Radarsat will be suited specifically to Canadian needs and will have a primarily commercial rather than scientific orientation. Its data will be marketed to specific users.



New technology

Radarsat will also feature a number of technical innovations making it superior for certain uses to any other remote sensing satellite developed.

The major innovation will be a movable SAR beam that can be positioned at different angles to gather more information than a stationary beam. This means that Radarsat can have a potential swath width (the width of area covered as the radar moves along track) of 500 kilometres — five times wider than the Seasat swath.

The ability to position the SAR beam at different angles will also allow the collection of stereo radar imagery, useful for topographical mapping.

Radarsat will also be the first SAR system to operate in C-band, a short, higher resolution microwave than the L-band used by Seasat. Though technically difficult to implement, C-band is versatile. It can, for example, distinguish different kinds of ice. It is sensitive to moisture in vegetation, and can therefore be useful in analyzing the health of crops.

To produce commercially useful data, the Radarsat system will have to be capable of very rapid turnaround, in order to gather, analyze and transmit information to users quickly.

In Arctic shipping, for example, ice condition forecasts quickly become outdated with often unexpected shifts in ice floes. A delay of a few hours can cost thousands of dollars. In order to choose safe, economic routes, captains must have accurate, timely information. Radarsat researchers predict that the system will provide ships with composite ice maps within hours of the satellite's passing overhead.

Moving along track, the SAR will harvest data and transmit it to ground receiving stations where it will be converted into digital images. Image data will be relayed by communication satellite to an Ice Information Centre in Ottawa. Here SAR images will be integrated with information from other sources and a composite picture of conditions transmitted, again *via* communications satellites, to ships.

Capable of processing up to a million square kilometres of surface imagery per day, Radarsat will be well suited to collecting scientific data over Canada's vast, sparsely populated territory. Its usefulness will by no means be limited to Arctic shipping. Radarsat scientists