

Fluid mechanics is a science to study how fluids flow and how fluids act on objects.
The wind tunnel is a comprehensive, complete and substantial system for students to study fundamental and applied topics of fluid mechanics
It is very helpful to observe the principles and construct intuition of fluid motion,

Long Win's Educational Facilities for Fluid Mechanics

Horizontal Open-loop Subsonic Wind Tunnel

Experimental items

Lift, drag force and pitch moment measurement Pressure distribution measurement Flow visualization

Collocation devices

Various testing models 20-column liquid manometer Laser sheet generator Image recording device Hot wire anemometer PC-based control and data acquisition system

Lift and Drag Force Measurement of Airfoil



NACA 4415 airfoil models:

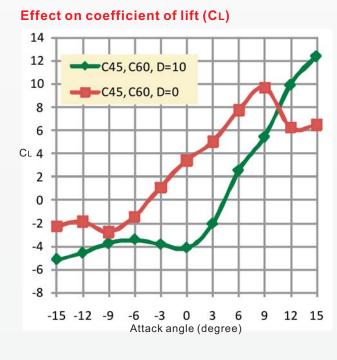
- (A) Chord 45 mm, 60 mm; Length 300 mm; Twist angle (D) 10 degree which is symbolized as C45, C60, D=10
- (B) Chord 45 mm, 60 mm: Length 300 mm; Twist angle (D) 0 degree which is symbolized as C45, C60, D=0

Adjust following parameters to study

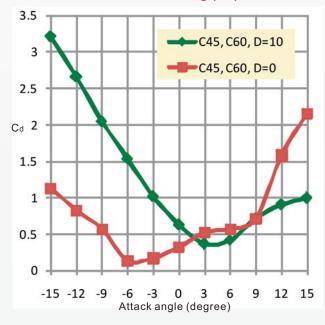
<u>coefficient of lift (C_L)</u> and <u>coefficient of drag (C_d)</u> in each condition.

- 1. Attack angle: +15 ~ -15 degree
- 2. Wind speed: $5 \sim 30$ m/sec

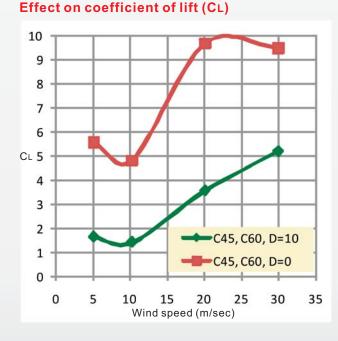
(I) Comparing different airfoil twist angle by changing attack angles at 20 m/sec



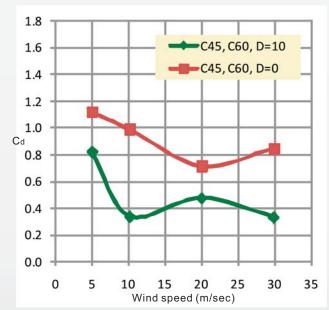
Effect on coefficient of drag (Cd)



(II) Comparing different airfoil twist angle by changing wind speed at attack angle 9 degree



Effect on coefficient of drag (Cd)



Lift and Drag Force Measurement of Airfoil



NACA 4415 airfoil models:

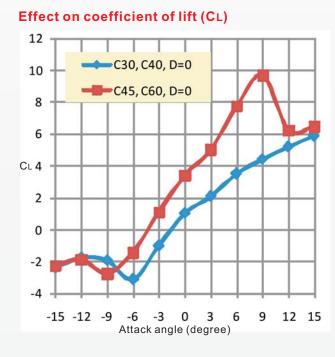
- (B) Chord 45 mm, 60 mm: Length 300 mm; Twist angle (D) 0 degree which is symbolized as C45, C60, D=0
- (C) Chord 30 mm, 40 mm; Length 300 mm; Twist angle (D) 0 degree which is symbolized as C30, C40, D=0

Adjust following parameters to study

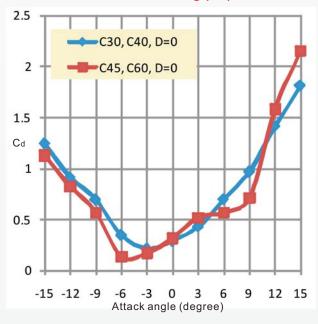
<u>coefficient of lift (C_L)</u> and <u>coefficient of drag (C_d)</u> in each condition.

- 1. Attack angle: +15 ~ -15 degree
- 2. Wind speed: $5 \sim 30$ m/sec

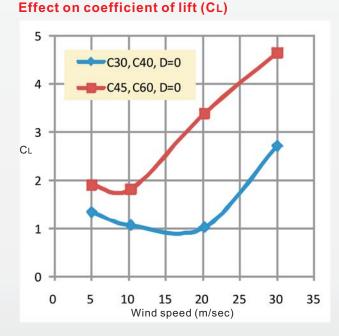
(III) Comparing different airfoil area by changing attack angles at 20 m/sec



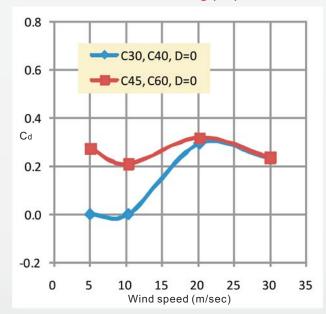
Effect on coefficient of drag (Cd)



(IV) Comparing different airfoil area by changing wind speed at attack angle 0 degree



Effect on coefficient of drag (Cd)

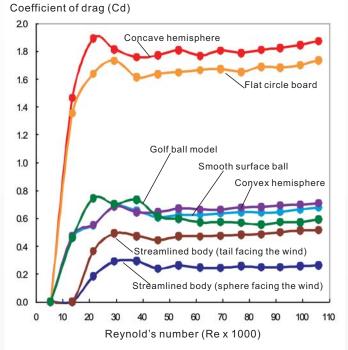


Equal-Area Drag Models



Standard models with 43 mm in diameter:

- 1. Smooth surface ball
- 2. Concave hemisphere
- 3. Convex hemisphere
- 4. Flat circle board
- 5. 2-D cylinder
- 6. Streamlined body
- 7. Golf ball model



Pressure Distribution Measurement

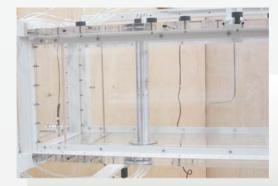


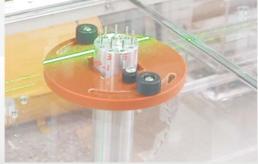




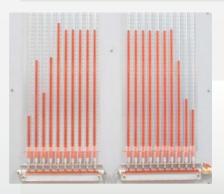


- Standard models with 17 pressure holes.
- (A) Cylinder model
- (B) Rectangular rod model
- (C) Flat plate model
- (D) Airfoil model

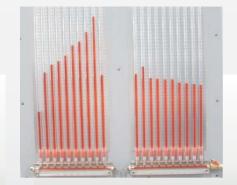




Demonstration of setting pressure distribution models. Pressure holes are connected with liquid manometer.

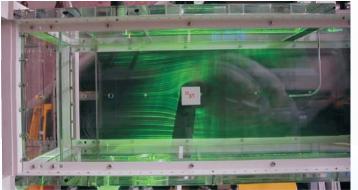


Example 1: Pressure distribution of cylinder model



Example 2: Pressure distribution of rectangular rod model

Flow Visualization





Doing flow visualization experiments with the use of smoke generator to produce a smoke sheet on the upstream of test section and LW-9117 laser sheet generator to have a light sheet reflected on the smoke sheet. The experiment is applicable to various types of models for flow field observation.

Features



Digit meters for monitoring wind speed, atmospheric pressure and temperature.



PC-based control and data acquisition system is available.



Axial Fan for driving source and canvas flexible connector for shock absorption



The settling section is delicately designed as a drawer type. The door is accessible for sealing up the section and open to move screen layers. Each turbulence reducing screen can be removed for cleaning.



Customized wind speed range is available. In Long Win's Lab, we own a LW-9300R wind tunnel with the maximum wind speed 105 m/sec.

Collocation Devices



LW-9028

2-component balance Lift force: ~ 30N Drag force: ~ 20N Accuracy: 1% FS

3-component balance Pitch moment:~10 N-m Accuracy: 0.5% FS



LW-9032 TSI hot wire anemometer With a digit display meter Range: 0.5~50 m/sec Accuracy: 2% of reading, or 0.5% of FS.



LW-9117 Laser sheet generator Beam power: 300 mW Wavelength: 532 nm



LW-8007 Liquid manometer Effective height: 500 mm Tube diameter 1.7 mm Inclined angle: 5 ~ 90 degree

Standard Models



Test section	0.2 x 0.2 x 0.8 m		
Speed range	1 ~30 m/sec		
Overall dimension	0.7 (W) × 3.2 (L) × 1.8 (H) m (Ref.)		
Space required	1.5 (W) × 4.5 (L) m × 2.5 (H) m		
Weight	400 kg. (Ref.)		



Test section	0.7 x 0.7 x 2 m	
Speed range	1~30 m/sec	
Overall dimension	2.2 (W) × 7.5 (L) × 2.2 (H) m (Ref.)	
Space required	4 (W) × 13 (L) m × 2.5 (H) m	
Weight	2500 kg. (Ref.)	



Test section	0.3 x 0.3 x 1 m		
Speed range	1~30 m/sec		
Overall dimension	1 (W) × 6 (L) × 2 (H) m (Ref.)		
Space required	2 (W) × 7.5 (L) m × 2.7 (H) m		
Weight	600 kg. (Ref.)		



Test section	1 x 1 x 2 m	
Speed range	1~30 m/sec	
Overall dimension	2.2 (W) × 9 (L) × 2.4 (H) m (Ref.)	
Space required	4 (W) × 14 (L) m × 2.5 (H) m	
Weight	2700 kg. (Ref.)	

Wind tunnel types		Open-loop suction type wind tunnel structure				
Flow field quality	Met over 80% of the cross-section area from axial center at 2 m/sec or up.					
	Flow field quality	Uniformity		>98%		
		Turbulence intens	ity	<1%		
	Speed range	1 ~ 30 m/sec	1 ~ 30 m/sec			
	Front air bell hood					
Turbulence		nb section	b section Aluminum alloy, hexagonal diagonal: 6 mm × 51 mm L			
reducing section Screens	section SUS304 material, 4		4 layers or more.			
	Curve cont	action ratio 4:1 ~ 9:1; Dependi		ing on wind tunnel models		
	Axial Fan	Axial Fan Canvas flexible connector for shock absorption				
Fan Section	Canvas flexible cc					
	Supporting frame	vith movable brake wheels and supporting fixing stands				
Pitot static pressure probe and fixture connector.						
			Range	Depending on wind speed range		
Wind Speed measurement	Different pressure	Accuracy	0.25%			
			With a digit display and RS-485 interface.			
	Wind speed control device		AC power, 3 phase			
Wind speed o			PC-based control is available, PC is excluded			
		Fit with speed range 2 ~ 10 m/sec.				
			Adjustable power supply for smoke sheet generation			
		Movable smoke sheet mechanism				
Smoke g	Smoke generator		Oil drop modulation devices			
			Upper and lower liquid cups			
		Circulating oil pump				
		1800 ml of liquid for smoke sheet generation				
Supporting frame The wind tunnel will be mounted on supporting frame with movable brake wheels and supporting fixing stands.				pporting frame with fixing stands.		



Owning a laboratory with the area of **2000 square meters**. **Over 100 kinds** of self-developing equipments are in our lab.

Devoted to fundamental and applied research of thermal & flow, fluid mechanics, condition test and solid mechanics fields for education, IT, semi-conductor, automobile, air-conditioning, LED industries.

Long Win can be your strongest support. Welcome to visit us and test.



Design/Manufacture

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