location in the boat measured from the bow. The program assumes that the center of gravity of a paddler is 26 cm above the bottom of the hull and 7 cm forward of where the kayaker is sitting. This latter accounts for the kayakers legs being straight out in front of him. Any inside cargo is assumed to have its center of gravity 10 cm above the hull bottom. Deck cargo, human or otherwise, is assumed to have a center of gravity 10 cm above the deck.

Figure 5 shows the computer output for the boat documentation and some details of the test runs. Hull displacement is the weight of the amount of water that would completely fill the inside of the hull up to the deck or sheer line. Although data may be input in either English or metric units, the program converts most of it to metric for purposes of internal calculations and output.

The actual hull measurements, often called a table of offsets, are illustrated in figure 6 for the sample Bering Sea kayak. They consist of x,y coordinates for cross-sections of the kayak at specified distances from the bow. The x corresponds to half-breadths and the y to heights above baseline in a typical boat plan table of offsets. The computed area of these cross-sections is given in square centimeters.

The last page of program output is shown in figure 7. Each numbered column refers to the loading conditions given in figure 4. Column 1 is the kayak by itself, 2 is the kayak and kayaker, 3 is a kayaker weighing 120 lbs. and so forth. Two interesting and related rows in this figure are the speed in knots and the wetted surface area. The theoretical or hull speed of a self-propelled displacement boat varies directly with the waterline length of the hull. A long waterline boat should go faster than a shorter boat. As a boat approaches this hull speed it is trying to climb its own bow wave and for the kayaker, it is an uphill battle. For small boats there must be a major increase in waterline length before the hull speed increases appreciably. The real limiting factor for small boats is the amount of wetted surface area which directly influences the frictional resistance. Hull designs that keep the wetted surface area low will be easier to paddle for long periods than one with a higher area, everything else being equal.

The row titled pounds per inch immersion indicates how much weight may be put in the boat that will depress a given waterline one inch. In our example Bering Sea kayak in figure 7, we note that for column 2, the kayak and kayaker, it will take 87 pounds (if it were located at the center of gravity) to settle the boat another inch into the water.

Figure 8 is a sample coding form as made up for the Bering Sea kayak. While the Fortran program itself is stored on disk, the input is on punched cards. An explanation of how to code the various fields on the coding form may be found in the appendix.

III The Kayak Research

In the table of comparative data from the simulation program, figure 9, it is important to keep in mind that there are many questions we could ask that only make sense in a contextual way. If we wanted to know which kayak was the most stable, we should also specify the environmental conditions under which it was used, the skill of the kayaker in that area, and what sort of hunting and fishing was taking place. For example, most of the eastern arctic kayak types, i.e., E. Hudson Bay, H/D Straits, Cumberland Peninsula, and N.