Air Flow Display for the Mary Brogan Museum of Art and Science

Group 13
Joseph Cognato
Jonathan Glynn
Matthew Hartman
Ramon Villarreal

Product Needs

- Demonstrate properties of aerodynamics to young minds (K-12)
- Low maintenance
- Interactive
- Robust and simple as to facilitate many repeated demonstrations

Air box

- Already built and to the correct needs for a flow display
- Small size allows for easy storage and transportation
- Has two high velocity fans and a track already installed
- Space for a front panel display

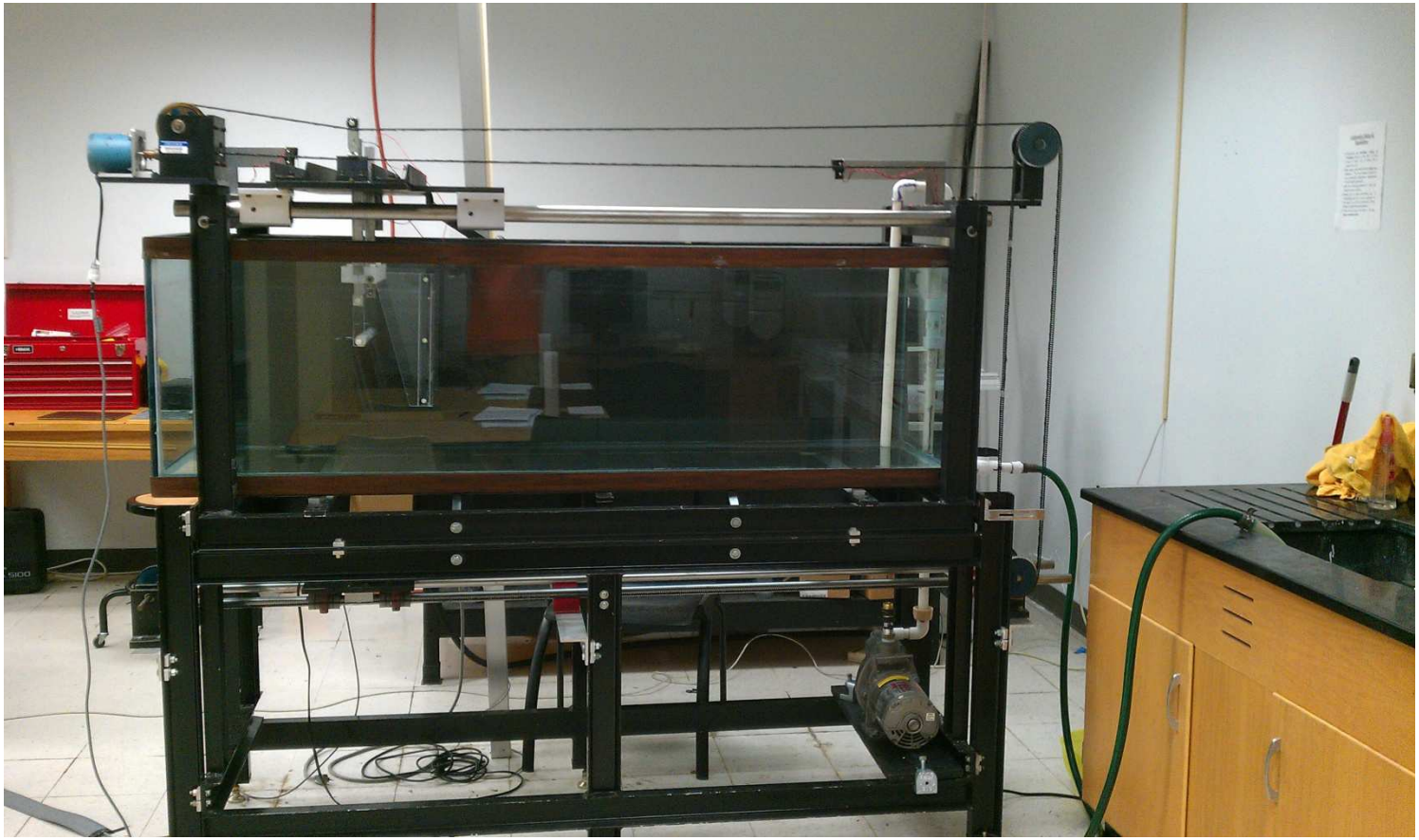
Air Box Unlimited

- Not for quantitative experiments
- Allows for greater focus on interactive elements and less on the display itself
- Does not allow for true visualization of the flow from both size constraints and containment constraints

SUMMARY

- Already built
- True visualization might not be necessary
- Low maintenance
- Easy transport
- Adaptable
- Simplification of display allows for wider ranger of box contents

Concept 1 - Towing Tank



Concept 1 - Tank Aspects

- Chain drives to sync test section and light source
- Switches as fail safes
- Water Medium
- Hydrogen bubbles to visualize flow
- Nylon fixtures
- Large and Heavy

Concept 1 - Test Section

- Aside from moving the section allows for little interaction
- Limited variation in display and constraints on additional tools

- Allows for a variety of shapes
- Can show true flow visualization
- Requires a specific type of light source
- Without the correct contrast is hard to show
- After initial set up can be run repeatedly with same results
- Robust design

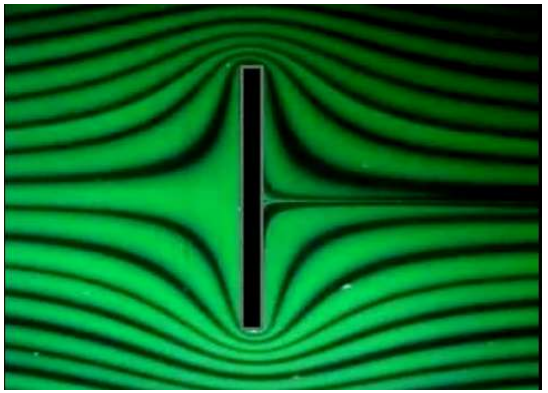
CONCEPT 1 - TANK SUMMARY

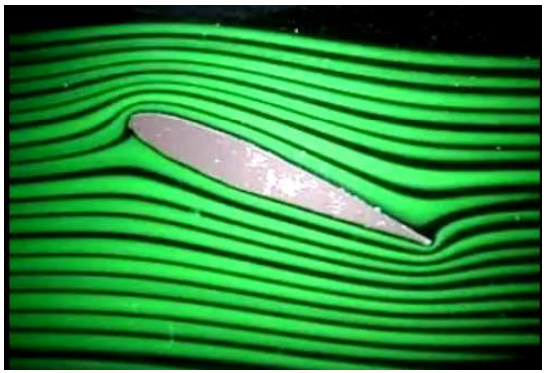
- Robust
- Allows for true visualization
- Does not need electronic medium to demonstrate true flow
- Of all visualization techniques requires least maintenance
- Might be to technical for teaching purposes
- Can be Dangerous
- Limited display options

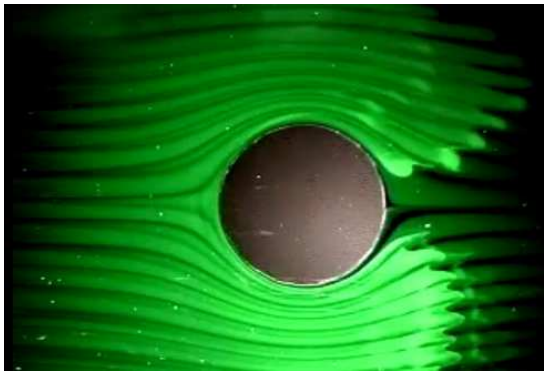
Concept 2 - Flow Visualization using Smoke

ADVANTAGES

- Easy flow visualization
- Didactic
- Small change in actual wind tunnel design







Disadvantages

- Maintenance
- Cost
- Smoke control inside the museum
- Difficulty of creating a laminar flow

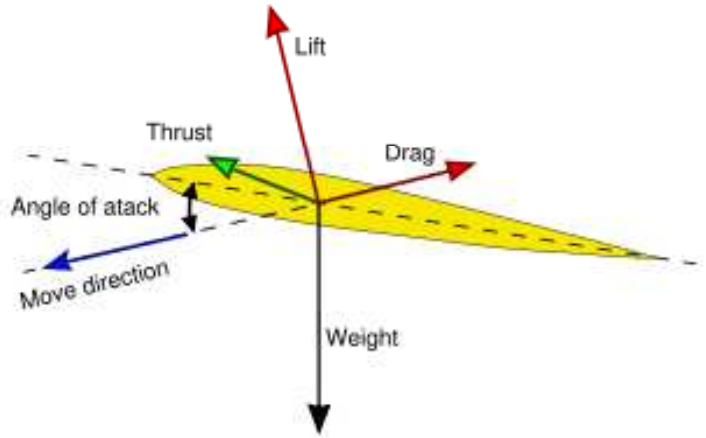
Air Flow Tracer → £2,840.00 ≈ US$4000.00

Display

- Easy to use in for controlling and selecting objects

Display

- Quick explanations about the effects occurring



COMSOL MULTIPHYSICS

- Finite element analysis software
- Allows for visualization without smoke or water
- Can give data over the surface of airfoil

COMSOL MULTIPHYSICS®

Concept 3 - Carts

- Attachable airfoil/geometric shapes
- Display different forces based on geometry
- Moves along the track based on attachment

Concept 3 - Carts

Pros

- Visualization for drag force
- Relatable to kids
- Multiple attachments
- Cost efficient

Cons

- Doesn't actually display air flow
- Forces aren't very strong
- Allows kids access to the wind tunnel

Concept 4 - Hand

- Allow an entry point in the wind tunnel
- Place a hand inside while the fans are on
- The hands act as an air foil
- Allows for a tactile response to forces

Concept 4 - Hand

Pros

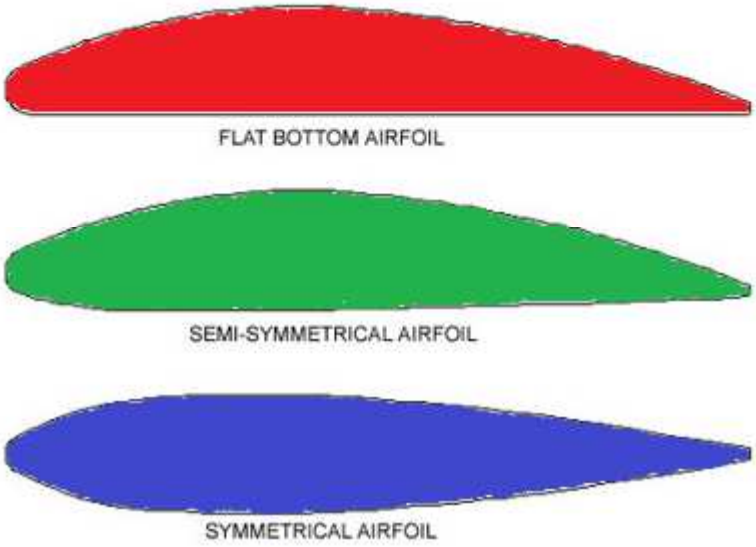
- Extremely interactive
- Forces are felt and not observed
- Cost effective

Cons

- Kids are allowed access to the tunnel
- Visualization is challenging

Concept 5 - Airfoil

- Simple wing design
- Ride rotatable pin joint
- Allow user to change pitch
- Turbulent flow design



Concept 5 - Air Foil

Pros

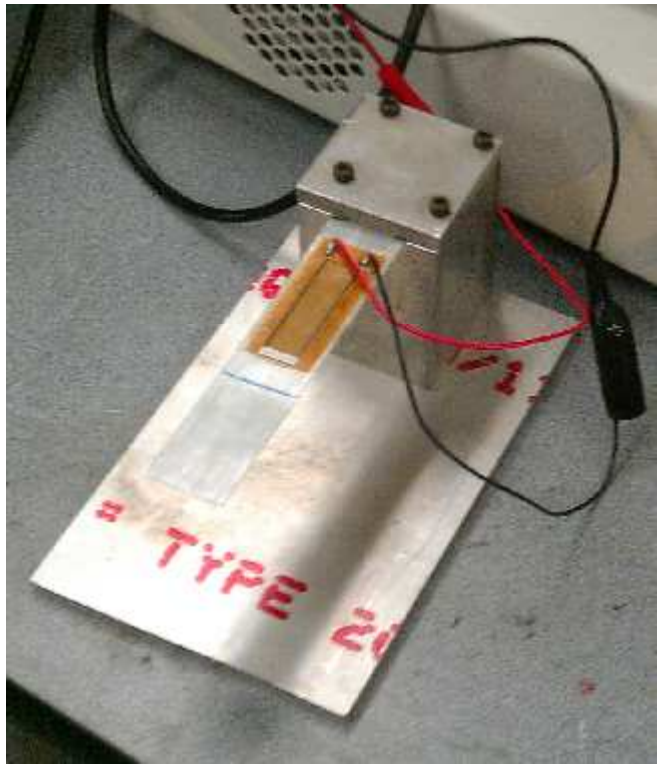
- User interaction
- Simple
- Low maintenance

Cons

- Can't see streamlines
- Can't switch wing
- Space

Concept 6 - Wake Visualization

- LED light display
- Vibrations cause a voltage



Concept 6 - Wake Visualization

Pros

- See there is a wake
- Interactive
- Little maintenance

Cons

- Space
- Electrical connections
- Enough voltage produced

QUESTIONS?