Instructions for Water Table Use

Foreword:

Because the water table is made of acrylic it is fragile and prone to cracking. Keep this in mind when putting the water table at an angle to increase the flow rate. Be prepared for the water table to break at all times. Take care not to scratch the testing surface; this introduces defects in the flow and makes phenomena less defined.

Limitations:

Detached Shocks – They are difficult to achieve in a water table. This is probably because of the high surface tension of the water. One solution is to add soap to the water, decreasing its surface tension.

Comparison to CFD – The water table is an analogy to shocks in compressible flow. Keep this in mind when comparing to CFD models; the discrepancy in values between the two methods can be up to 25%.

Angle and Mass Flow Rate – The mass flow rate is highly dependent on the angle of the system. The pump does not control the speed of the water as much as it controls the mass flow rate/height of the water. Keep this in mind when calibrating for your system.

Leaks and Failures – Always be prepared for leaks and catastrophic failures. Operate the water table in a location that can get wet. Remove items that can be damaged by water before operating the water table.

Lighting – To be able to observe the phenomena well, proper lighting is needed.

Interference – "Mach waves" from imperfections and uneven flow are difficult to remove from the system. Unless it is interfering with your observations, it is usually wise to ignore the imperfections. Minor adjustments are preferable if you have interfering phenomena.

Instructions for Set-up:

1) Ensure that the water table is on a stable, flat surface. This surface should be elevated above the ground for easy clean-up. The very end of testing surface should rest on the bucket.
2) Place the aluminum block at an angle behind the inlet to the table. This diverts the jet of water and prevents it from putting too much pressure on the back acrylic piece.
3) Make sure that the pump sits on the foam inside the receiving bucket.
4) Double-check that all tubing is connected and the valve is closed.
5) Fill the bucket that holds the pump to the brim with water.
6) Fill the water table that holds that aluminum block to the brim with water.
7) Open the valve slightly
8) Plug in the pump
9) Slowly open the valve to the desired flow rate. DO NOT open the valve all the way – stay below 80% open.
10) (Optional) introduce rheoscopic fluid or soap.
11) Introduce testing geometry

Instructions for Clean-up:

1) Unplug the pump
2) Close the valve
3) Remove any testing geometry
4) Place the bucket on the floor
5) Detach the tube at the pump and, using your hand to cover it, lower the end into the bucket.
6) Open the valve
7) When the vast majority of the water is removed from the system, pick up the water table and empty the remaining water into the bucket by turning the water table over.
8) Remove the pump and empty the water from the pump bucket.

Version 2.0

1) Make as much of the table from sheet metal as possible.
2) Design a built-in angle into the system. This is what controls the water velocity the most.
3) Chemically weld any acrylic pieces that are required for the water table. A solution of 90% dichloromethane (methylene chloride) and 10% acetic acid works well. These chemicals can be bought at UI's chemical store in Renfrew. Cover any seals with silicone caulking. Avoid any other caulking/epoxy as they are neither water-proof nor flexible enough for this application.
4) Use long plastic wall-corner protective pieces as the retaining walls on the testing portion of the table instead of acrylic pieces. This will reduce interference by keeping an even surface.