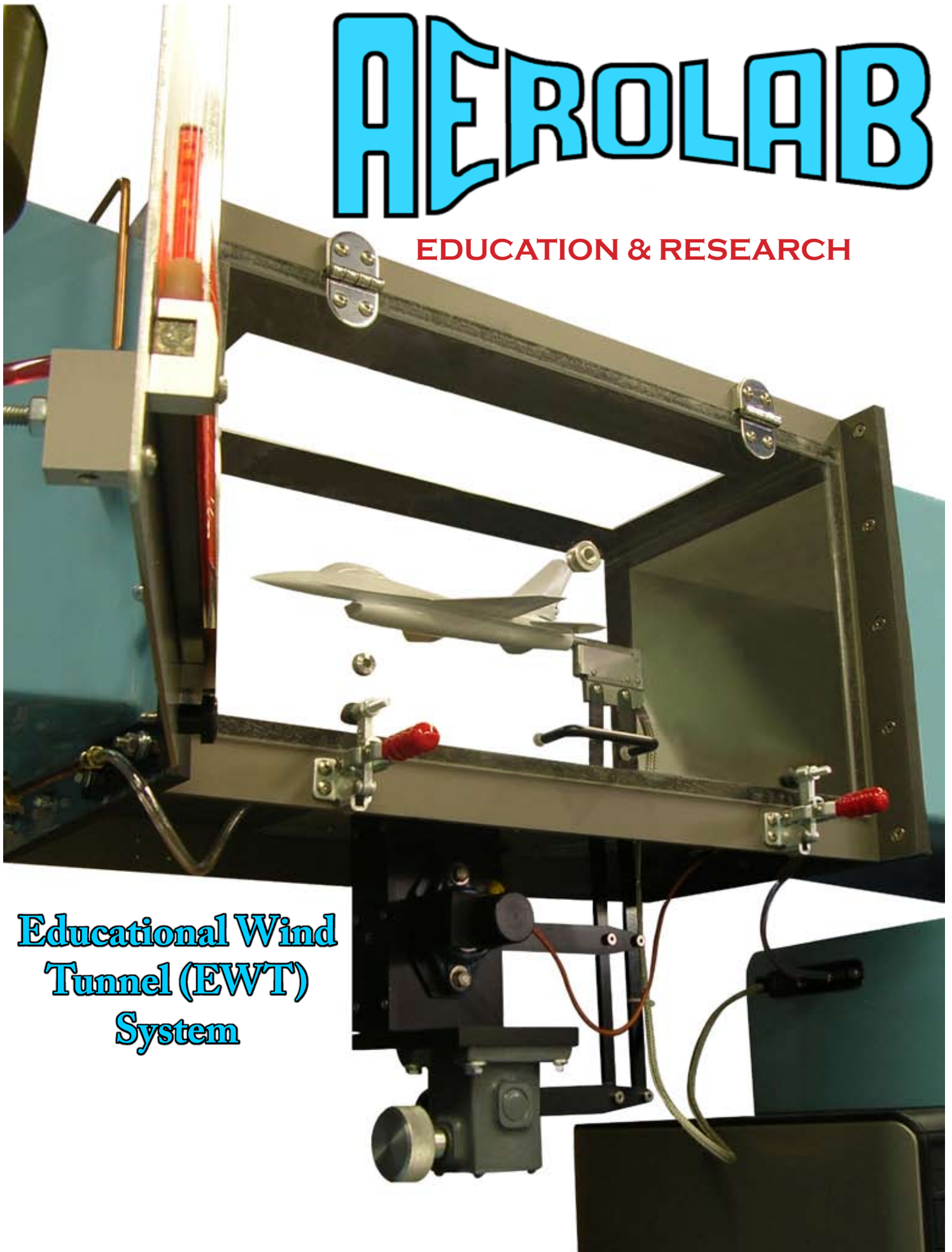
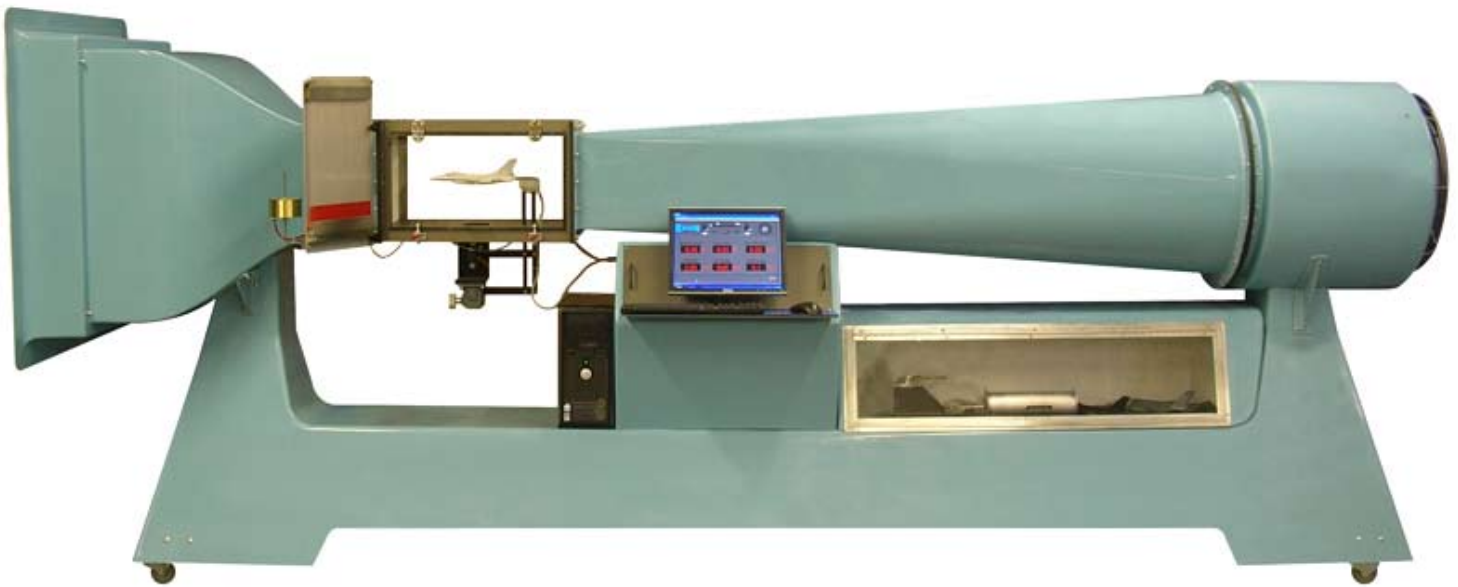


# AEROLAB

EDUCATION & RESEARCH



**Educational Wind  
Tunnel (EWT)  
System**



## Educational Wind Tunnel

*Conceived in 1947 by AEROLAB founder A. Wiley Sherwood, the EWT is a wind tunnel system designed to meet the needs of educators and researchers, alike.*

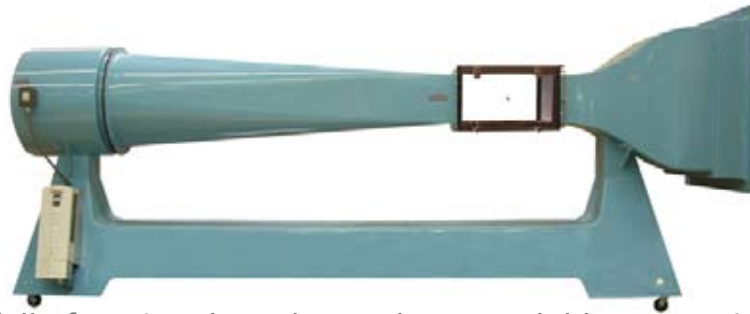
*Lending itself well to budget-conscious users, the EWT can be configured to meet your specific requirements. For increased capability, features can be added as needed.*

*Flexibility and adaptability are essential qualities in our rapidly-changing, technology-centered world. The AEROLAB Educational Wind Tunnel (EWT) System possesses both of these qualities. Aerodynamic principals do not change, but the tools we use to study and record them do. Although production of the first EWT started in 1947, the system has evolved in stride with advances in measurement and data technology. Because the EWT is based on a proven air duct design (from the proprietary inlet design through the user-friendly test section and out the noise-attenuated exhaust) the current instrumentation and data acquisition system can easily update older existing EWT systems.*

### **Basic Specifications:**

- Test Section Dimensions: 12"x12"x24" (30.5cm x 30.5cm x 61cm)
- Airspeed Range: 10 mph (4.5 m/s) to 145 + mph (65 + m/s)
- Turbulence Level: less than 0.2%
- Length: 15 feet (4.6m)
- Width: 42 inches (1.1m)
- Height: 6 feet (1.8m)
- Weight: approximately 600 pounds (272 kg)
- Power: 10 hp (7.5 KW) electric motor
- Mobility: four industrial-grade steel casters w/ polyurethane wheels
- 230 or 460 VAC option

# Build your system starting with the basics!



The basic EWT is a fully-functional wind tunnel. Upgradable at any time, it's a fine starting point for educators and researchers, alike.

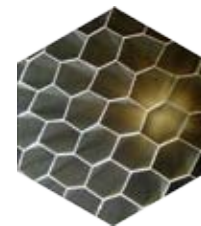
## Standard Features:

### **Fiberglass Construction**

- accurately-formed
- rugged and strong

### **Honeycomb Flow Straightener**

- aluminum
- 4-inch deep hexagonal cells
- removable for cleaning



Aluminum Honeycomb

### **Turbulence-reducing Screens**

- two 20 x 20 (mesh) screens made of 0.009" (0.23mm) diameter stainless steel wire

### **Contraction (bell mouth) Contour**

- proprietary design used on all AEROLAB wind tunnels
- 9.5:1 contraction ratio

### **Static Pressure Ring**

- access to test section static pressure for non-intrusive  $q/V$  measurements
- consists of four pressure ports – one on each wall just prior to test section entrance w/ manifold

### **Test Section**

- hard anodized aluminum structure
- two top-hinged Acrylic side windows and one top window
- integrated yaw table w/ engraved scale and prepared for optional model positioning system

### **Diffuser Design**

- increases wind tunnel efficiency and overall flow quality

### **Motor**

- high-efficiency 10 hp (7.5 KW) electric motor

### **Fan / Propeller**

- high-efficiency
- 9-blade
- balanced

### **Noise Attenuator**

- reduces noise w/ 2 layers of acoustic insulation

### **Speed Controller**

- solidstate Variable Frequency Drive (VFD)
- accepts analog or digital remote control signals
- built-in display is selectable for Hz, RPM, % power and Amps
- adaptable to 208-240VAC, 380-480VAC and 50/60Hz

### **Excellent Flow Quality**

- less than 0.2% turbulence

### **Functionality**

- easy to use

### **Mobility**

- four high-quality steel casters with polyurethane wheels



*Complete EWT Systems include all of the following options. Budget-conscious users can select components as needed.*



#### Data Acquisition, Display and Control System:

- National Instruments hardware and LabVIEW software
- configurable to meet any need
- capable of measuring, displaying and recording force/moment balance output and angle of attack
- capable of controlling wind tunnel airspeed
- Dell desktop computer
- contact AEROLAB for more details



#### 3-component "Sting" Force/Moment Balance:



- Normal Force, Axial Force and Pitching Moment (easily reconfigurable for Side Force, Axial Force and Yawing Moment)
- 3/8" outside-diameter sting
- designed specifically for the EWT Model Positioning System
- adaptable to other model positioning systems
- completely instrumented w/ strain gages, wired and ready for use
- supplied with 1st-order calibration and calibration fixture



#### Model Positioning System:

- designed specifically for the EWT to keep models centered regardless of pitch angle
- manual pitch adjustment to +/- 20°
- parallelogram vertical arms keep model centered regardless of pitch angle
- 3/8" "sting" to mount models
- mounts to EWT test section yaw table for combined yaw/pitch capability

#### Drag Model Set:



- five model set: teardrop, backward cup, sphere, forward cup and circular flat plate.
- mounts to any 3/8" sting balance using one set screw
- great for flow visualization and force measurements

#### Suggested Experiments (Sophomore)

- compare effect of shape on Drag Force for objects with similar cross sectional area (teardrop excluded)
- use smoke to visualize flow phenomenon

**1:48th Scale F-16 Model:**

- mounts to any 3/8" sting balance using one set screw
- Strong, stiff and durable
- 11.5 inches (29.2cm) long with 7.5 inch (19cm) span

*Suggested Experiments (Sophomore)*

- generate  $C_L$ ,  $C_D$  and  $C_M$  curves as a function of angle of attack (Aerolab Sting Balance and Model Positioning System required)
- provide Visualization of flow using the Aerolab smoke generator or apply tufts for a low-cost alternative observation

*Suggested Experiments (Junior)*

- explore various flight characteristics including  $V_{stall}$  and Stability derivatives
- learn the basics of tunnel corrections as applied to flight vehicles

**Pressure Cylinder:**

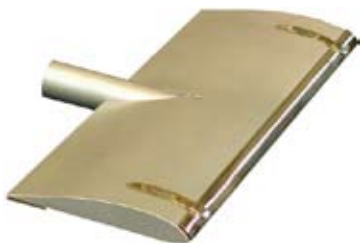
- mounts vertically and spans the test section of the EWT
- 24 flush-mounted pressure taps along its circumference
- manually-set angular position read from turntable scale
- outside diameter of 4 inches (10.2cm)
- supplied with all necessary tubing

*Suggested Experiments (Sophomore)*

- demonstrate the pressure distribution over a cylinder
- compare experimental results with theoretical prediction
- investigate the loss of pressure in the separated region

*Suggested Experiments (Junior)*

- explore the effects of trip-strip application

**Wing with Slat and Flap:**

- Clark Y-14 airfoil
- adjustable slat and flaps
- mounts to any 3/8" sting balance using one set screw
- great for both flow visualization and force measurements
- 9.875 inch (25cm) span and 3.5 inch (9cm) chord
- other NACA airfoil choices are optional – contact AEROLAB

*Suggested Experiments (Sophomore)*

- observe the effects of slats and flaps on the "clean" Clark Y-14  $C_L$ ,  $C_D$  and  $C_m$  curves

*Suggested Experiments (Junior)*

- study the effects of slats and flaps on stability derivatives

**Pressure Wing:**

- mounts vertically and spans the test section of the EWT
- 18 flush-mounted pressure taps around the Clark Y-14 airfoil
- manually set angle of attack is read from turntable scale
- 3.5 inch (9cm) chord
- supplied with all necessary tubing
- other airfoil choices are optional – contact AEROLAB for more details

**Suggested Experiments (Sophomore)**

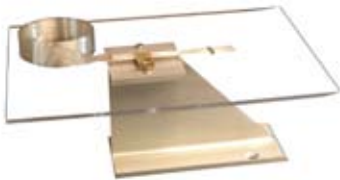
- demonstrate the pressure distribution over an airfoil
- investigate the loss of pressure in a stalled region
- illustrate the effect of camber on lift

**Suggested Experiments (Junior)**

- generate  $C_L$ ,  $C_D$ , and  $C_M$  curves using  $C_P$  measurements (offers a practical introduction to numerical integration techniques)
- predict performance parameters such as  $C_{l=0}$ ,  $C_{m=0}$  location, and  $C_{l,max}$
- explore the effect of trip strip application

**Boundary Layer Plate and “Mouse”:**

- convenient way to demonstrate and study boundary layers and boundary layer growth
- 10-tap total pressure probe (“mouse”)
- three Mouse locations along the length of the flat plate
- pressure taps ascend at an angle to span the boundary layer

**Suggested Experiments (Sophomore)**

- introduce the concept of boundary layer development
- observe the phenomenon of boundary layer growth

**Suggested Experiments (Junior)**

- calculate the expected boundary layer thickness and compare against experimental measurements

## All-in-one Educational Tool

The Complete EWT System allows the demonstration and study of basic aerodynamic phenomena. It also introduces students to modern instrumentation and data acquisition tools and techniques – a truly all-in-one, user-friendly educational tool.

**Wake "Rake":**

- 18 total-pressure "taps"
- mounts into EWT test section through turntable
- ports span approx. 1.75 inches (4.4cm) and are 2.125 inches (5.4cm) in front of the 90° bend
- 10 inches long
- supplied with all necessary tubing

**Suggested Experiments (Junior)**

- determination of drag through wake study

**Yaw Probe:**

- three pressure ports w/ 60° separation
- overall length of 10.5 inches (26.7cm), outside diameter of 0.125 inches (32mm)
- mounts easily in EWT test section window probe port
- adjustable aluminum triangular base used for angular indication
- supplied with ample tubing for connection to your choice of indicators

**Suggested Experiments (Sophomore)**

- demonstrate the fundamental principles behind flow discovery using differential pressure measurements.
- explore the difference between instrument and tunnel inclinations.

**Suggested Experiments (Junior)**

- calibration and alignment of the yaw probe
- implications of uncertainty in measurements
- locate the angle of flow separation on a cylinder
- investigate the tunnel angle variation.

**Pitot-static Probe:**

- mounts easily in EWT test section window probe port
- rounded tip total-pressure tap and 6 static ports
- reaches 2.6 inches (6.6cm) forward of the bend and extends 13 inches (33cm) to the bend with an outside diameter of 0.125 inches (32mm)
- supplied with ample tubing for connect to your choice of indicators

**Suggested Experiments (Sophomore)**

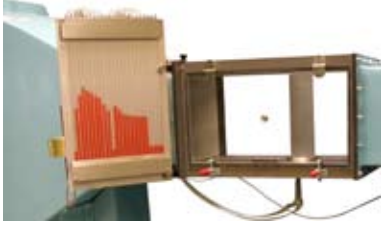
- study "analog" airspeed measurement and probe design
- effects of alignment

**Turbulence Sphere:**

- highly polished
- 4" (10.16cm) diameter
- equipped with a 3/8 inch sting mounting post
- critical Reynolds number determination with balance data only - sphere has no pressure taps

**Recommended Experiments (Junior)**

- measure wind tunnel turbulence level, study effect of size and Reynolds number

**Multi-manometer:**

- 24-tube
- 0 – 14 inches (0 – 35cm) of water
- reservoir and fluid included
- easy-to-read inch scale
- applicable to all AEROLAB models with pressure taps

**Model Storage and Display Cabinet:**

- fiberglass construction
- designed and molded to perfectly fit the EWT base
- plexiglass top-hinged door
- convenient storage for models, tools and CDs

**Custom Options:**

- contact AEROLAB with your ideas!
- we'll be glad to write a quotation to meet your exact needs

### Accessories (not included in Complete EWT System)

**Smoke Generator:**

- produces thick, white smoke (vaporized white mineral oil)
- 110 VAC only
- **Not** included in Complete EWT System

*For more information and pricing about the AEROLAB Educational Wind Tunnel System or any AEROLAB product, please contact us at:*

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