

**Flow Facilities**  
**10/03/07**  
**Flow Visualization: The Physics and Art of Fluid Flow**  
**Fall 2007**

Here is a list of flow facilities; equipment is listed below. If something is marked with a question mark or is listed “available soon” feel free to nag us.

**AIR**

Facility	Lighting	Visualization	Phenomena	Access
Fine Arts Studio	Try projector for light sheet or use strobe (studio’s or yours)	Stage fog. Large fog generator is available for checkout	Free air motion or vortex rings from burping box or ZeroBlaster	? Current status unknown. FA students with strobe cabinet access. Check out fog generators from Prof. Sweetman
ITLL sink space, or checkout for home use: Vortex ring generators; zeroblaster, or timed generator	Try projector for light sheet, or strobe	Stage fog	Vortex rings, symmetric and asymmetric	Check out fog generators and timed vortex generator from ITLL Check out zero blasters and projector from JH
Misc air flows	Strobe for volume vis	Dry ice vapor <sup>1</sup> humidifiers, steaming pots, medical nebulizers (<\$5) <sup>2</sup> Fog generators	Jet flows, positive buoyancy convective flow	JH has nebulizers

<sup>1</sup> Dry ice is solid carbon dioxide. Do not seal into a container, let it breathe. Handle with extreme care; it can freeze flesh. Cover with hot water for best effect, otherwise a water ice shell will form.

<sup>2</sup> Medical nebulizers require a small compressed air source. Do not nebulize oils (i.e. canola) without use of a proper respirator or aerosol filter mask: oil coated lungs define pneumonia and asphyxiation.

Planar Jet Facility ECSL 121	CW argon ion laser; time avgd images	Stage fog	Disturbed jet flow, see Fig 1, <a href="http://stripe.colorado.edu/~hertzber/researchprojects.html">http://stripe.colorado.edu/~hertzber/researchprojects.html</a>	See Prof Hertzberg. Last two group projects only.
Color Schlieren, Large system for ECSL 121 only. 2 small systems for home checkout.	EG&G strobe, provided. Maybe works. Car headlight for other light source; see Settles' book	Light bent by $\eta$ gradients	Convective flows from warm/hot objects: hands, candles, hair dryers (turbulent jet). You may need time to make your own color stops.	See Prof. Hertzberg, last two projects only.

## LIQUIDS

ITLL Flume	Strobe or 500 Watt work lights or North Star lights	Free surface or food coloring. Be sure to bleach water clean. Try poster paint dots for surface flows.	Free surface: weirs, hydraulic jump, inclined flow. Wakes: submerged objects, one can inject dye. Jets: coflow, reverse, transverse. Boundary layers and surface flows.	Sign up for flume time in ITLL. See Darby.Odell@Colorado.edu ITLL module engineer.  North Star lights in Durning Lab Greg.Potts@
Large Fish Tank in ITLL (50 gal)	Strobe	Food coloring. Be sure to bleach water clean afterwards	Short jets, vortex rings, boundary layers	ITLL signup/checkout
Hele-Shaw cell	Work light or bounced strobe	Food coloring of detergent, corn syrup, water, etc	Saffman-Taylor instability	ITLL checkout

Reversible Flow Demo	Strobe	Food coloring	Glycerin or corn syrup. Students write in the fluid with dye and rotate the inner of two cylinders slowly. Upon reversing the direction, the original writing reappears.	ITLL checkout (take home 2 days). Two sets are available.
Blackstock's Kallirosopic Fluid	Needs polarized light setup		Any flow with shear; turbulence	Prof. Hertzberg
Small (10 gal) Fish Tanks	Strobe	Food coloring, alumina powder, cornstarch particles; anything you are willing to put down your own drain.	Short jets, vortex rings, boundary layers Steady vertical vortex (from stirring machine)	ITLL checkout (take home 2 days)
Soap Film Tunnel; high humidity needed.	Diffuse sunlight is best.	Thin film effect	Jets, wakes, shear layers	ITLL signup/checkout
Fish Tank ECSL 121 (voltage source limitation)	Strobe or work lights	Hydrogen Bubble apparatus	Any motion in salted water	JH. Extra training and work required



Figure 1 Planar jet, forced.

## Equipment Checkout

Please note that this equipment is often either expensive, rare, or both. Students checking out equipment are expected to take responsibility for the equipment. If equipment is lost, stolen, or broken, there are no funds available for replacement or repair (no, CU has no insurance for this stuff, it would cost too much).

Equipment	Location	Notes
Stage fog generator (large)	JH	Fog is nontoxic water-based glycol solution. \$40/gal., don't waste. Can leave residue.
Stage fog generator, (small)	ITLL	
Zero Blaster ring generator and fog fluid	JH	
4.5" schlieren system	JH	
	<b>CAMERAS</b>	
Canon G2 digital camera, 4 megapixels. Stills, with short video capabilities	ITLL 24 hr checkout	
I-Speed high speed video system	ME Durning Lab. See John Coyle	Training required.
Nikon F 35 mm film body	See Prof. Hertzberg	
Nikon macro 102 mm	See Prof. Hertzberg	
Stereo cameras (film)	See Prof. Hertzberg	
	<b>LIGHTING</b>	
Sunpak Auto 383 Flash (strobe) unit & 25' cable	See Prof. Hertzberg	
CW 5 Watt argon ion laser	See Prof Hertzberg	Serious training required.
Misc black lights	ITLL checkout	
Party strobe		
High power slide projector(s)	Fine Arts. See Prof. Sweetman	
500 W work lights, several sets	ITLL	