||JAI SRI GURUDEV||

S.J.C. INSTITUTE OF TECHNOLOGY
DEPARTMENT OF AERONAUTICAL ENGINEERING

CASE STUDY REPORT

Subject code: 18AE59
Subject : Aerodynamics II

Submitted by,

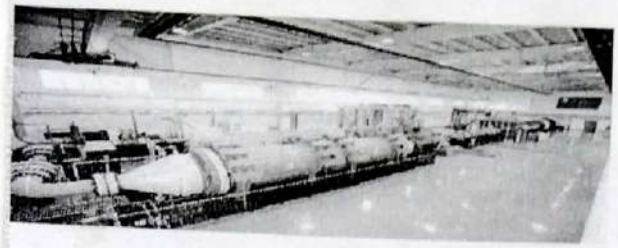
DEEPAK M	1SJ19AE004
MADHU R	1SJ19AE011
NANDAVARAPRASAD D M	1SJ19AE017
VENKATESH PRASAD M K	1SJ19AE039

6/6

Mentor,

Prof. Deepa M S
Head of Department
Department of Aeronautical Engineering
S. J. C. Institute of Technology Chikkaballapur

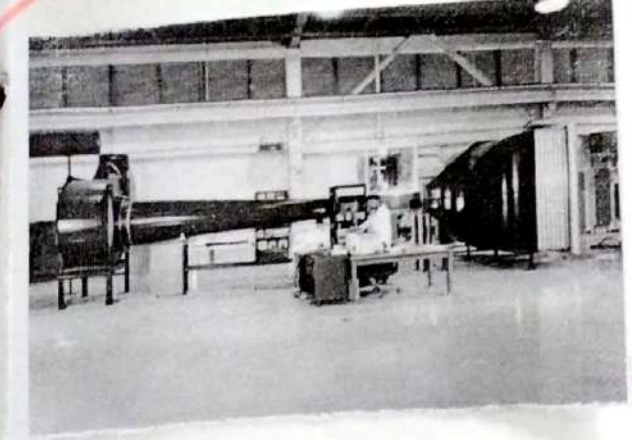
WIND TUNNEL

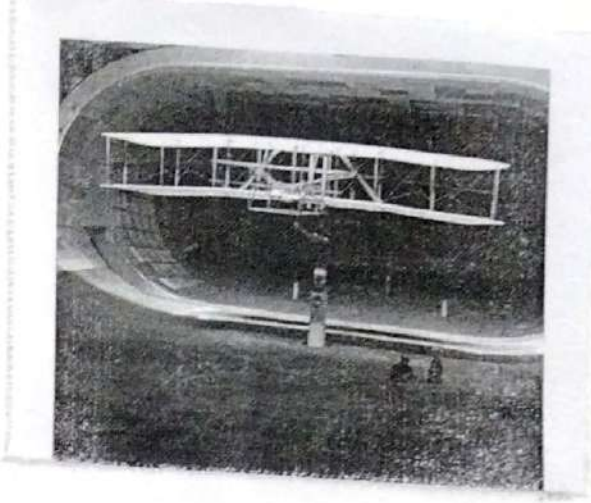


* Wind tunnels are large tubes with air blowing through them which are used to replicate the interaction between air and an object flying through the air or moving along the ground.

* A wind tunnel is a tool used in aerodynamic research to study the effects of air moving past solid objects. A wind tunnel consists of a tubular passage with the object under test mounted in the middle

* Wind tunnels are used to predict the amount of force generated by solid objects.





Basic Principle of A Wind tunnel

* The object being tested is held securely inside the tunnel so that it remains stationary

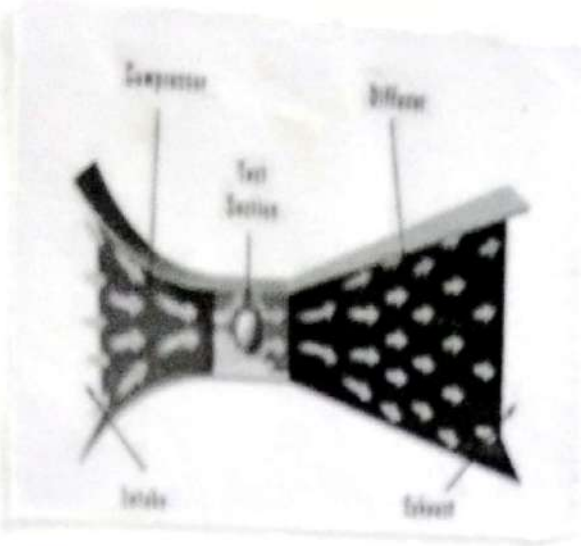
* The object can be an aerodynamic test object such as a cylinder or an airfoil, an individual component, a small model of the vehicle, or a full-sized vehicle

* The air moving around the stationary object shows what would happen if the object was moving through the air

* The motion of the air can be studied in different ways; smoke or dye can be placed in the air and can be seen as it moves around the object.

Colored threads can also be attached to the object to show how the air moves around it

Special instruments can often be used to measure the force of the air exerted against the object.



Classification of A Wind Tunnel

* Based on Spud
  1. Subsonic
  2. Transonic
  3. Supersonic
  4. Hypersonic

* Based on shape
  1. Open circuit wind tunnel
     - Blowdown
     - Suction type
  2. Closed type of Wind tunnel

* Based on working fluid
* Based on purpose.

Based on Spud.

* Subsonic or low spud

Maximum flow spud in this type of wind tunnel can be 135 m/s. Here the Mach number comes out to be around 0.4 For subsonic flows we neglect the effects of compressibility

* Transonic

Maximum velocity in test sections can reach upto spud of sound i.e, 340m/sec and mach number of 1. They are common in aircraft industryas most aircraft operate around this spud. Here effects of compressibility should be considered.

* Supersonic

Velocity of air in test section of such wind tunnels can be upto mach of 5. This is accomplished using convergent-divergent nozzle. power requirements for such wind tunnels are very high

* Hypersonic

Velocity of air in test section of such wind tunnels can be measured between mach 5 and mach 15. This is accomplished using convergent divergent nozzle. For hypersonic flows, we must make additional considerations for the chemical sate of gas.

Based on Shape

* Open circuit wind tunnel

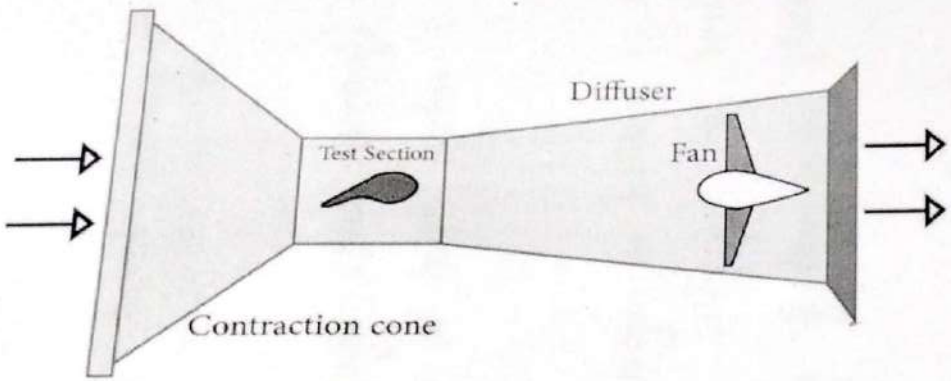
This type of wind tunnel is open at both the ends. The chances of dirt particle entering with air are more. So honeycomb structures are required to clean the air. They are further divided into two parts.

a) Suction type:- If the fan or blower pulls the air through the working section they are called suction-type wind tunnels

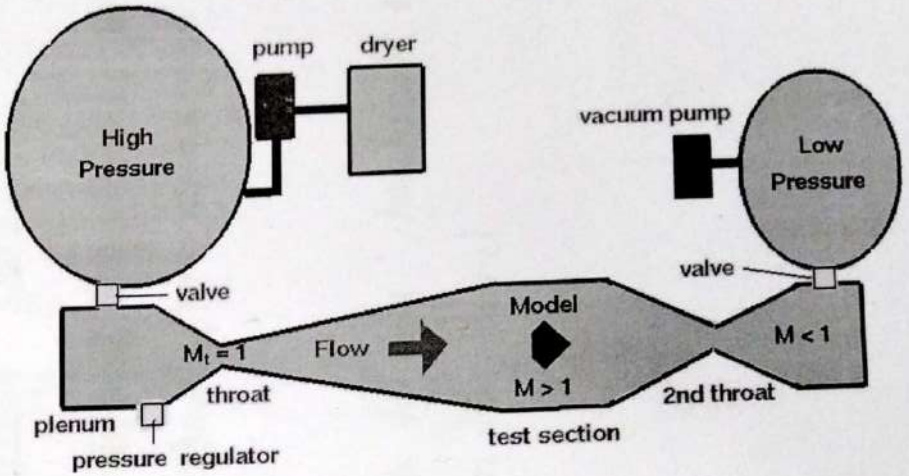
b) Blowdown type:- Portable wind tunnels in which the fan or blower pushes air through the working section are called blowdown-type tunnels.

* Closed circuit wind tunnel

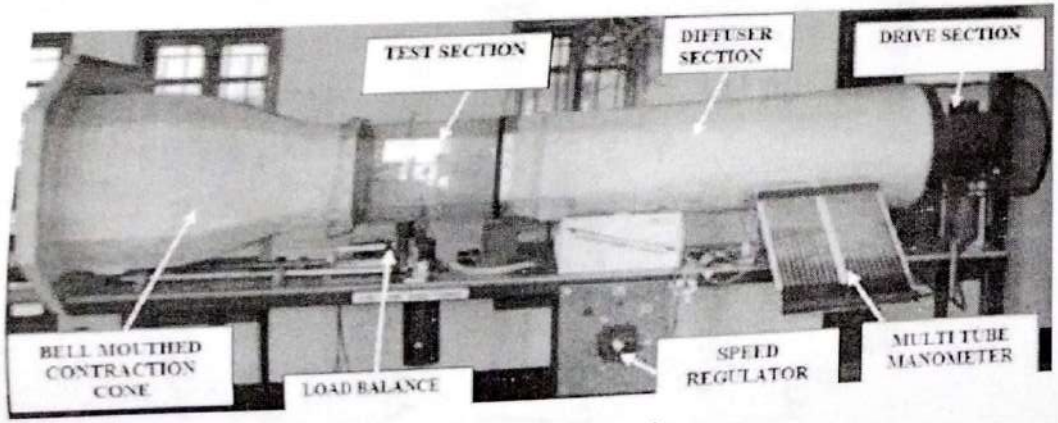
Outlet of such wind tunnels is connected to inlet so the same air circulates in the system in a regulated way. The chances of dirt entering the system are also very low. Closed wind tunnels have more uniform flow than open type. they are more costlier than open type tunnels.



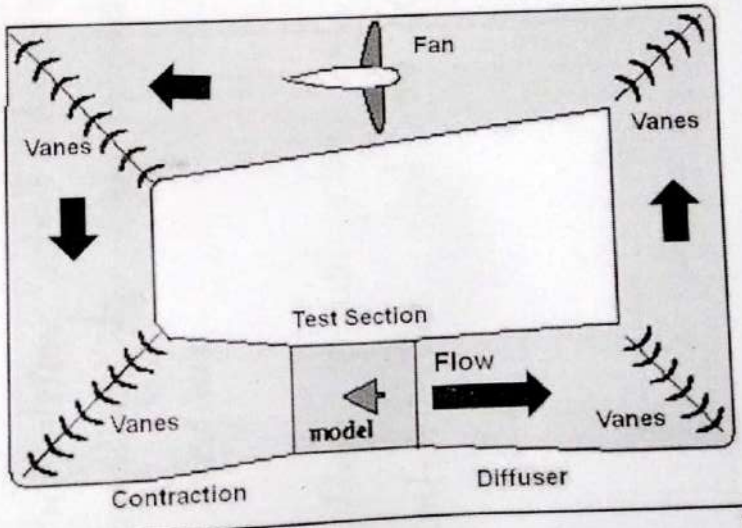
Open circuit wind tunnel



Blowdown type



Suction type



Closed circuit tunnel

Based on Working fluid

For most low spud aircraft wind tunnel testing air is moved through the tunnel

To visualize shock waves for high spud aircraft or to study the flow around submarines or boats water is used as working fluid

In Hypersonic wind tunnels nitrogen or helium is used as working fluid similarly cryogenic nitrogen has been used for high Reynold's number for testing of transonic flows

Based on Working fluid

* Propulsion wind tunnels have special requirements for handling the high temperature exhaust from turbine and rocket engines

* "Flow visualization" or "smoke tunnels" handle the exhaust contaminates that are used in the tunnel.