up to 2.5 kilometres on either side of the towfish.

At the same time, a "boomer" sends powerful sonar vibrations downward. Echoes bouncing directly off the bottom are interpreted into a profile of the bottom. Other echoes travel into the sea floor before returning, and these will enable *Seabed 2* to estimate composition of materials buried beneath the ocean floor. Sand, for instance, scatters sound less than rough gravel. A sound profile can accurately predict from the scattering what kinds of material would be found if a hole were dug at any particular spot along the path of the towfish.

"It's amazing what an enormous leap you have to take to go to greater depths," says James Rossiter, Huntec's vice-president for development and marketing. The company's current model towfish, *Seabed 1,* weighs 300 kilograms and can work in water between 200 and 400 metres; the *Seabed 2* will have to weigh 3 000 kilograms. "The whole towing technology is substantially different when you're at those depths. It takes a much fatter cable to keep on a path at that depth, so cable drag becomes a very large factor," said Mr. Rossiter.

Tests this summer

The first *Seabed 2* will be ready for testing next June. The hardware is being built in Toronto and the instrumentation is being prepared in Halifax under $5.5-million worth of federal development contracts. According to company president Roger Hutchins, another generation of equipment will be built to work at 6 kilometres, making it capable of exploring all but the deepest abysses in the oceans.

Towed submersibles have been standard equipment in oceanography for several years, usually providing only sidescan or downward echo readings on any one pass. Limitations on range and depth have hindered careful study of the ocean depths.

Seabed 2 is being designed to adapt to biases in the data caused by changes in water conditions. Readings in water are often unreliable because water has perverse properties. "Air is much more predictable," Mr. Rossiter said. Differences in salinity, density and temperature can change a sonar signal and cause false readings.

The system will also correct the readings if the towfish drifts off track. The towfish will at times be towed by 5 to 7 kilometres of cable and there is a possibility of drifting. A track recovery system measures roll, pitch and yaw of the towfish and its position in respect to the ship to ensure the instruments are making accurate measurements.

After being interpreted by the computer, the data from a towfish are transformed into a continuous series of shaded lines on long rolls of paper. Surface measurements form a picture that looks from a distance like a black and white photograph. Changes in composition and features of the bottom are highlighted as patterns and variations in shadings of grey that are sometimes very subtle.

Design incorporates computer

Seabed 2 will take advantage of recent leaps in the capabilities of computers as well as developments in sonar equipment. Huntec is looking at whether a colour display of the data may make it easier to interpret.

Because it can take almost an entire day to lower the towfish on several kilometres of cable and raise it again, scientists will want a piece of equipment that is sturdy and reliable. *Seabed 2* is designed so that if one component fails another system will back it up and continue taking measurements, Mr. Rossiter said.

Towfish often make the news when they are used to find remains of sunken ships. Repeated passes of a small towfish helped a group of Ontario explorers find the remains of two ships that sank in Lake Ontario during the War of 1812. The sidescan sonar images of the wrecks created an eerie likeness of the ships on the computer printouts. The masts even seemed to cast a shadow, but in the lightless depths the shadow was in fact an area where sound waves could not penetrate because they had been bounced back by the ships.

Mr. Rossiter said *Seabed 2* could be used for deep-sea treasure-hunting – and in fact can locate items as small as 10 centimetres in diameter – but that is not its prime purpose.

As designed, the *Seabed 2* will be especially useful for mapping and exploration of minerals and sediments by commercial firms and government agencies, he said. It also would be useful for routine sweeps of pipelines and around oil-production platforms. The system is being designed in the form of modular components so the technology can be added on to smaller, less sophisticated systems.

The project is being backed mainly by the pilot industry laboratory program of the federal National Research Council, with additional support from the Departments of Energy, Mines and Resources, Defence and Fisheries and Oceans.

Huntec ('70) Limited is a wholly Canadian company which sells and leases specialized geoscientific instrumentation, designed and manufactured at its plants in Toronto and Dartmouth, Nova Scotia.

Over 70 per cent of the company's revenue from the sale of products and services is derived from export markets. The company has two main product groups, geoelectric instrument systems for mineral prospecting on land, and acoustic based systems for seafloor engineering studies and geological mapping. All Huntec products are available for lease or sale throughout the world and are supported by a field engineering service group.

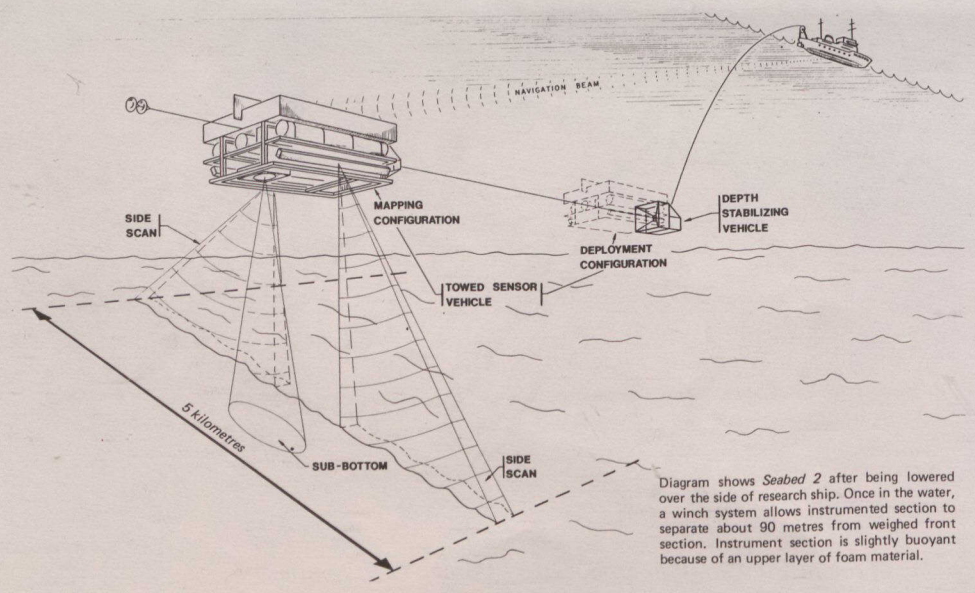

Diagram shows *Seabed 2* after being lowered over the side of research ship. Once in the water, a winch system allows instrumented section to separate about 90 metres from weighed front section. Instrument section is slightly buoyant because of an upper layer of foam material.