

Today:  
Admin  
Facilities and Equipment

- Admin:
- Please sit with your team, so you can discuss possibilities as they come up today
  - Email plan for first team assignment on Monday.
  - Also, Clouds 1 image due Monday.

Bring to class:  
Zeroblasters  
Small fog machine  
Ultrasonic humidifier  
Blackstock demos



FlowFacilitie  
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**Flow Visualization Equipment and Facilities**  
02/15/11  
MCEN 4228/5228 -002  
Flow Visualization: The Physics and Art of Fluid Flow

Here is a list of flow facilities; equipment for checkout is listed below. Make a reservation with Nick Stites ([Nick.Stites@Colorado.edu](mailto:Nick.Stites@Colorado.edu)) to use the big facilities in the ITLL (flume, wind tunnel, sink space room). To check out the smaller equipment in the ITLL, including stuff stored in the Media Shack, see Mike Elliott ([Mike.Elliott@Colorado.edu](mailto:Mike.Elliott@Colorado.edu)). His office is the checkout office on the 2B level of the ITLL. If he is not there, pick up the checkout phone on the south facing wall near the south stairs of either lab level; an equipment checkout person should be able to help you. Greg Potts ([Greg.Potts@Colorado.edu](mailto:Greg.Potts@Colorado.edu)) in the Durning Lab (1B level of ME wing) has a huge assortment of parts for DIY setups: glassware, plexi, pumps, plumbing, fans etc. Mike E has a stash of miscellaneous stuff too.

**AIR**

Facility	Lighting	Visualization	Phenomena	Access
Vortex ring generators; zeroblaster, or timed generator. Use in the ITLL sink space (can be made dark), or checkout for home use.	Try projector for light sheet, or strobe	<b>Stage fog</b>	Vortex rings, symmetric and asymmetric	Check out fog generators and timed vortex generator from ITLL; in MediaShack. 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, humidifier
Color Schlieren, Large system for ECSL 121 only. 2 small systems for	EG&G strobe, provided. Maybe works. Car headlight for other light source; see	Schlieren: Light bent by $n$ gradients Could do stereo with 2 small	Convective flows from warm/hot objects: hands, candles, hair dryers	See Prof. Hertzberg, last two projects only.

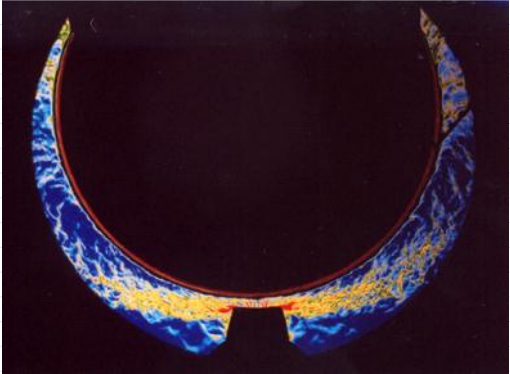
<sup>1</sup> Dry ice is solid carbon dioxide. Do not seal into a container, let it breathe. Handle with extreme care; it can freeze flesh. Cover with hot water for best effect, otherwise a water ice shell will form.  
<sup>2</sup> Medical nebulizers require a small compressed air source. Do not nebulize oils (i.e. cannabis) without use of a proper respirator or aerosol filter mask; oil coated lungs define pneumonia and asphyxiation.

Some stuff is in my lab, not in Media shack yet.

Surprisingly difficult to capture.



Brynne Sutton, Emrys Hall,  
Thomas King, Bethany  
Rotherham FV2003



Colleen Stroud FV 2004



home checkout.	Settles' book	systems	(turbulent jet) You may need time to make your own color stops. Can be used in water too.
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**LIQUIDS**

Facility	Lighting	Visualization	Phenomena	Access
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 Nick Stites@Colorado.edu ITLL module engineer. North Star lights in Durning Lab Greg Potts@
Large Fish	Strobe	Food coloring	Short jets	Check with JH

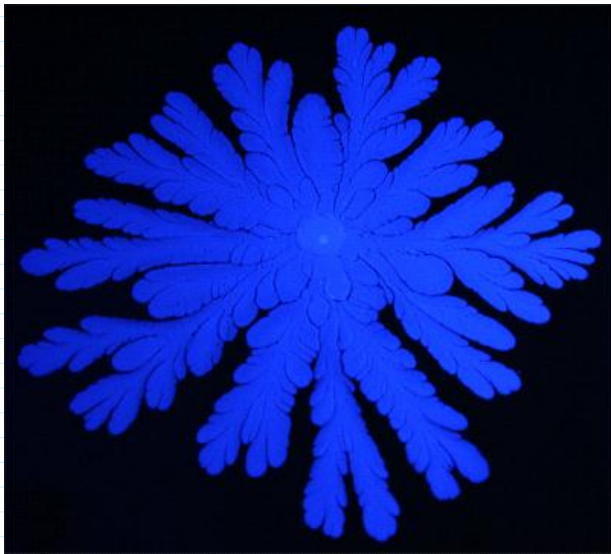
		dots for surface flows.	inject dye. Jets: coflow, reverse, transverse. Boundary layers and surface flows.	engineer. North Star lights in Durning Lab Greg Potts@
Large Fish Tank in ITLL (50 gal)	Strobe	Food coloring. Be sure to bleach water clean afterwards	Short jets, vortex rings, boundary layers	Check with JH first. ITLL sign up/ 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	Any lights will work; everything is slow	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.



Tanner Ladtkow, Tim Read  
FV 2006



Melissa Talmage,  
Nigel Gorbald, Lok  
Kin lee, Christopher  
McCray, Taylor  
Simonson FV2006



[http://www.youtube.com/watch?v=W3YZ5veN\\_Bg](http://www.youtube.com/watch?v=W3YZ5veN_Bg)



Bethany Rotherham  
FV2003

Rubbing alcohol dyed with fluorescent laundry detergent was injected into a thin layer of pancake syrup in a Hele Shaw cell, resulting in fingering from the Saffman-Taylor instability.

Tanner Ladtkow, Andrea Fabri, Tim Read  
FV 2006

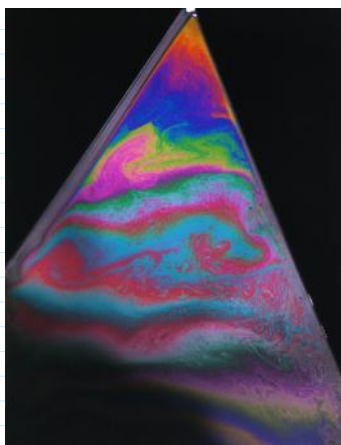
Katina Butler, Kerstin Lieff, Adrien Robert,  
Chris Wilke FV 2004

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) Small ring generators available.	ITLL checkout (take home 2 days)
Soap Film Tunnel; high humidity needed.	Diffuse sunlight is best.	Thin film effect	Jets, wakes, shear layers	ITLL sign-up/checkout. Normally in MediaShack
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
Blackstock Rheoscopic Fluid cell	Needs polarized light setup	Streaming birefringence	Cylinder wake	Prof. Hertzberg
Ferrofluid	Normal studio lighting	Move it with magnets	Magnetic field lines	Impossible to clean up spills. Will stain anything. Nontoxic, though.
Glycerin				Mix with soap solutions to extend soap film life

#### 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). Durning Lab is in the basement level of the ME wing, ECME 1B66, run by Greg Potts: 2-7646, [greg.potts@colorado.edu](mailto:greg.potts@colorado.edu)

Equipment	Location	Notes
Stage fog generator (large)	JH	Fog is nontoxic water-based glycol solution. S40/gal., don't waste. Can leave residue.



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Stage fog generator, (small)	ITLL MediaShack or JH	
Zero Blaster ring generator and fog fluid	JH	
4.5" schlieren system (2)	JH	
Big schlieren (20" diameter, 8" focal length, need 24' dark space)		
<b>CAMERAS and LENSES</b>		
Olympus I-Speed high speed video system	ME Durning Lab. See Greg Potts.	Training required. Up to 30,000 fps, but is low resolution, and low sensitivity; needs lots of light.
Flip HD video camera F460	JH	Fixed focus, use closeup lenses
Nikon D700 DSLR with 24-105mm zoom	See Prof. Hertzberg	Tight leash.
Nikon extension tubes	See Prof. Hertzberg	
Nikon 24 mm wide angle lens	See Prof. Hertzberg	
Nikon 50 mm lens	See Prof. Hertzberg	
Nikon macro lens 102 mm	See Prof. Hertzberg	
Closeup Lenses: +1, 2 4 in 58 mm dia, +2,+3 in 72 mm dia.	JH	
Stereo cameras (film)	See Prof. Hertzberg	
<b>LIGHTING</b>		
Sumpak Auto 383 Flash (strobe) unit & 25' pc cable	See Prof. Hertzberg	
CW 5 Watt argon ion laser	See Prof Hertzberg	Serious training and a bit of repair required.
Misc black lights	ITLL, checkout, MediaShack	
Party strobe	MediaShack	
500 W work lights, several sets	ITLL	
<b>MISC</b>		
Grete-Macbeth/X-Rite Eye-1 Spectrophotometer	See Prof. Hertzberg	For color calibration of monitors, cameras, printers and projectors.
Large backdrop (8 foot square), Small table-top	Durning lab	

tent, black velvet		
Assorted tripods	JH	



suttondbvlo  
rtlores

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