10.Facilities

Tuesday, February 15, 2011
5:20 PM

Today:

Team member behaviors
Facilities and Equipment

Admin stuff:

- Please sit with your team, so you can discuss possibilities as they come up today
- Mac users, in submitted filenames: letters and numbers only, NO SYMBOLS please.
- Don't forget UNCOMPRESSED edited final image, not jpg.
- Please no zips, many steps to put in workflow. You can upload as many files as you need to.
- Team First image due Weds March 6.
- Please turn in hardcopy of reports in addition to posting in D2L dropbox

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

Chem Stores: on campus source for glassware, chemicals, lab supplies (cash OK):
http://chem.colorado.edu/purchasing/index.php/chemstores/2-uncategorised/21-chemstores-west
More optics cleaning tips: http://www.newport.com/How-to-Clean-Optics/141176/1033/content.aspx

Music students who volunteered to score FV videos:
Alex White: alexander.white@colorado.edu
Jim Simmons: jim.simmons.composer@gmail.com
eric.mulhern@gmail.com
kayla.stearns@colorado.edu
andriy.sovetov@colorado.edu
morgan.denney@colorado.edu
Payment is not expected, but you must give attribution in film credits

Team Behaviors

This American Life #370 Ruining It for the Rest of Us.
Bad team behaviors: The Jerk, The Slacker, The Depressive
The cure: solicit input from everyone.

http://www.thisamericanlife.org/sites/all/play_music/play_full.php?play=370

Expectations For Teams
Flow Visualization
Spring 2013

Reasons for putting you on teams:

1. So that you can attempt to image more complex flow phenomena. If the work of developing a setup is spread out among you, then you can try a challenging experiment.
2. So that you can attempt more challenging imaging techniques. The teams were chosen to spread out photographic and fluids expertise and equipment amongst the teams.
3. To have partners to bounce ideas off of. This makes ideas multiply.
4. To get informal feedback on your work.
5. To interact with students from different backgrounds.

Thus, working on a team is STRONGLY EXPECTED, but not strictly required for the team assignments. You are not required to work only with your team, but you are expected to make significant effort to be available to help them with their images and ideas. You do not all have to use the same equipment. Do plan to spend at least an hour or two to help **each** of your teammates, and recognize that you can plan on having 4 to 8 person-hours at your disposal for your project. Plan multiple meetings. If you find you are not available for specific sessions, figure out how to make it up to your team.

I hope you will take advantage of the benefits of working in teams and of the opportunity to broaden your network. Strong recommendation: don't work only with your friends. Bad for you professionally.

Following from this, here are the expectations for the deliverables on the team assignments:

Each student is expected to turn in a unique image or video that they had primary artistic and scientific responsibility for. You must give credit appropriately in your report, by explicitly naming the teammates that contributed, and what they did.

Each image/vid must be accompanied by a report. If several images come out of the same setup, you can copy descriptions of the apparatus, and the basic physics. If appropriate, give credit to report section authors. Be sure to describe the details relevant to your particular image.

Equipment and Facilities

Flow Visualization Equipment and Facilities
02/26/14
MCEN 4151-5151/Film 4200/Arts 5200
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) 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 Kai Amey (ameyexc@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) in the Durning Lab (1B level of ME wing) has a huge assortment of parts for DIY setups; glassware, plexi, pumps, plumbing, fans etc. Kai Amey has a stash of miscellaneous stuff too.

* Means equipment is currently in Hertzberg's lab ECME 1B64, but after first use will be in ITLL for checkout.

FLOW FACILITIES: AIR

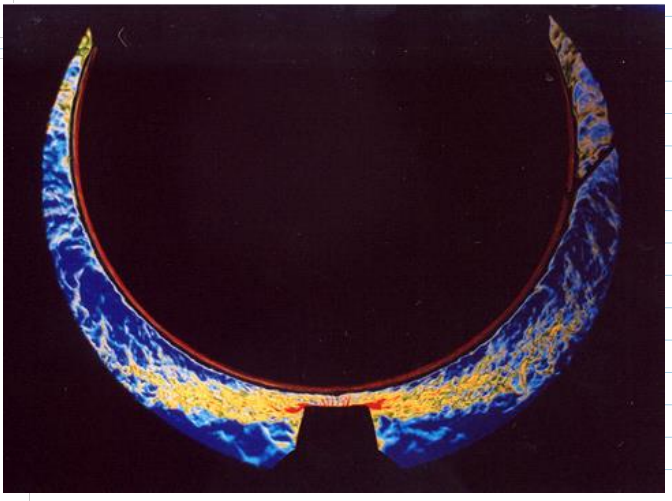
Facility	Lighting	Visualization	Phenomena	Access
Vortex ring generators; zeroblaster, or timed generator. Use in the ITLL sink space (can be made dark), or checkout for home use.	Try projector for light sheet, or strobe	**Stage fog**	Vortex rings, symmetric and asymmetric	*Check out fog generators and 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[1] humidifiers, steaming pots, medical nebulizers (<$5)[2] Fog generators	Jet flows, positive buoyancy convective flow	JH has nebulizers, humidifier
Color Schlieren, Large system	EG&G strobe, provided. Maybe works.	Schlieren: Light bent by η gradients	Convective flows from warm/hot	See Prof. Hertzberg, last two projects

[1] 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.
[2] 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.

Some stuff is in my lab, not in ITLL yet.

Surprisingly difficult to capture.

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



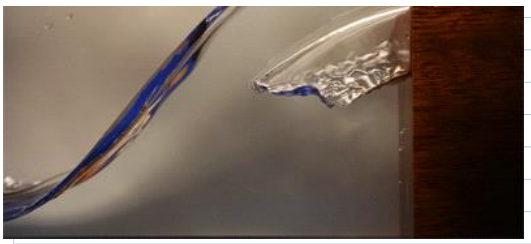
for ECME 1B64 (JH lab) only. 1 small systems for home checkout.	Bright single LED headlight works well too.	Could do stereo with 2 small systems	objects: hands, candles, hair dryers (turbulent jet). You may need time to make your own color stops. Can be used in water too.	only.
Reuben's Tube	Flame	Flame length represents pressure.	Standing wave resonance in a pipe, excited by a loudspeaker on the end.	JH. You'll need to provide a regulated propane supply, and follow combustion guidelines.

FLOW FACILITIES: LIQUIDS

Facility	Lighting	Visualization	Phenomena	Access
ITLL Flume	Strobe or 500 Watt work lights or North Star lights, or new LED floodlights (JH checkout)	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 Tank in ITLL (50 gal)	Strobe or work lights	Food coloring. Be sure to bleach water	Short jets, vortex rings, boundary layers	*Check with JH first. ITLL signup/

Colleen Stroud FV 2004

			layers and surface flows.	Durning Lab Greg.Potts@
Large Fish Tank in ITLL (50 gal)	Strobe or work lights	Food coloring. Be sure to bleach water clean afterwards	Short jets, vortex rings, boundary layers	*Check with JH first. ITLL signup/ checkout
Hele-Shaw cell	Work light or bounced strobe	Food coloring of detergent, corn syrup, water, etc	Saffman-Taylor instability	*ITLL checkout In Media Shack.

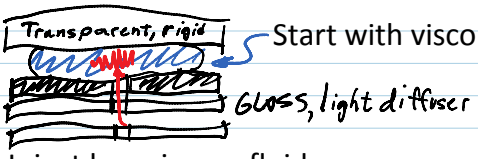


Tanner Ladtkow, Tim Read
FV 2006

Category in Imatch

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

Hele-Shaw cell
Taylor-Saffman instability



Start with viscous fluid

Inject less viscous fluid

Reversible Flow Demo	Any lights will work; everything's 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).
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 or JH checkout (take home 2 days)
Soap Film Tunnel; high humidity needed.	Diffuse sunlight is best.	Thin film effect	Jets, wakes, shear layers	JH lab. Could use a redesign.
Glitter Tanks (2) 6 foot X 3 inch black PVC half tubes	LED or other worklights	Glitter (Pearl-Ex), Pearl Swirl or pearlescent shampoo	Wake and wave phenomena	*In ITLL Media Shack. Would benefit from small recirc pump.
Fish Tank (voltage source limitation)	Strobe, LED or [illegible] lights	Hydrogen Bubble apparatus	Any motion in salted water	JH. Extra training and work required
Liquid Desk Toys: lava lamp, vortex lamp, drip timers, sparkly fluid in balls, etc.		Built in	Various, including low-order turbulence, wakes, droplet motion	JH. An assortment of dynamic desk toys that have fluid motion.
Blackstock Rheoscopic Fluid cell	Has polarized light setup	Streaming birefringence	Cylinder wake	Prof. Hertzberg. Also have extra fluid available, but apparatus

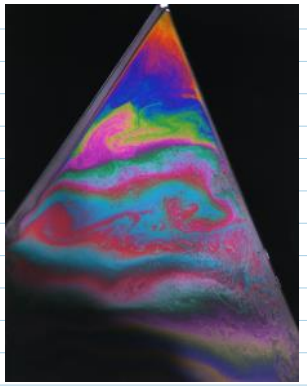
Needs glass top sheet

GI Taylor film includes reversible flow

http://www.youtube.com/watch?v=QcBpDVzBPMk&feature=youtube_gdata_player

butlersoap...

http://www.youtube.com/watch?v=iGySs9bJbwU&feature=youtube_gdata_player



Katina Butler, Kerstin Lieff, Adrien Robert, Chris Wilke, FV 2004 team1

Pass around

				must be very

Ferrofluid Climbs

				must be very clean; no salts.
Ferrofluid	Normal studio lighting	Move it with magnets	Magnetic field lines	Durning Lab? Impossible to clean up spills. Will stain anything. Nontoxic, though.
Glycerin				JH lab. Mix with soap solutions to extend soap film life

Equipment Checkout
Please note that this equipment may be 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.

Equipment	Location	Notes
Stage fog generator (cooled)	JH	Fog is nontoxic water-based glycol solution. $40/gal., don't waste. Can leave residue.
Stage fog generator, (small)	*ITLL MediaShack or JH	
Zero Blaster ring generator and fog fluid	JH	
Ultrasonic humidifier	*ITLL Media Shack	
4.5" schlieren system (2) Big schlieren (20" diameter, 8' focal length, need 24' dark space)	JH	
	CAMERAS and LENSES	
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

Ferrofluid Climbs
http://vimeo.com/55136676
David Oakley, Peter Davis, Kerylyn Lay, Jakob Anderegg, Brayden Hass.
2012
Pasted from <https://vimeo.com/home/myvideos/page:2/sort:date/format:video>

Ferrofluid Flies Up
http://vimeo.com/55075720
Brayden Hass, Jakob Anderegg, Peter Davis, Kerylyn Lay, David Oakley
2012
Pasted from <https://vimeo.com/home/myvideos/page:2/sort:date/format:video>

Add watercolors:
http://fabianoefner.com/?portfolio=millefiori

		lenses
Canon EOS Rebel XT 8 Mpx, no movie mode	See Prof. Hertzberg	
Canon extension tubes (for cheap lenses, no electronic pass thru)	JH	
Canon zoom lens: EF 75-300 mm	See Prof. Hertzberg	Autofocus, but no image stabilization.
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	
	LIGHTING	
Sunpak 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? JH	
Party strobe	JH	
500 W work lights, several sets	ITLL, JH	
Fluorescent shop lights: 3 foot X 2 tubes	JH	
LED worklight pair, on tripod	JH	
North Star video lights (2), cooled	Durning Lab	
	MISC	
Gretag-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 tent,	Durning lab	
black velvet	JH	
Assorted tripods	JH	

TURNTABLE

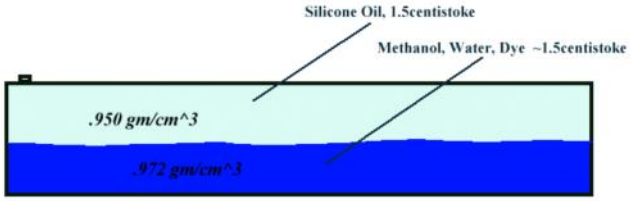
ATOC Equipment

Scott Kittelman <alan.kittelman@colorado.edu>
Department of Atmospheric and Oceanic Sciences
CB-311
303-492-4248 (lab phone number)

Scott has a wide range of equipment available, but he is only able to help two Flow Vis groups this semester, so contact me if you want to use this equipment.

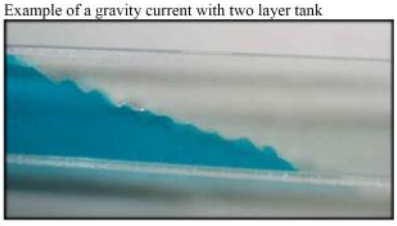
1) Karman vortices – Kalliroscope visualization in a large circular tank

2) Two layer tank with two immiscible fluids



Approx: 125cm long. Layer Depths ~7.5 cm each

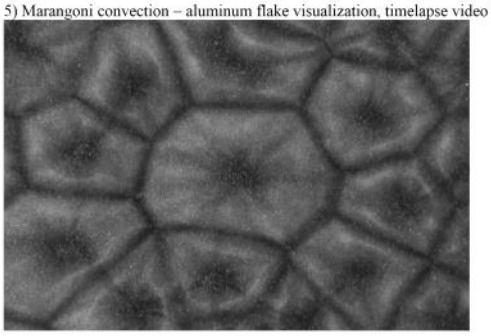
Example of a gravity current with two layer tank



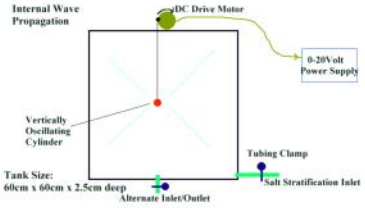
3) Kelvin-Helmholz instability in a 6' clear acrylic tank – two or three layer – dye visualization

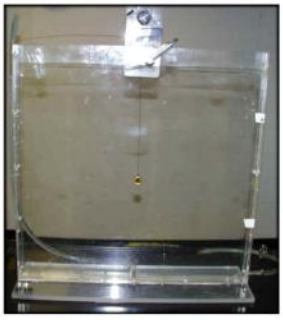
4) Double diffusive convection "Salt fingers"

5) Marangoni convection – aluminum flake visualization, timelapse video best

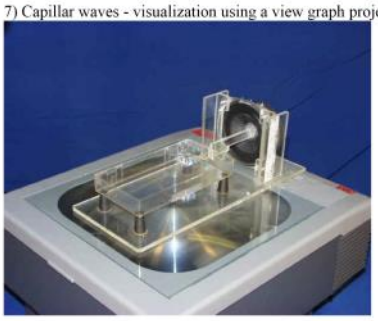


6) Internal gravity waves in a continuously stratified fluid- shadowgraph or Schlieren visualization





7) Capillar waves - visualization using a view graph projector.



8) Surface gravity waves with a shallow water ripple shadowgraph imagery.
Can visualize wave:
interference
reflection
refraction
dispersion

group and phase velocity
plane and circular waves
Doppler effect

9) Thermal convection – aluminum flake visualization of convection over a heating pad in a 6" layer of silicone oil