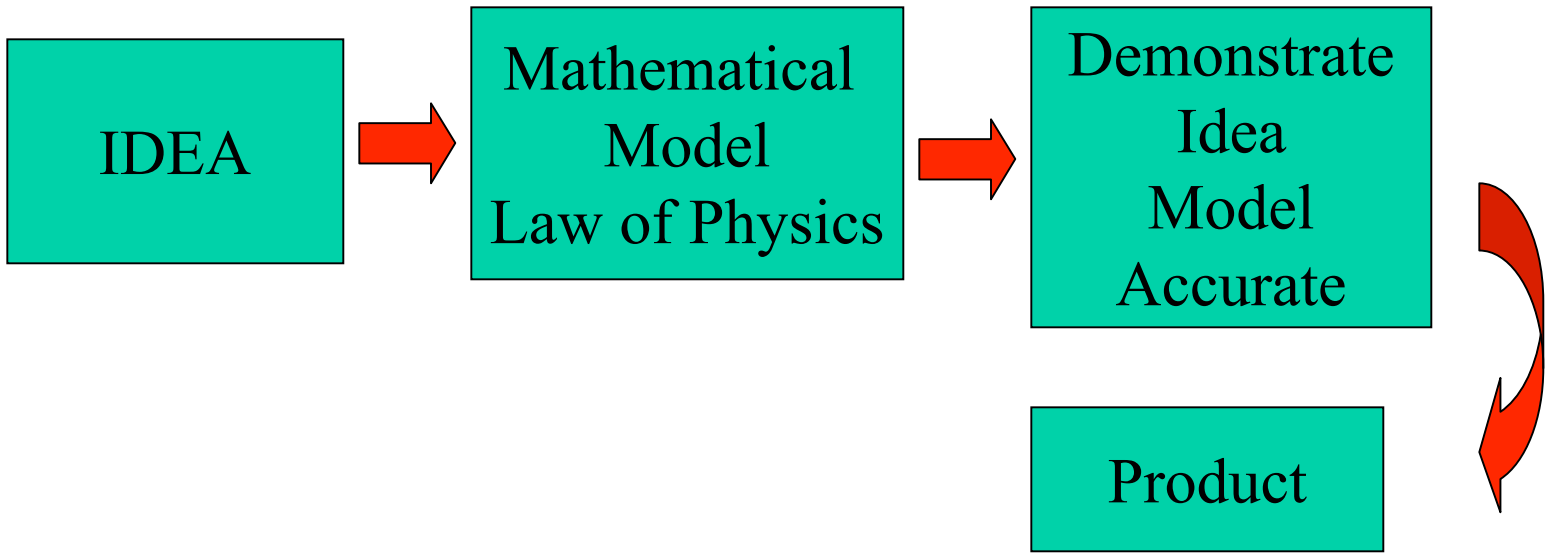
Air Plane/Engines Etc..

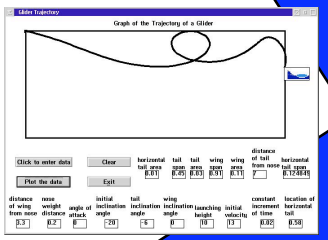
Q: What does an engineer do?

- Turn ideas into reality
- Impacted by a device designed/built by an (team of) engineer(s)!

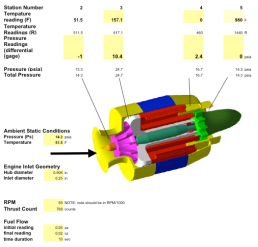


Physics of Flight?

How Planes Fly



Engine Basics

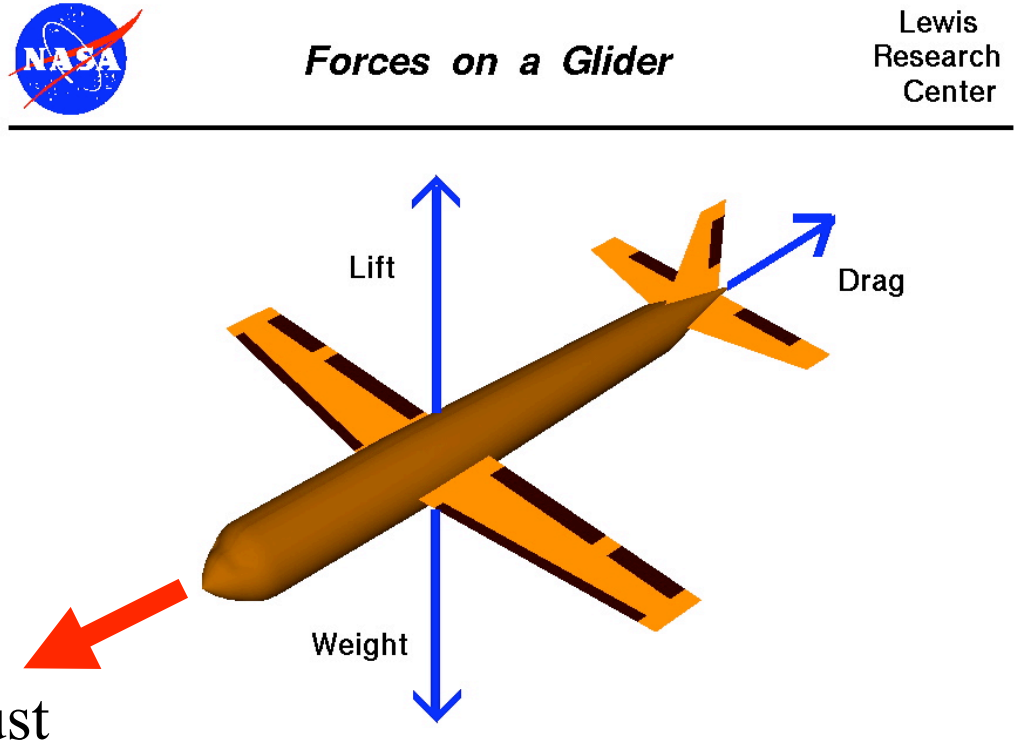


UEET Educational Engine Experiment

9/1/04

16

Physics/Mathematics and Aeronautics/Propulsion



-> F = m a

How to control it.

What is in an airplane? Structural

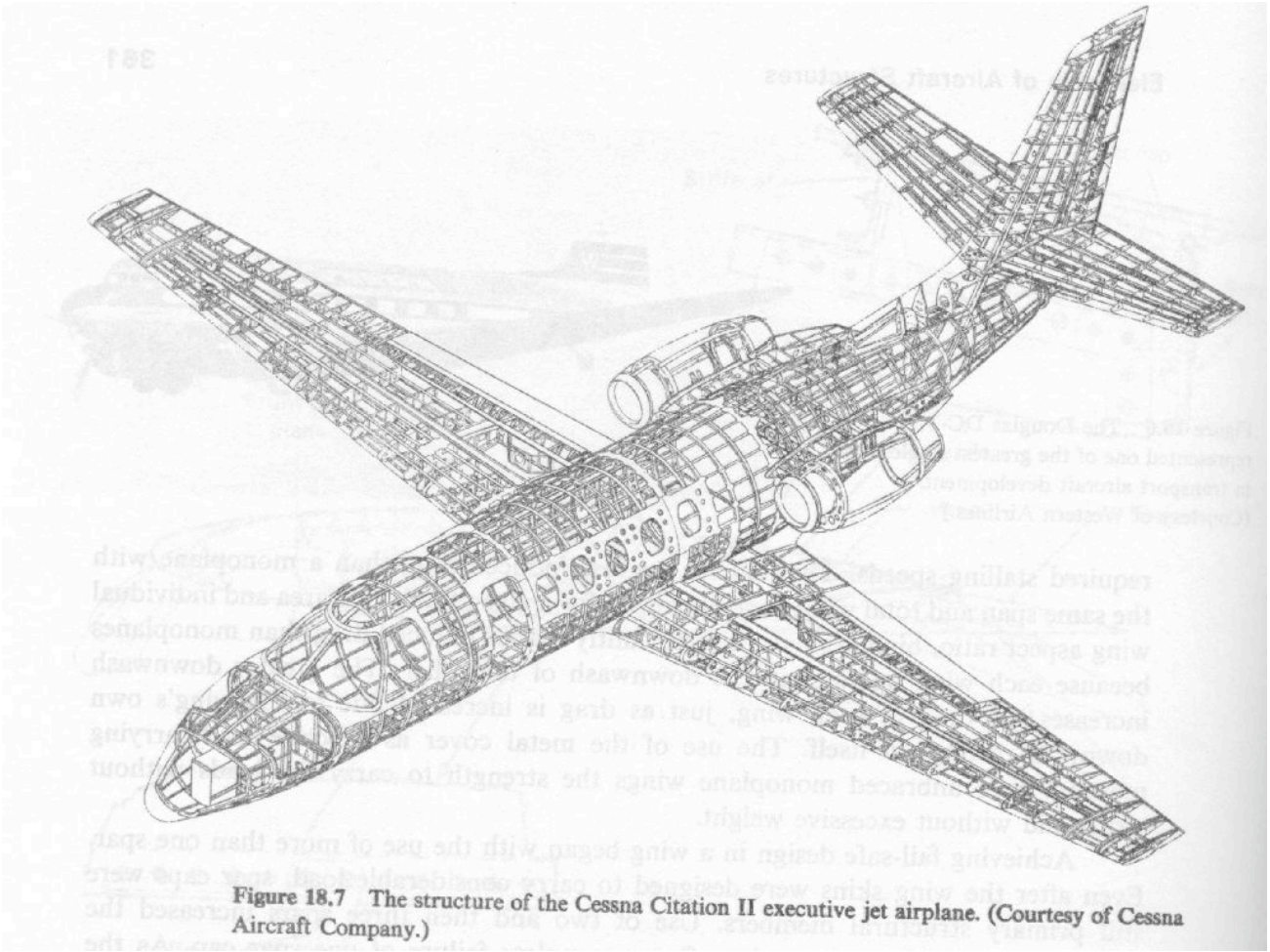


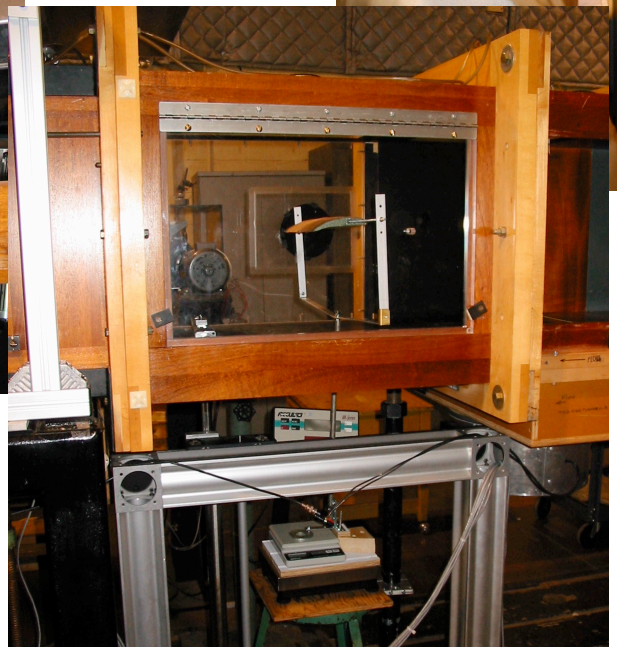
Figure 18.7 The structure of the Cessna Citation II executive jet airplane. (Courtesy of Cessna Aircraft Company.)

Bridge Structure Building/Testing

Analysis and Team Work

Design/Build/Test

Airfoil Wind Tunnel Testing



BASIC AERODYNAMICS

Forces and Stability of Flight

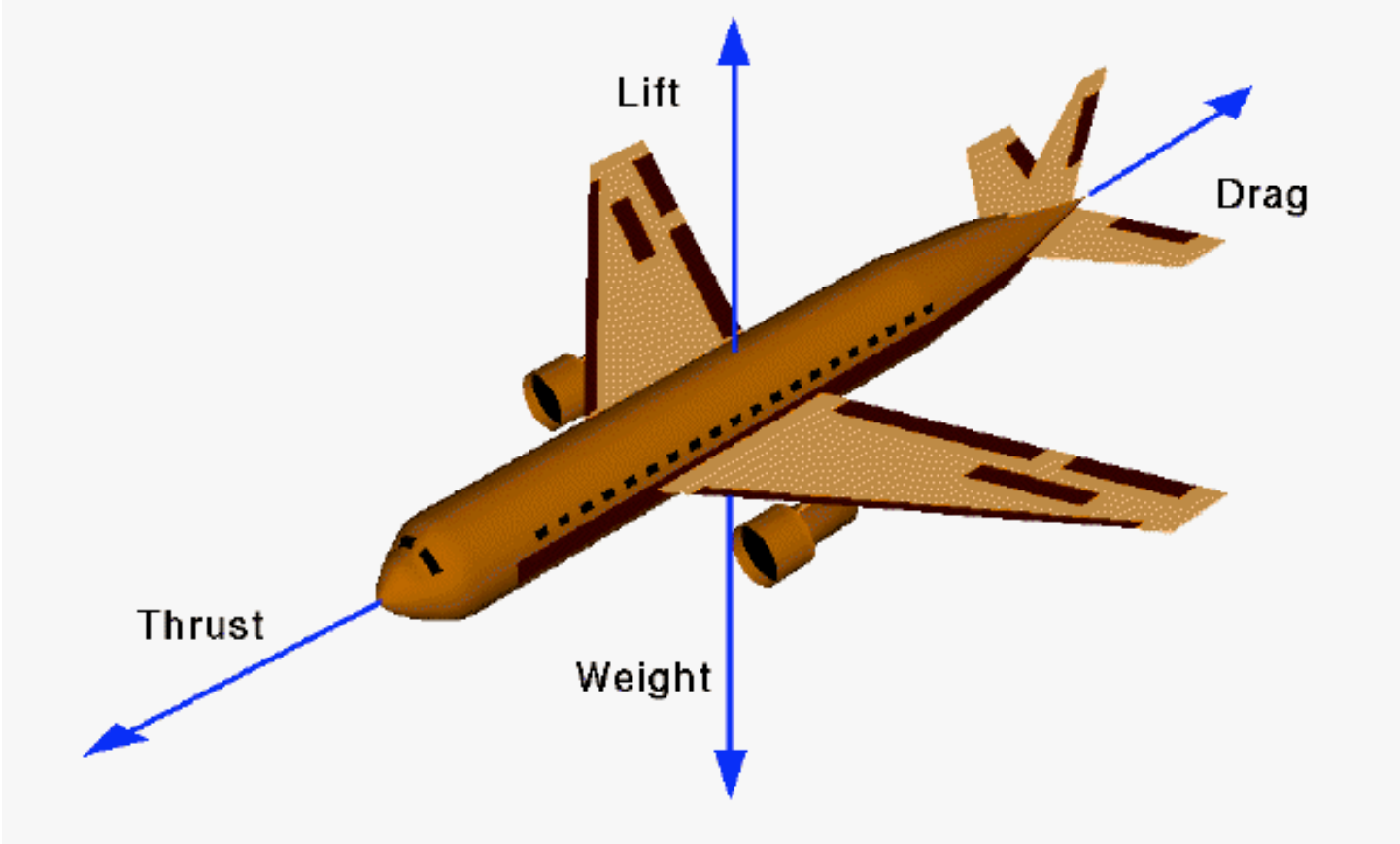
Introduction

We will go over this with more direct application of the Newton's Laws later in the year. Have your calculators handy!

In this session we will be discussing:

- Forces acting on an aircraft in flight.
- Stability around the 3 axis of flight.

The Four Forces Of Flight



The four forces of flight are

LIFT, WEIGHT, THRUST, and DRAG

LIFT

The upward force created by the effect of airflow as it passes over and under the wings. It supports the airplane in flight.

Lift is the key aerodynamic force. It is the force that opposes weight. In straight and level flight, when weight and lift are equal, an airplane is said to be in a state of equilibrium.

WEIGHT

The weight of the airplane is not a constant. It varies with the equipment on the aircraft, including, passengers, cargo and fuel load.

- **The direction in which the force of weight acts is constant. It always acts straight down toward the center of the earth.**

THRUST

Thrust is defined as the forward-directed pushing or pulling force developed by an aircraft engine.

The thrust line is an imaginary line passing through the centre of the propeller hub perpendicular to the plane of the propeller rotation.

In the case of a jet-propelled aircraft, the thrust line is parallel to the path of the ejected gases from the jet engine.

DRAG

Drag is the force which opposes the forward motion of an aircraft

Induced drag is drag produced by any part of the aircraft designed to produce lift. Wings, Horizontal Stabilizer, etc

Parasite drag describes the resistance of the air produced by any part of the airplane that does not produce lift.

Summary

- An aircraft is in a state of equilibrium when the sum of all forces and all moments is equal to zero. When an aircraft is in equilibrium, there are no accelerations and the aircraft continues in a steady condition of flight.

QUESTIONS?

THE 4 FORCES OF FLIGHT ARE?

LIFT, WEIGHT, THRUST AND DRAG

WHAT IS THE KEY AERODYNAMIC FORCE AND WHAT FORCE DOES IT OPPOSE?

LIFT OPPOSES WEIGHT

WHAT ARE THE 2 TYPES OF DRAG?

INDUCED AND PARACITE

Introduction to wind tunnel

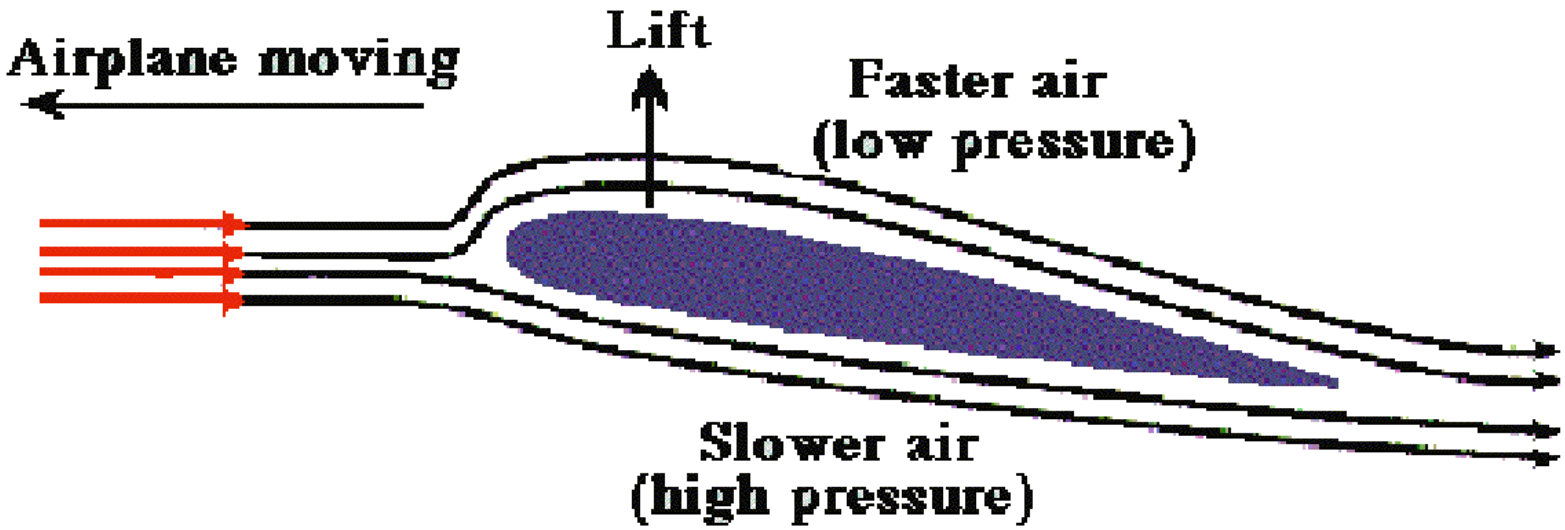
What is wind tunnel?

Why do we use them?

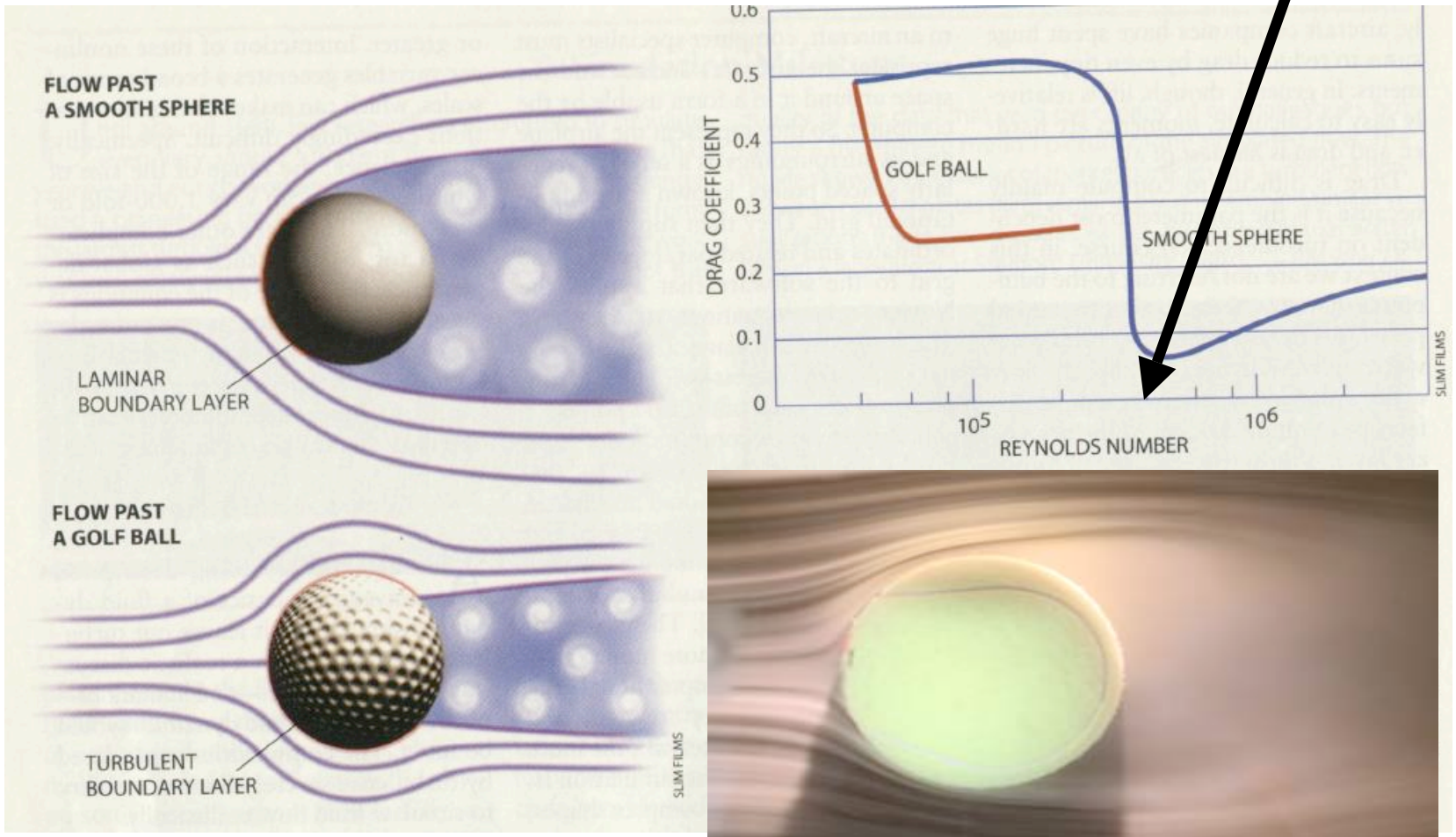
What do we do with them?

It is not just for Airplanes!

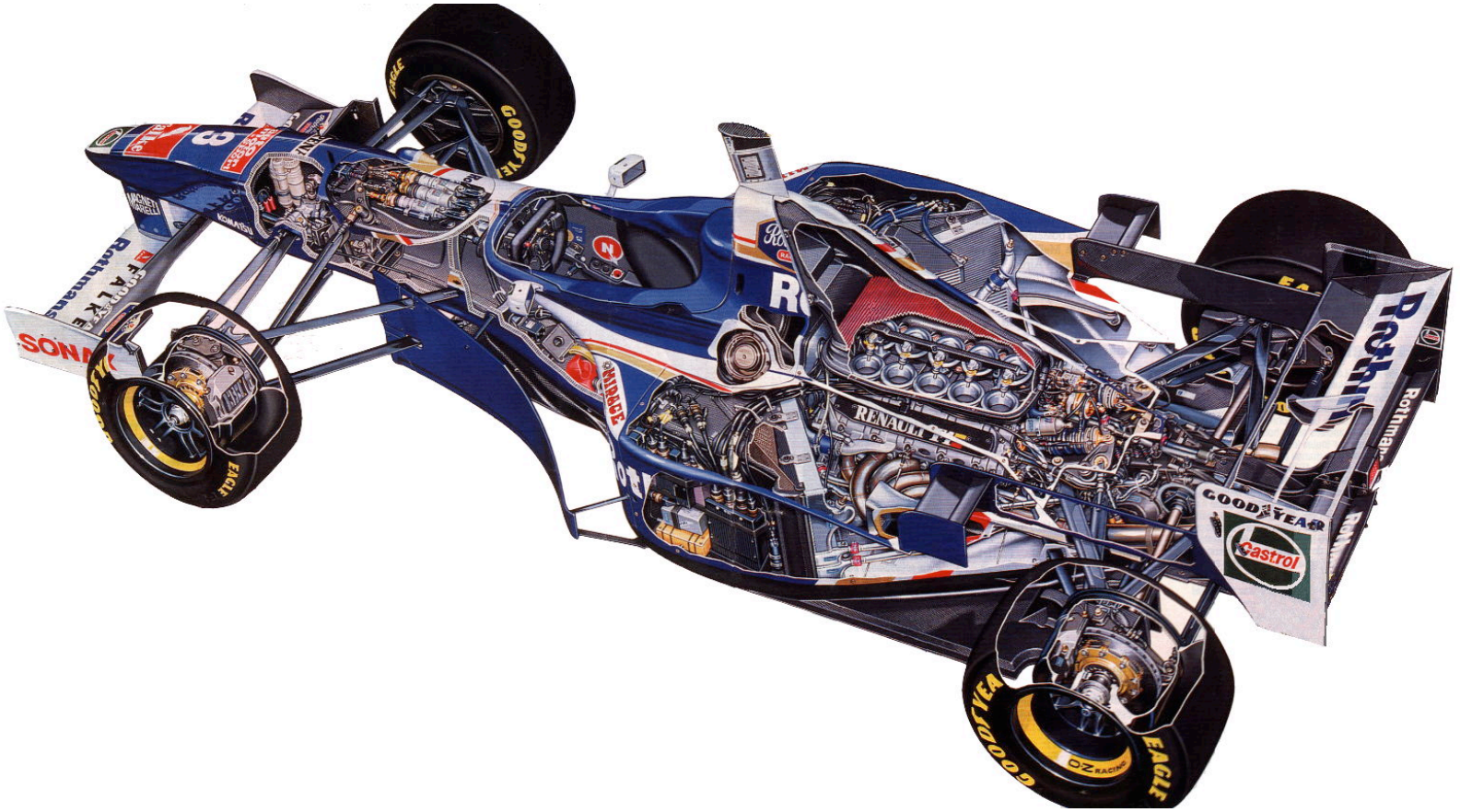
Aerodynamic Lifting Devices



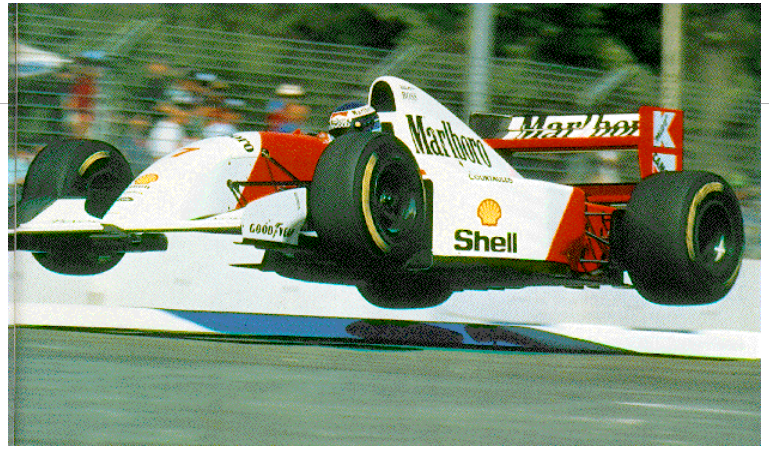
Golf and Tennis Anyone?

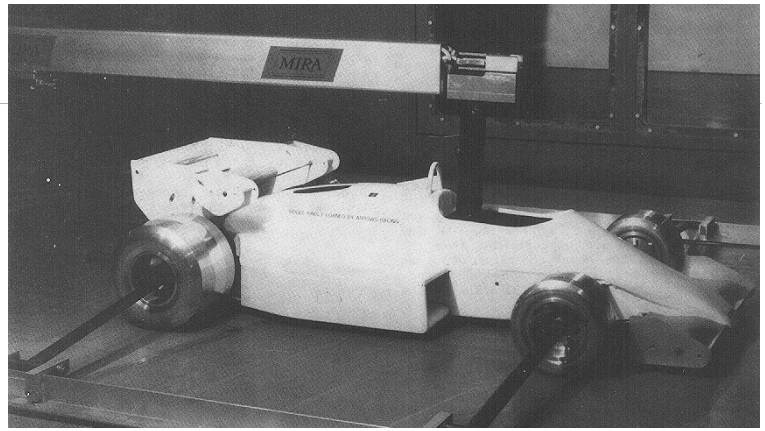


This car has wings, Why?

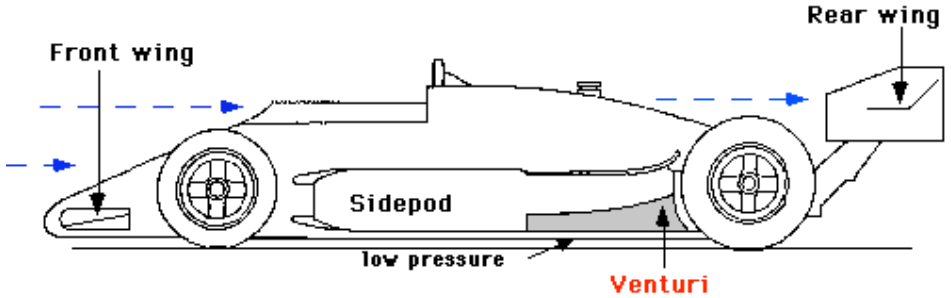


Aerodynamics of RaceCars



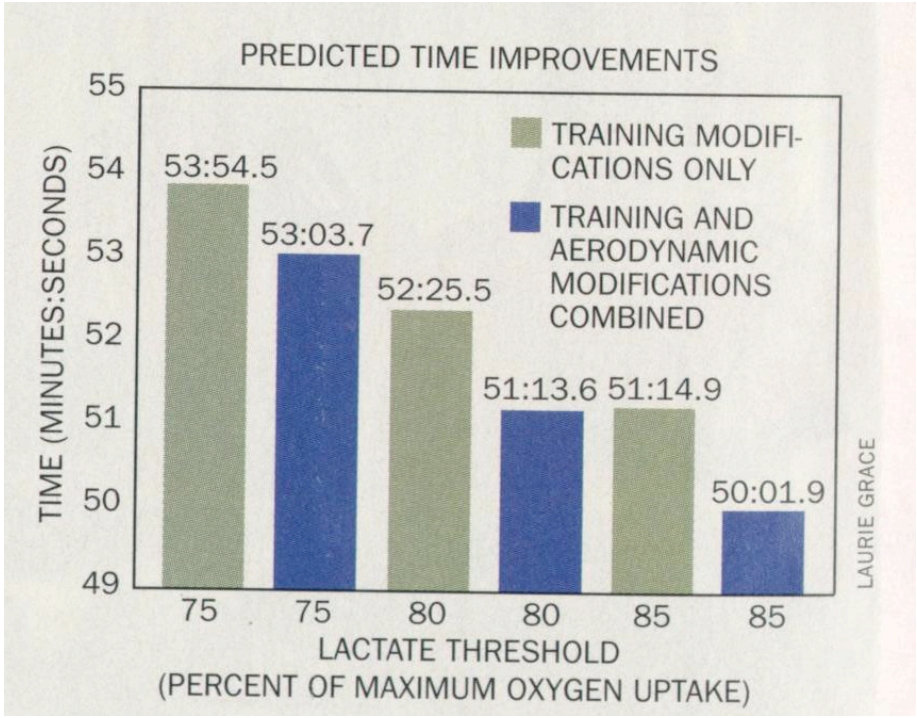


Ground Effect Car



The ground effect car is capable of speeds in excess of 230 mph. The front and rear wings create downforce which forces the car to the track. The underbody venturi tunnel creates a low pressure area between the chassis and the track which "sucks" the car to the track. The venturi is shaded gray. The blue arrows indicate airflow.

Race Bike Aerodynamics



Information will be posted

https://explorersposts.grc.nasa.gov/post630/