Finally, the batteries for these beacons only last 48 hours. The distress signal could, therefore, cease before a rescue team has a chance to locate the distressed ship or aircraft.

The idea of using satellites to monitor distress signals is not new, and goes back to the 1950s before the advent of the satellite era. Canada and the United States began working independently at first, but got together in 1977 to develop the SARSAT program ("Search and Rescue Satellite"). Shortly thereafter, they were joined by France. The USSR, which had developed a similar project called COSPAS, reached an agreement with the SARSAT group in 1977 on joint technical specifications which have increased the efficiency of this worldwide system for locating distressed ships and aircraft.

In the summer of 1982, the Russian satellite COSPAS was launched into a polar orbit around the Earth, equipped to relay distress signals on an international frequency of 121.5 MHz. The satellite circles the Earth in 100 minutes at an altitude of 1 000 km. During that time, the earth shifts 23 degrees in longitude (this represents a lateral shift of almost 2 000 km in southern Canada). The satellite's path is thus slightly different during each orbit. With the launching last March of the American satellite TIROS-N, all areas of the world are now monitored twice as often.

There is now a growing number of ground stations throughout the world capable of receiving the signals relayed by the SARSAT-COSPAS satellites. Canada's Department of National Defense, responsible for Canadian rescue operations, has a ground station at Shirley's Bay near Ottawa, and there are four in the United States and one in France. All six stations were designed and built by a high technology company in Ottawa, Canadian Astronautics Limited, which specializes in systems engineering and real-time digital processing of signals.

The stations are equipped with a 3 m parabolic antenna which tracks the satellite as soon as it appears on the horizon; travelling at an altitude of 1 000 km, the COSPAS satellite takes only about 20 minutes to cross the sky. During this passage, the station can receive distress signals from both sides of the satellite's path, covering a total width of 4 000 km. Ten minutes after the satellite has crossed over Canada, the computers at the Ottawa ground station have finished processing the data received, and can calculate the origin of any distress signal within a few kilometres.

James Taylor, president of Canadian Astronautics Limited, explains that, while sophisticated computers are needed to process the huge quantities of complex data, the method used to pinpoint distress signals within the SARSAT network is based on a principle that has been known to physicists for a long time — the Doppler effect. The classic Doppler example known to all science students is the changing tone of a train's whistle, which has a high pitch as the train approaches, and fades to a low pitch as the train moves away. The same effect applies to the frequency of a radiobeacon signal from an aircraft or ship in relation to an orbiting satellite. Because ground-based computers know the frequency of the signal sent from the distress site, they can compute the Doppler shift in the signal received by the satellite. This, in conjunction with

National Defense

It isn't easy to spot a downed aircraft in heavily wooded areas; this photograph was taken in the mountains of British Columbia by the rescue team last September.