

# Immersive Fluid Flow Experience

**Inventor: Thomas Hansen**

**Senior IT Consultant and  
Ph.D. Student  
UWM School of Freshwater Sciences**

**Contact: Jessica Silvaggi, Ph.D.**

**Senior Licensing Manager**

**1440 East North Ave.**

**Milwaukee, WI 53202**

**Tel: 414-906-4654**

**[jsilvaggi@uwmfdn.org](mailto:jsilvaggi@uwmfdn.org)**

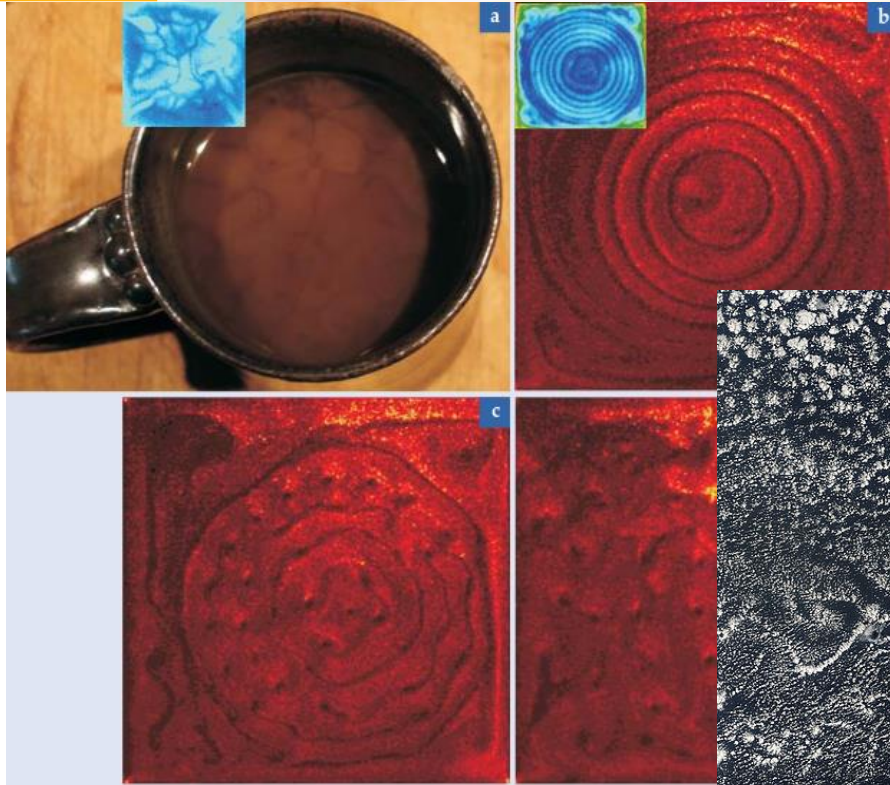
- Computational fluid dynamics (CFD) is a branch of fluid mechanics that uses numerical analysis and algorithms to solve and analyze problems that involve fluid flows



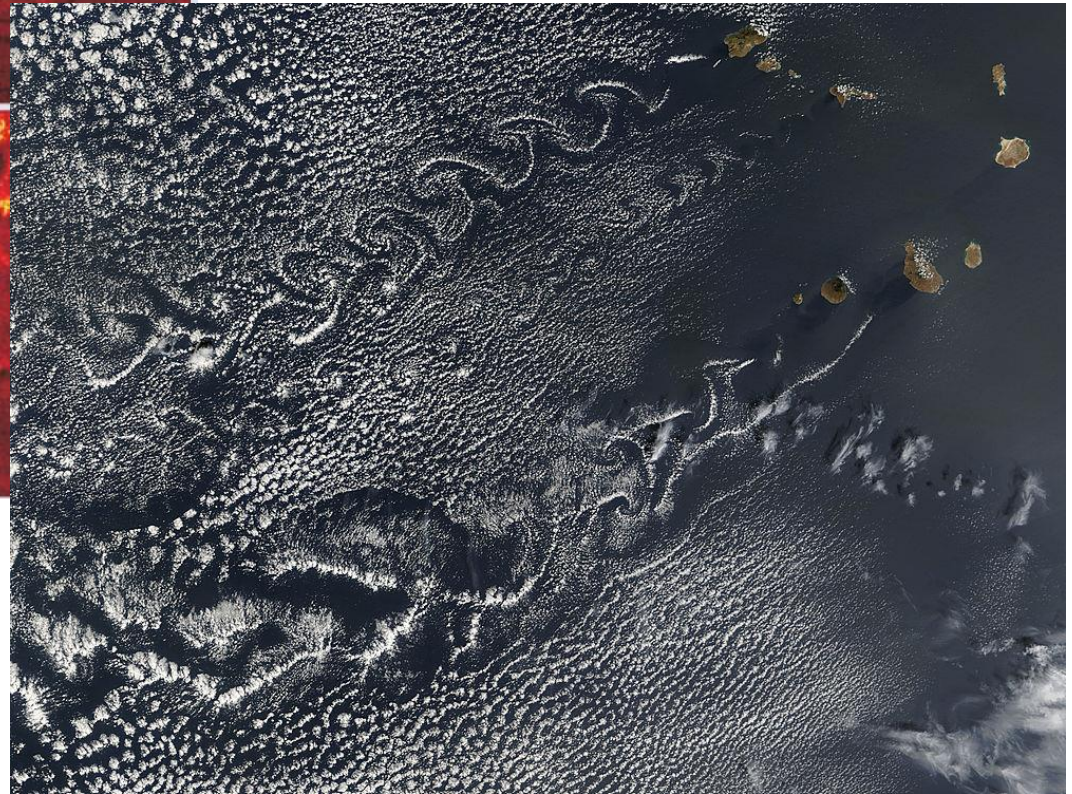
**Problem:** Teaching fluid dynamics can ironically get very dry very fast.

(Navier-Stokes Equation)

$$\underbrace{\rho \left( \underbrace{\frac{\partial \mathbf{v}}{\partial t}}_{\text{Unsteady acceleration}} + \underbrace{\mathbf{v} \cdot \nabla \mathbf{v}}_{\text{Convective acceleration}} \right)}_{\text{Inertia (per volume)}} = \underbrace{\underbrace{-\nabla p}_{\text{Pressure gradient}} + \underbrace{\mu \nabla^2 \mathbf{v}}_{\text{Viscosity}}}_{\text{Divergence of stress}} + \underbrace{\mathbf{f}}_{\text{Other body forces}}$$



Fluid Dynamics has great beauty and complexity, spanning time and space from a cup of coffee...

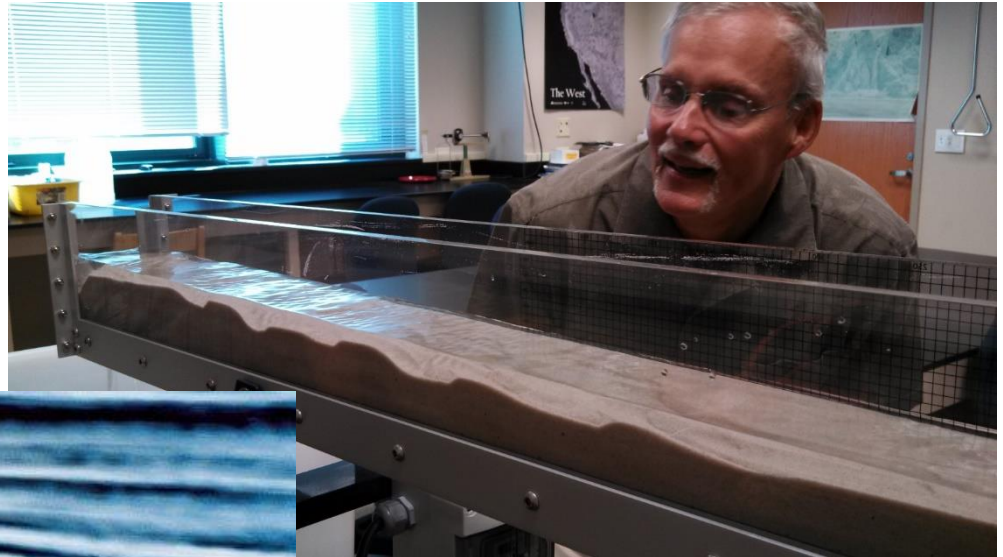


...to cloud patterns off the Cape Verde Islands



- **Demonstrating fluid dynamics can involve expensive and/or messy equipment**

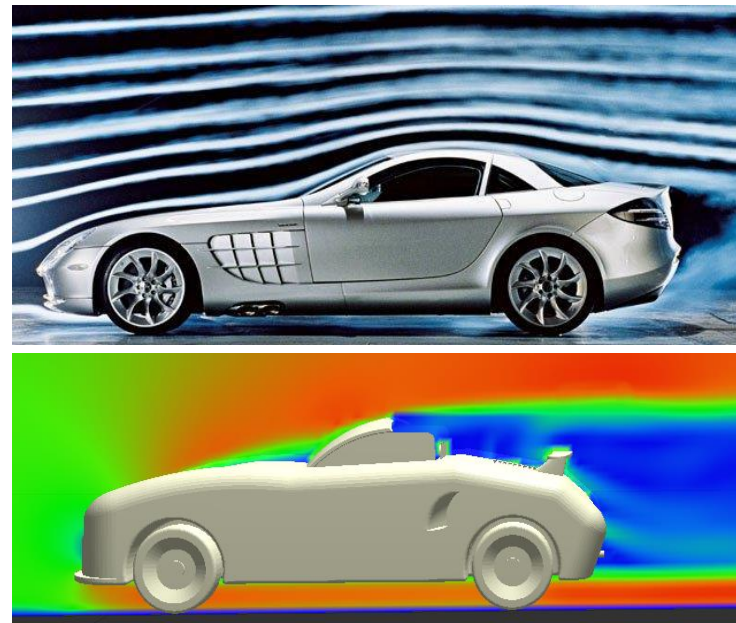
Flumes



Wind Tunnels



- Interactive shadow art



[Ecomodder.com](http://Ecomodder.com) /  
[spyderchat.com](http://spyderchat.com)

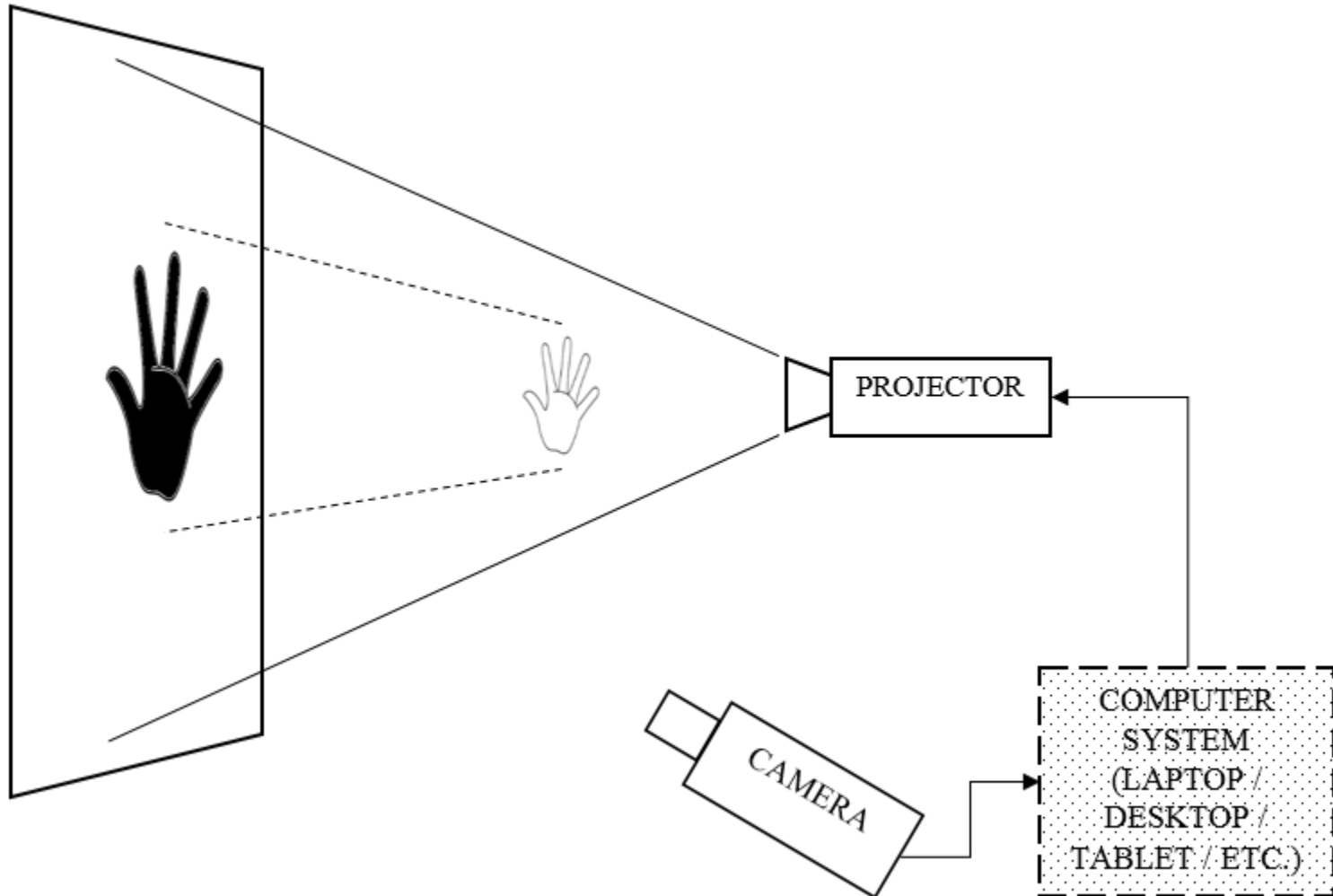
- Wind tunnel visualizations, physical (smoke) and digital simulations



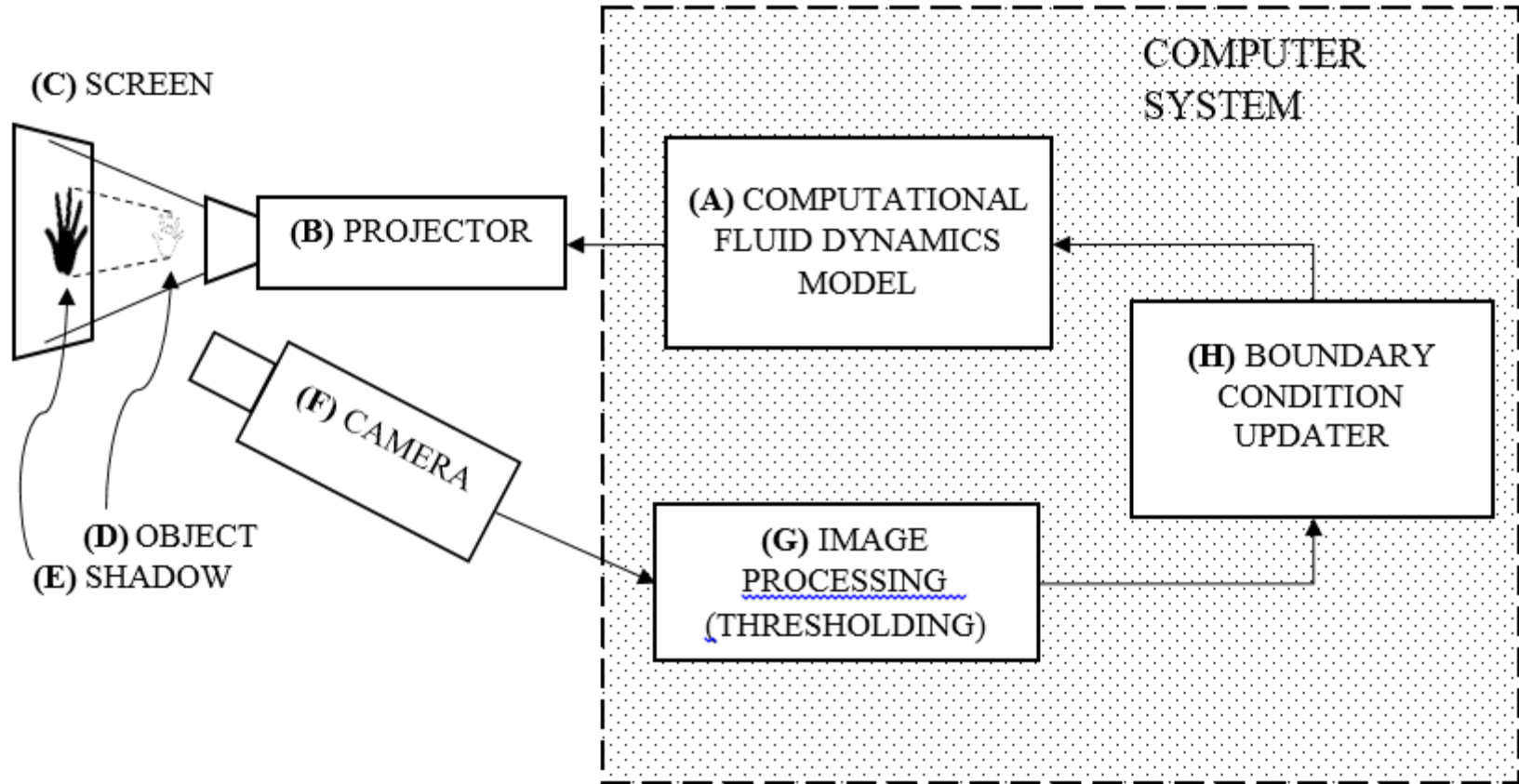
# Solution: The Immersive Fluid Flow Experience

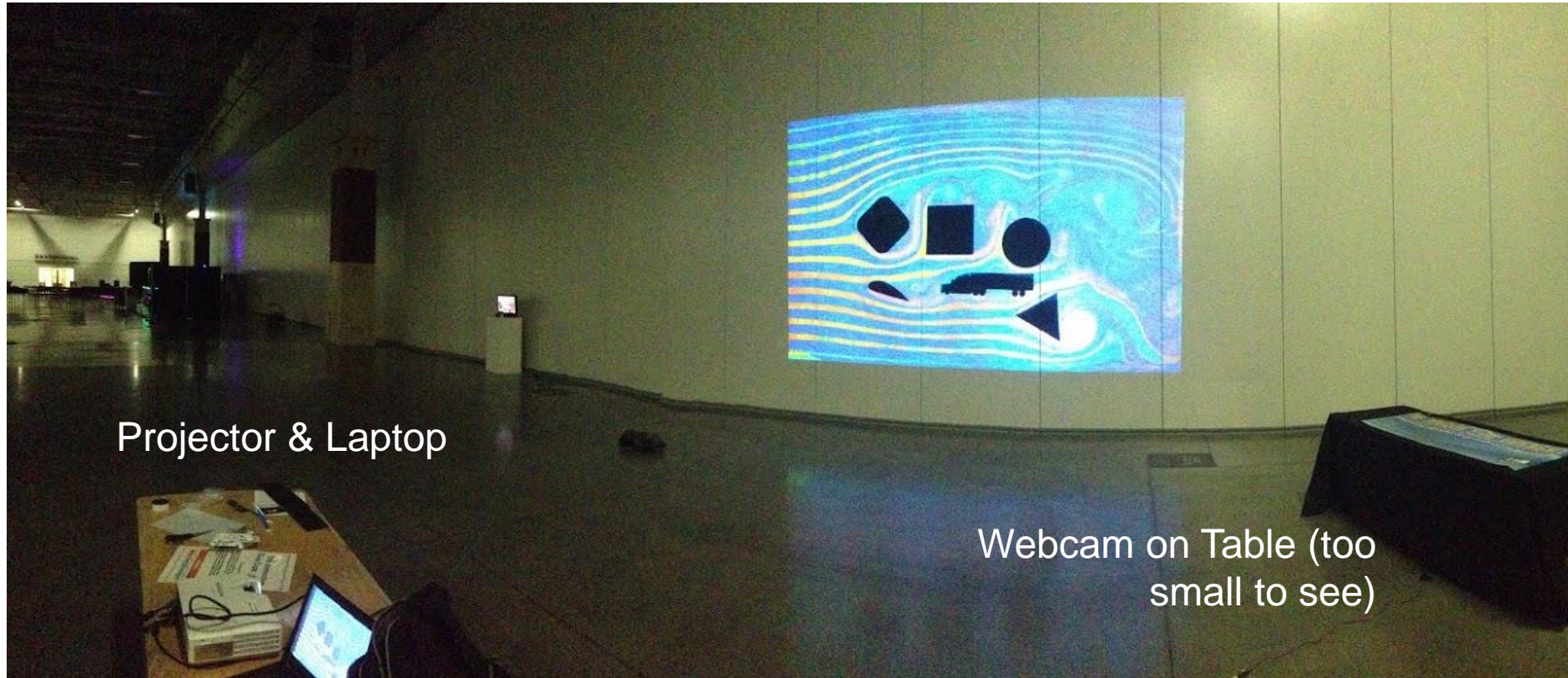


# Schematic Drawing: Set up









Projector & Laptop

Webcam on Table (too small to see)

Things looked pretty straightforward. But then the kids showed up...

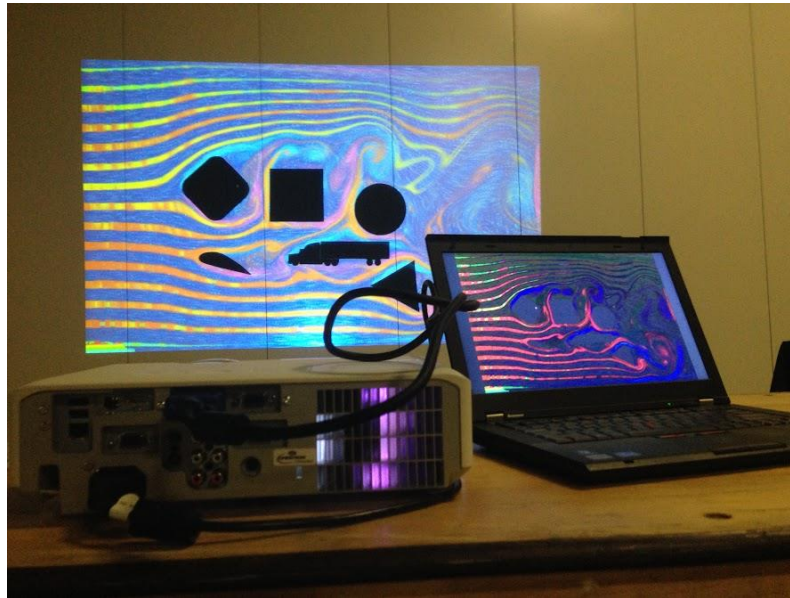
<https://www.youtube.com/watch?v=cLQ98Wizx7Y>

<https://www.youtube.com/watch?v=NG2vbz3hODc&feature=youtu.be>

<https://www.youtube.com/watch?v=OO6Ywrq4brA&feature=youtu.be>



# Equipment Required



- **Good laptop or desktop computer**
- **Projector**
- **Webcam**
- **Screen or wall to project on**
- **Shapes were simply cut from poster board material and stick-on magnets were applied**

- **Science/Art Museums**
  - In 2007 children's museums attracted 30 million visitors annually
  - Museums spend more than \$2B per yr on educational activities; typically  $\frac{3}{4}$  of budget on K-12
  - 25,000 museums in US in 2014
- **Classrooms**
  - **Physics**
  - **Architecture**
  - **Water related courses/Engineering**
  - **Interactive Art Courses**
- **Airports for entertainment**
  - Over 5200 public airports in US alone in 2013
- **Music industry/entertainment**

- **Licensees in the interactive display, educational products, or digital out of home advertising to offer this technology to a wider audience including airports**



# Immersive Fluid Flow Experience

**Contact: Jessica Silvaggi, Ph.D.**

**Senior Licensing Manager**

**1440 East North Ave.**

**Milwaukee, WI 53202**

**Tel: 414-906-4654**

**[jsilvaggi@uwmfdn.org](mailto:jsilvaggi@uwmfdn.org)**