Roosevelt's make-work program in 1933, construction was started on the Maine coast of the Bay of Fundy (in Passamaquoddy Bay), but it was never completed because of a lack of funds. In 1969, a four-year study sponsored by the Canadian government in conjunction with the provinces of New Brunswick and Nova Scotia was published which examined all aspects of tidal power plant development in Fundy. The report of the Atlantic Tidal Power Programming Board (ATPPB) suggested the best sites for the plants to be built with predictions of the power output that could be expected from the project on completion. In view of the huge costs of construction, however, a sum that might run well in excess of a billion dollars, the project was not deemed economically feasible. (The report was drawn up before the sudden rise in the cost of fossil fuels in the early 1970's).

Because such large amounts of money and construction time would have to be spent on a tidal power plant project, it is important to have a fairly detailed knowledge of how the physical system behaves (the tidal wave in the selected bay or estuary) and to reliably predict how the constructed plants would disturb or alter the system's natural state. It would be a costly mistake to build the system only to find that its presence diminished the tidal wave to the point where the energy return no longer justified the economic investment.

One of the simplest ways of obtaining this information is to build a mathematical model that reflects the behavior of the marine system, a set of equations that simulate the movements of the tidal waters as they ebb and flow through the Fundy basin. The proposed changes can then be made to the model (in this case the addition of the tidal barriers) and the resultant affects on the system studied. Expensive errors can therefore be avoided and the best sites for the tidal barriers chosen, the degree of confidence in the results being reflected in the precision with which the model simulates the real system.

Such a mathematical approach is presently being attempted by Dr. G.F.D. Duff, Chairman of the University of Toronto's Mathematics Department. With the aid of a National Research Council operating grant, he is setting up a model that simulates the tidal motion of the waters from the head of the Bay of Fundy out through the Gulf of Maine and extending across the North Altantic ocean to the coasts of Africa and South America.

"When this study began," says Dr. Duff, "the existant models of the system did not cover much more than the Bay of Fundy itself. This includes the one used by the Atlantic Tidal Power Programming Board in its feasibility study of tidal power development. However, examination of the information on the tides in Fundy and the surrounding areas suggested the importance of extending the mathematical description to include these outlying waters. After working with some restricted models, I concluded that the tidal characteristics throughout the North Atlantic did make a difference and were significant to a realistic simulation of the Fundy tidal system."

Dr. Duff explains that some idea of the nature of tides is needed to appreciate the complexity of the Fundy system. Tides result from the gravitational attraction of the sun and the moon on the waters of the oceans, and to some extent from the centrifugal force of the earth's rotation. The energies imparted to the oceans by these forces are ultimately dissipated as tidal friction against the coasts of the continents. The fact that the sun and the moon act independently and their distances from the earth vary continuously means that an ever-changing pattern of forces is exerted on the oceans, resulting in a tidal behavior that is much more complex than that of a simple, harmonious ebb and flow. Of the three main components that make up the tide-raising force in Fundy, the most important one is the semidiurnal (twice daily) lunar tide. With a period (time between successive high tides) of 12 hours, 25 minutes, this component results in an amplitude or wave height of 18.5 feet in the Minas basin at the head of the Bay. The other two components are the semidiurnal solar tide with a wave height of 2.7 feet and the lunar elliptic tide (the effect of the approach and recession of the moon in its elliptical orbit) with a wave height of 3.5 feet. As well, there are several minor components resulting from the cyclic character of the paths of the sun and the moon. The highest tides result when these various cycles

Dr. G.F.D. Duff (right) discusses a point of interest on the map of the Bay of Fundy with Dr. Y.L. Park, a colleague involved in the programming part of the study. • Le Dr G.F.D. Duff (à droite) discute, devant une carte de la baie de Fundy, avec le Dr Y.L. Park qui travaille sur la programmation de l'étude.