New era in transportation -a cushion of air

An ACV may look like something from outer space, but this contemporary, versatile new vehicle is quite down to earth in some transportation areas.

Supported above the surface over which it is travelling by a self-generating pressurized cushion of air, the ACV — or air cushion vehicle — can overcome many of the adverse conditions presented by certain land, water and ice surfaces. For this reason, these vehicles, once they are developed, may be of particular importance in areas of Canada where certain types of terrain and other surfaces impose serious transportation burdens and limitations.

Of Canada's total area of 3.8 million square miles, the Arctic alone comprises 1.3 million square miles, more than a third of the whole of Canada. Muskeg, covers 12 per cent of the land aera; some 48 per cent is wooded and inland waters form nearly eight per cent of the total area of the country.

Against this background, an extensive network of shipping, pipelines, highways, railways and airways have been developed to serve a scattered population of over 20 million people. But technological change in all forms of transport is continuing. To meet the needs of this developing country's resources in these difficult conditions, new operating techniques and specially designed vehicles have emerged. A recent example is the snowmobile, a Canadian development which serves both as a functional and amusement vehicle.

Possibly the earliest reference to the ground effect machine, or air cushion vehicle, was made by the Swedish scientist and philosopher, Emanuel Swedenborg in 1916. His proposal for a ground effect machine was a domed, eliptical, light wooden frame covered with canvas, which looked very much like a giant flying bug, the only difference being that it couldn't get off the ground. This, Swedenborg left to future generations.

In 1876, John B. Ward of California obtained a U.S. patent on a machine which had two supporting and one steering wheel. To elevate the machine Ward used a series of blowers encased in the side of the machine which obtained air from side openings and discharged it vertically through base openings.

The 19th century saw sporadic attempts to reduce the frictional resistance of ships by introducing air beneath the hull. However, activity increased in the 20th century. For example, in 1916, Dagobert Muller Von Thamamhul of Austria constructed an air cushion torpedo boat which reached a speed of 40 knots on trials. But nothing further seems to be known about it.

In Canada, J. C. M. Frost did basic ACV research work at Avro Limited



in the early 1950s. Later, Canadair Limited built a test vehicle for the investigation of recirculating lift systems. In 1953, an English electronics engineer, Christopher Cockerell, turned to hydrodynamics, with particular reference to the reduction of skin friction drag.

Pursuing the idea of side keels, or sidewalls, as the means of preventing the air from escaping laterally, one of his models included a centrally supplied cushion of air contained by hinged trailing doors fore and aft. The power required to replace the hinged doors by thin water curtains was difficult to assess, so Cockerell substituted an inward facing air curtain. He then constructed an annular nozzle and test results proved encouraging, indicating that a cushion of air could be contained by an annular jet and that a lift force could be obtained several times greater than that of the jet alone. In 1956, Cockerell obtained support for his idea from the Ministry of Supply and the next year the Ministry placed a contract with Saunders-Roe for towing tank tests. The Saunders-Roe study showed the hovercraft concept, as it then became known, to have great potential. The project was de-classified in 1958, freeing Cockerell to approach the National Research Development Corporation (N.R.D.C.) which provided financial support. N.R.D.C. then formed Hovercraft Development Limited to initiate, control and organize development work. A contract was placed with Saunders-Roe to design and manufacture a full-scale craft, which made its first public appearance in June of 1959.

The National Research Council of Canada's involvement in air cushion vehicles dates to the early 1960s when requests were received to undertake work in this field on high-speed ferries, air cushion trucks for remote areas

Dome-shaped machine proposed by Swendenborg in 1716. (Courtesy Kalerghi Publications, London, England)

La machine proposée par le Suédois Swedenborg en 1716 (cliché Kalerghi Publications, Londres, Angleterre).