

# WishList

November 14, 2022

## 1 Fluids Laboratory (Wish List)

### 1.1 Devices to Replace/Enhance Current Experiments

Current Experiment	New Experiment	Educational Value
- <a href="#">Viscosity using Stokes Law (Theory)</a> - <a href="#">Viscosity using Stokes Law (Data)</a>	Particle Drag Coefficients ( <a href="https://sunlabtech.com/particle-drag-coefficients/">https://sunlabtech.com/particle-drag-coefficients/</a> )	Dedicated Instrument quicker set-up and changing conditions. Essentially the same as current experiment using dedicated apparatus instead of salvaged labware

### 1.2 Devices to Extend Current Experiment Suite

New Experiment	Educational Value
<a href="#">Reynolds Demonstration</a>	Demonstrate Osborne Reynolds dye experiments and subsequent invention of the dimensionless group that characterizes laminar, transitional, and turbulent flow regimes. - Uses 1.0 X 0.5 meters of bench space. Will fit in current lab space without much fuss
<a href="#">Cake (Plate-and-Frame) Filtration</a>	Illustrates deep bed filtration and cake (forming on a septum) filtration. - A unit process at larger scale than typical benchtop filtration, plus deep bed. - Combine with a turbidimeter to illustrate breakthrough (in deep bed). - Illustrate dead end filtration and deliquoring - Demonstrate cycle-time analysis - Uses 2.0 x 1.0 meters of floor space
<a href="#">Hydrographs after Precipitation</a>	This would be a nice addition to the laboratory suite. - Uses 1.6 X 1.0 meter of floor space - Has odd way to time-varying flow, but rest of apparatus is cool

New Experiment	Educational Value
Water Hammer in Pipes	A transient flow experiment - Can develop data and analyze using rigid-column theory or elastic pipe theory - Uses 1.0 X 1.0 meter of floor space
Fluidized Bed (Upflow Filtration	Demonstrate material “quickenning” with upward fluid gradient - Geotechnical implications - Uses 0.75 x 0.70 meter of floor space
Compressible Flow	We don’t do any compressible flow experiments, should add this someday - Uses 0.9 X 0.65 meter of floor space
Subsonic Wind Tunnel	Use to find drag coefficients of object of various shapes - 3D print weird shapes, measure $C_D$ and render in dimensionless charts - Uses 2.2 X 0.65 meter of floor space, weighs 220 Kg

### 1.3 Instrumentation to Extend Current Experiment Suite

The list below are some items that would require substantial DIY building, but once completed would greatly modernize the learning experience

Instruments	Educational Value
Septra or equivalent 0-35 psi pressure transducers	Replace manometer fittings, somewhat more modern tools and similar to what is used in industrial measurement and control - Plumbing fittings (SwageLoc) to connect to existing devices also needed - Need about 20 with 3 spares to instrument the various existing devices and tilting flume
Septra or equivalent 0-100 psi pressure transducers	Same as above, higher range
Single board microprocessors (Raspberry Pi or Arduino) to interface with above transducers - Use as data loggers - Include actuators to use as experiment controllers	Modern industrial control - Can introduce process control (program as PID controllers) to some experiments - Use to generate local (to the room) wireless network and computers can collect data and send directly to a local web server
Non-contact Temperature Sensors	Use to record temperature with above microprocessors
Hot Wire Anemometer	These are fairly simple to build they go on one leg of a wheatstone bridge and from the resistance change, we measure velocity - Used in air, water has too high thermal conductivity, still would be meaningful to try

Instruments	Educational Value
IR Flow Visualization	IR Image interpretation for quantifying shallow flows

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