WHERE MATH AND SCIENCE TAKE FLIGHT

iFLY MAKES LEARNING FUN WITH STEM

The Science & Engineering of iFLY

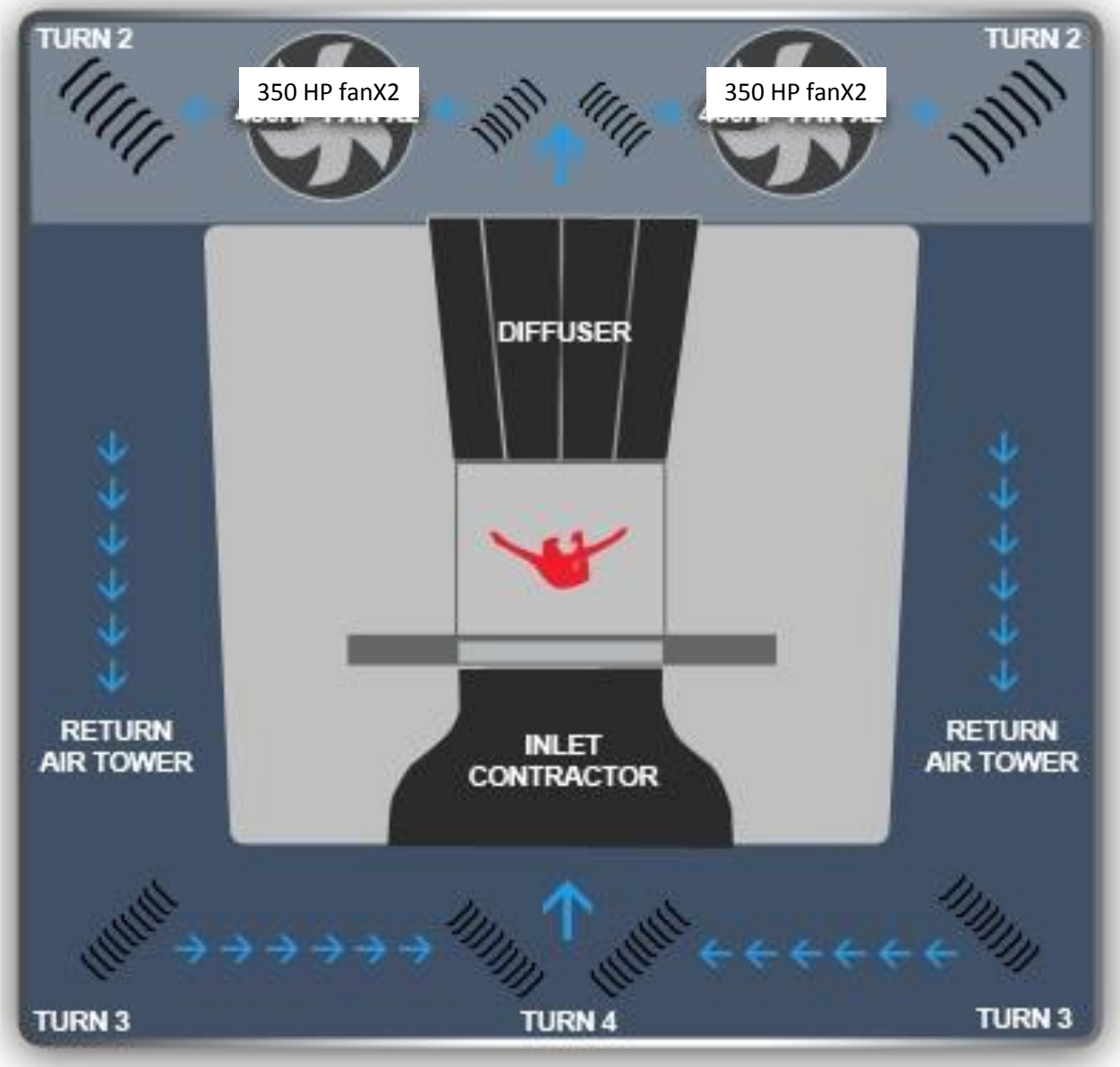
iFLY INDOOR SKYDIVING


STEM is fun!

STEM is used in the real world to solve problems and improve lives.

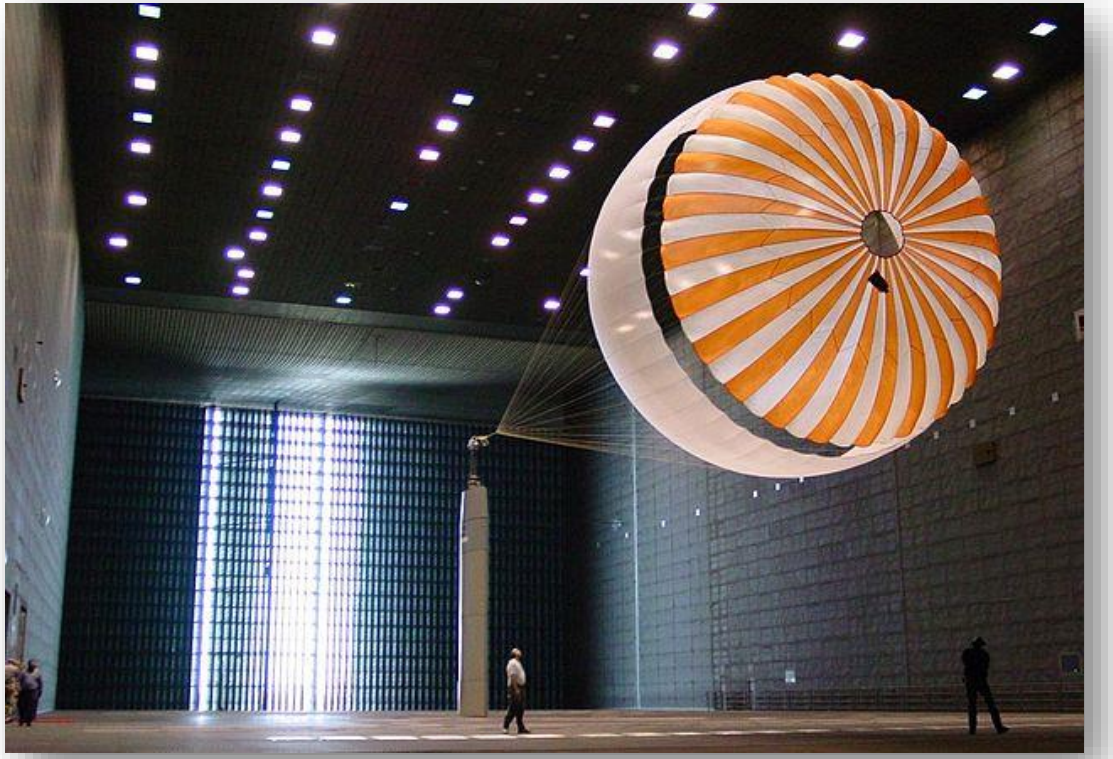
Exciting futures in STEM await you.

This is a Closed Loop Vertical Wind Tunnel.

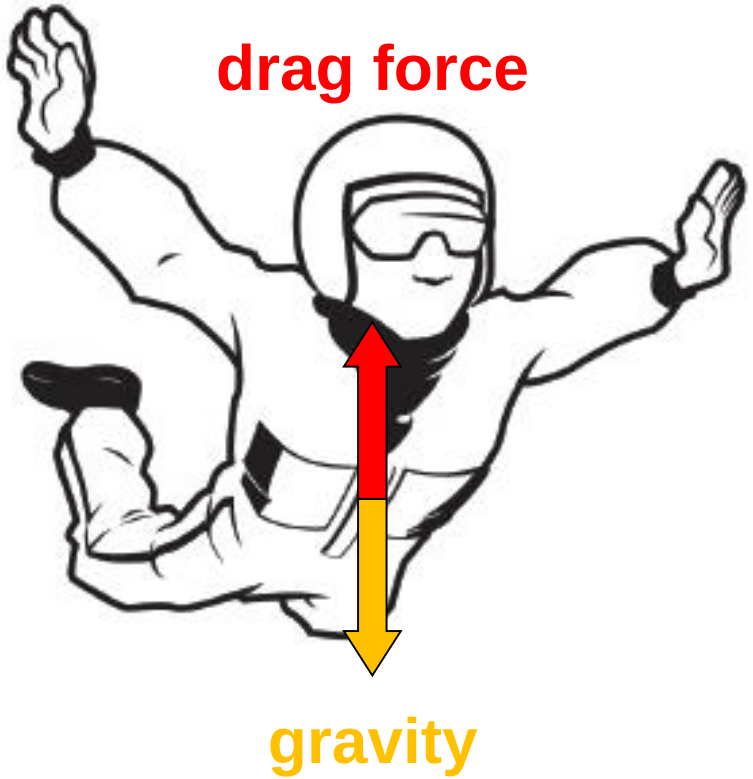


Wind tunnel testing

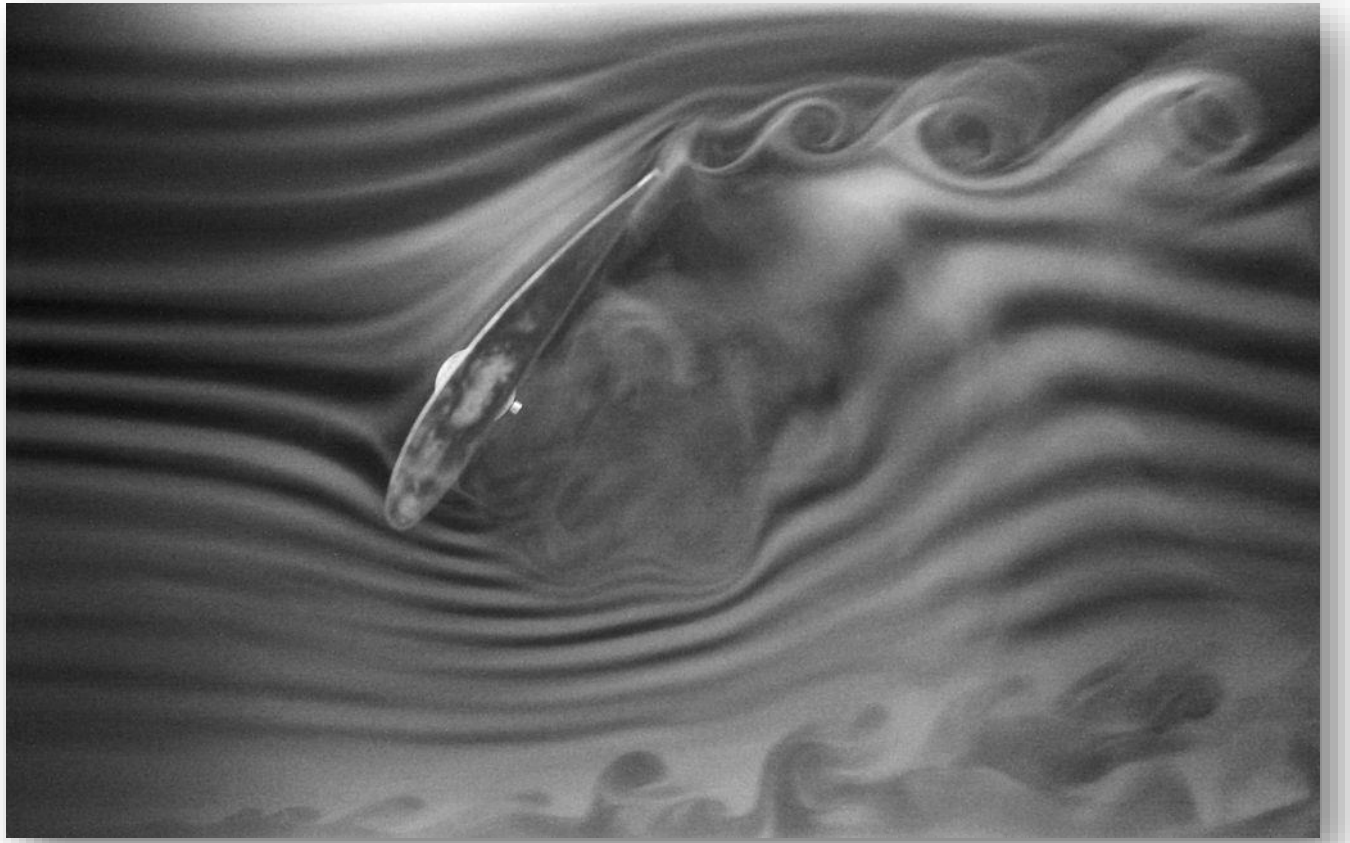

By Ekrem Canli (Own work) [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons



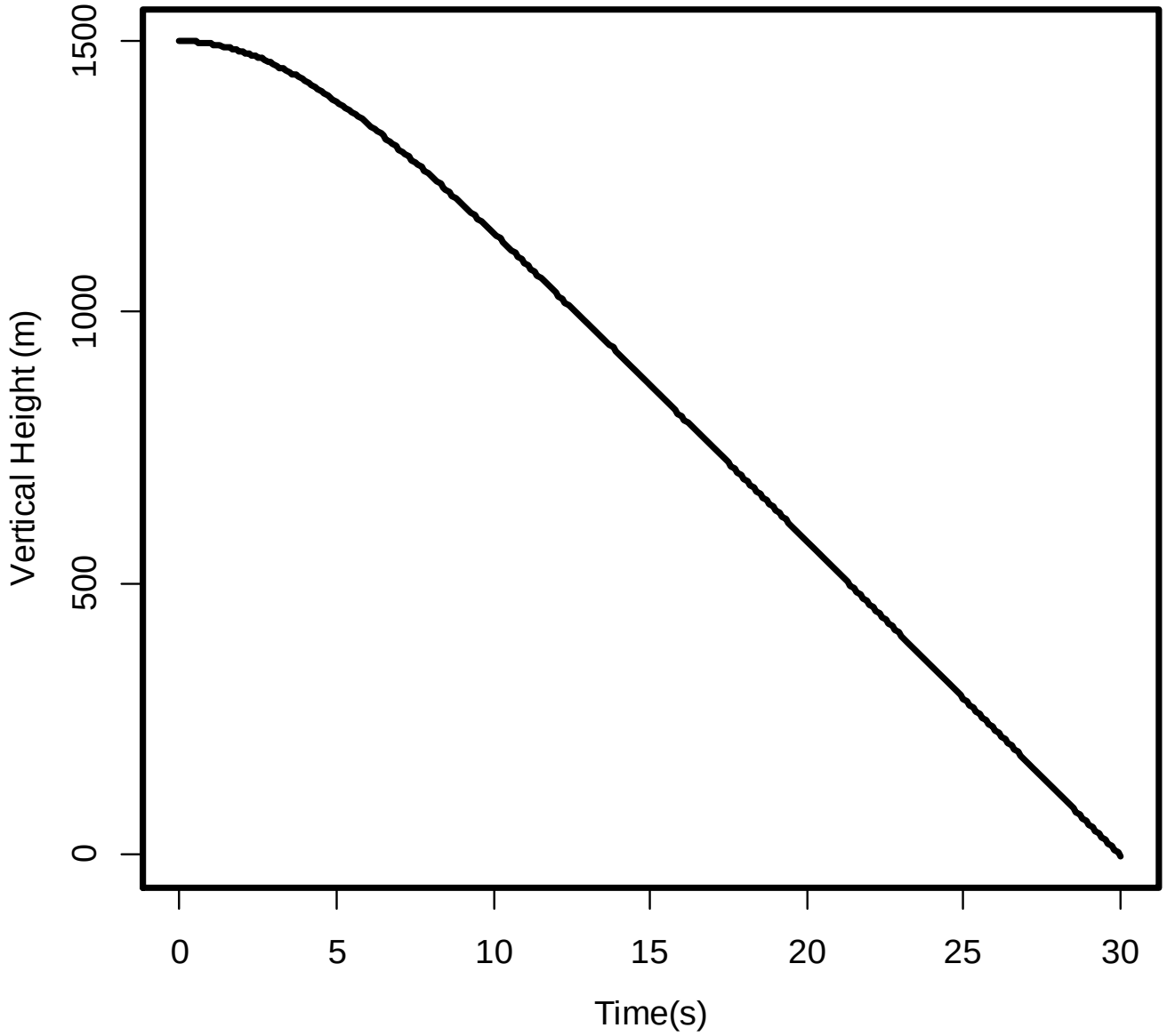
What forces are acting upon a sky diver in the tunnel?



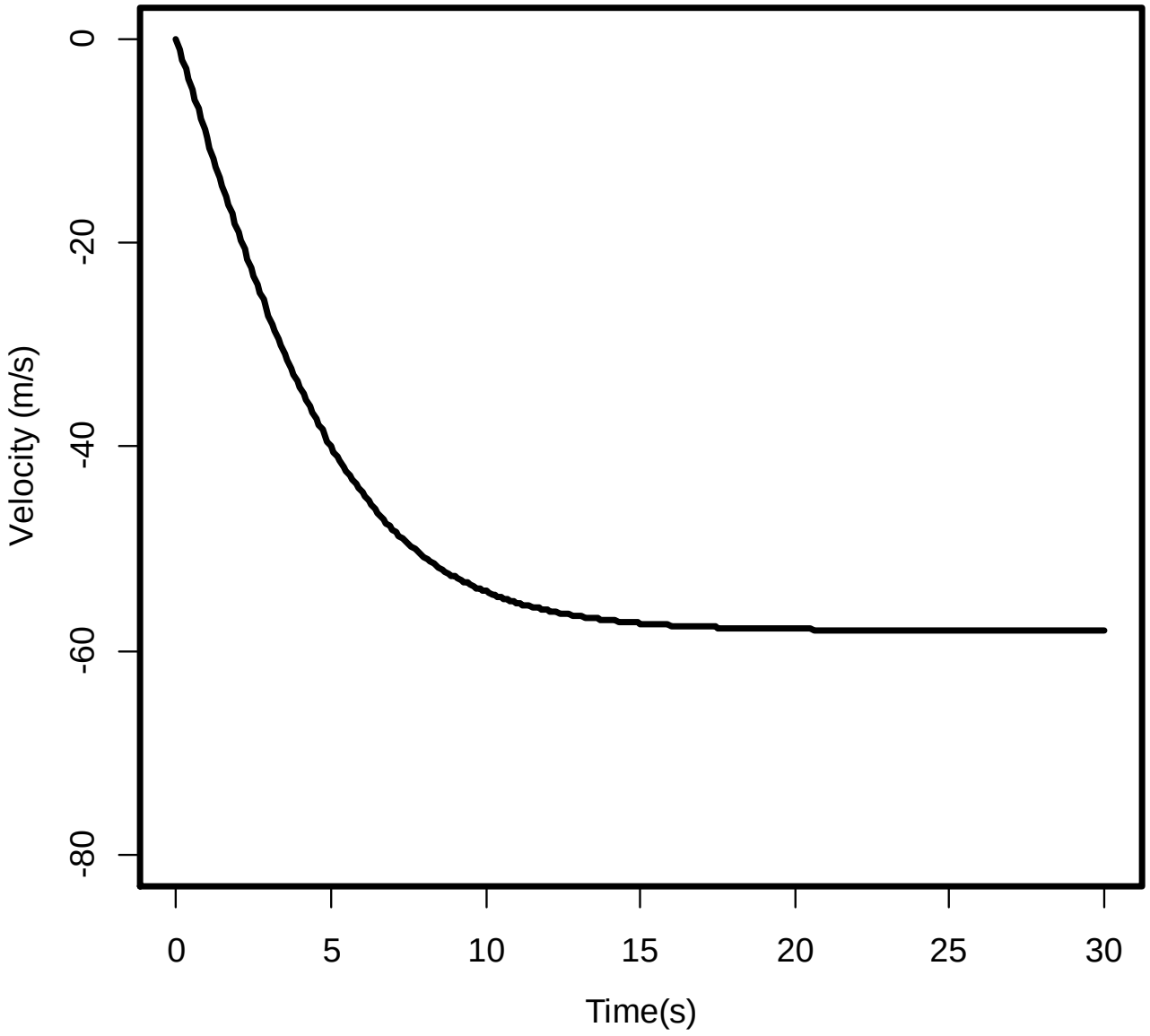
Air
is a
fluid.



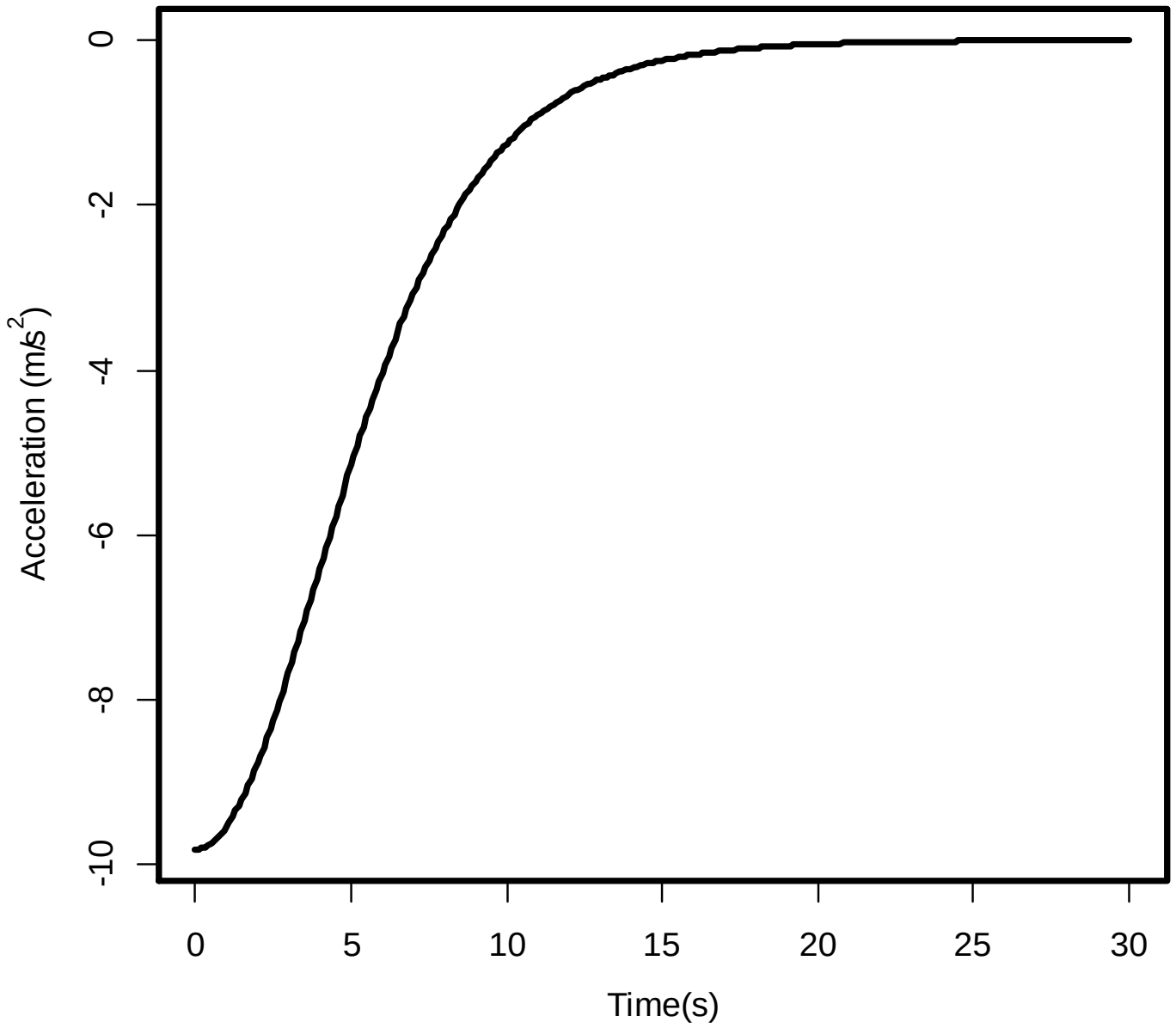
Skydiver’s Height When Falling from an Airplane

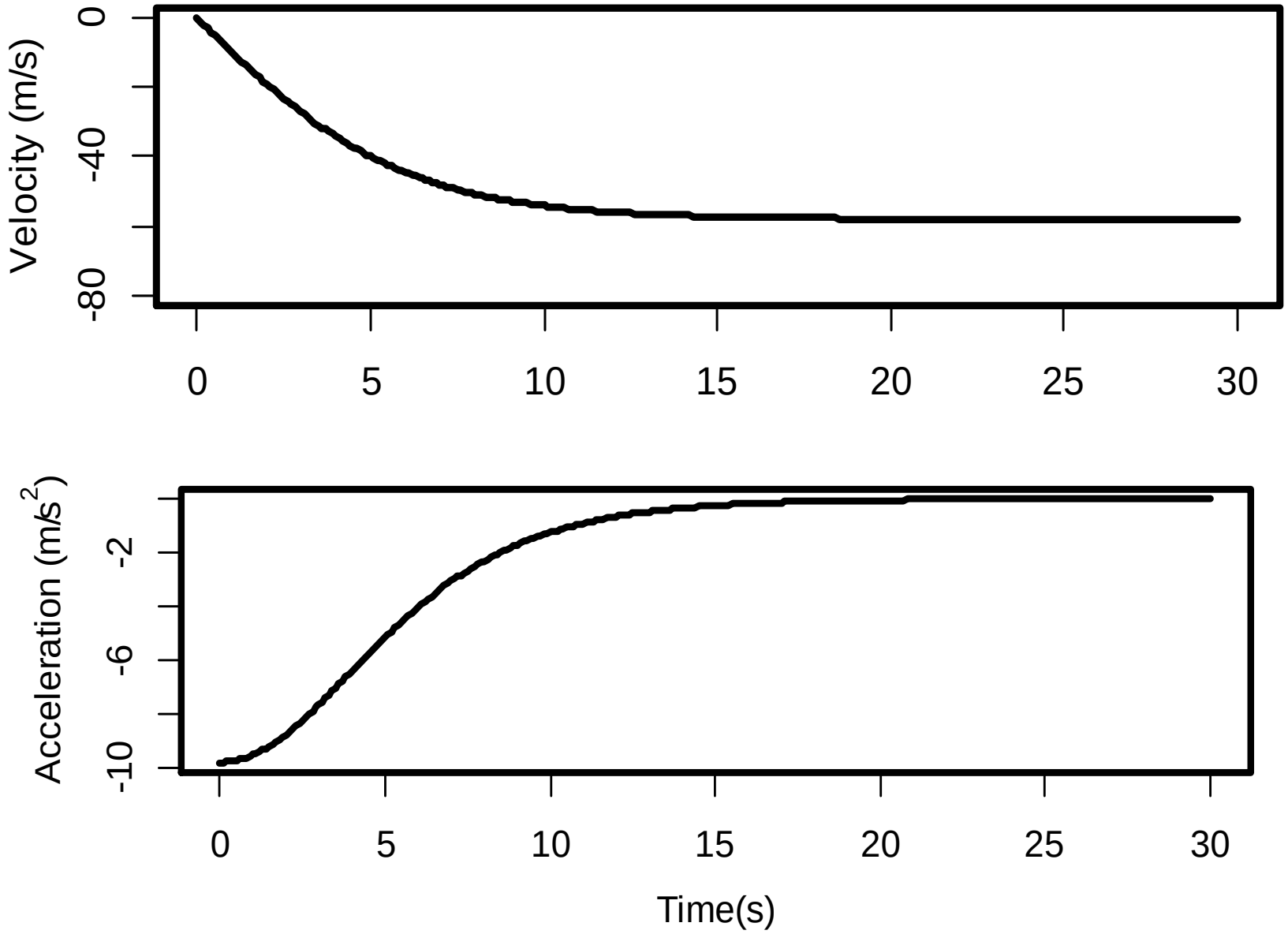


Skydiver’s Velocity When Falling from an Airplane



Skydiver’s Acceleration When Falling from an Airplane




Velocity (m/s)
0
-40
-80
0
5
10
15
20
25
30
Acceleration (m/s^2)
-2
-6
-10
0
5
10
15
20
25
30
Time(s)

force of air

gravity

force of air

gravity

When **drag force = gravity**, you reach ***terminal velocity***.

force of air

gravity

force of air

gravity

$$F_W - F_D = ma$$

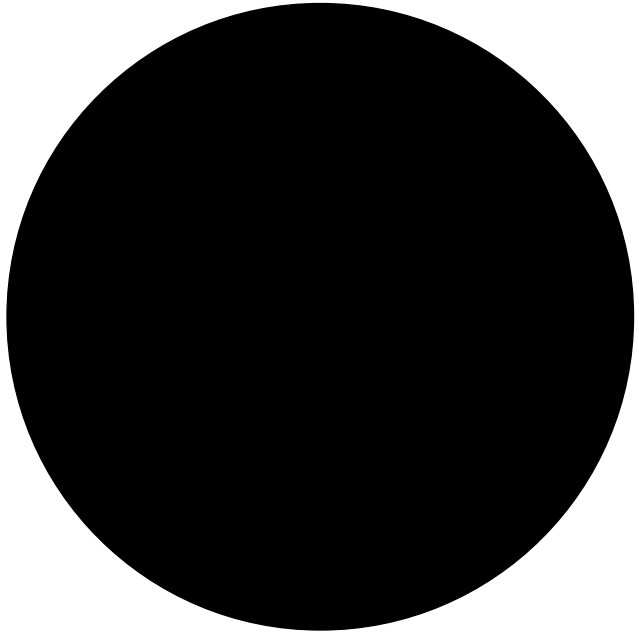
At terminal velocity:

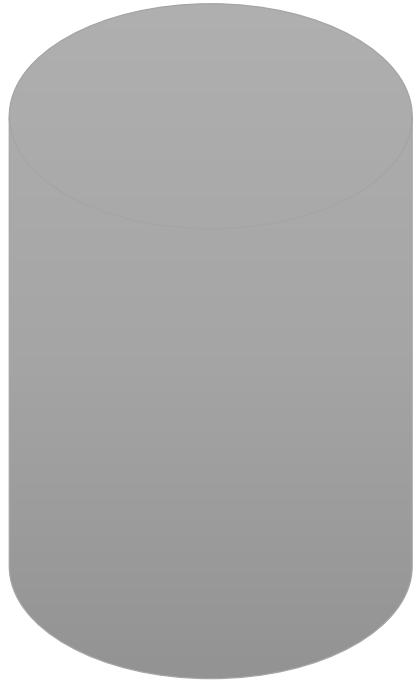
$$F_W - F_D = 0$$

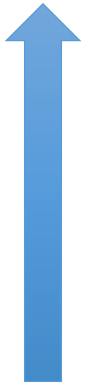
$$F_W = F_D$$

By User Alers on sv.wikipedia - Originally from sv.wikipedia

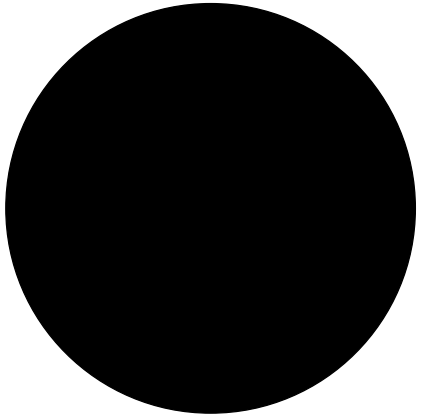
A larger
frontal area
decreases
your **velocity**.







wind



How fast
does the air have
to move
to support
your weight ?

Engineers and scientists use mathematics to ***quantify*** physical principles
…because…
we want to be able to ***predict*** what's going to happen.

What factors contribute to your terminal velocity?

- *Mass*
- *Gravity*
- *Surface Area*
- *Drag*
- *Air Density*

Mass

$$v = \frac{m}{\quad}$$

Gravity

$$v = \frac{mg}{\qquad\qquad}$$

Frontal Area

$$v = \frac{mg}{A_f}$$

Drag

$$v = \frac{mg}{A_f C_D}$$

Air Density

$$v = \frac{mg}{A_f C_D \rho}$$

The experiment plan: predict your terminal velocity

$$v = \sqrt{\frac{2mg}{A_f C_D \rho}}$$

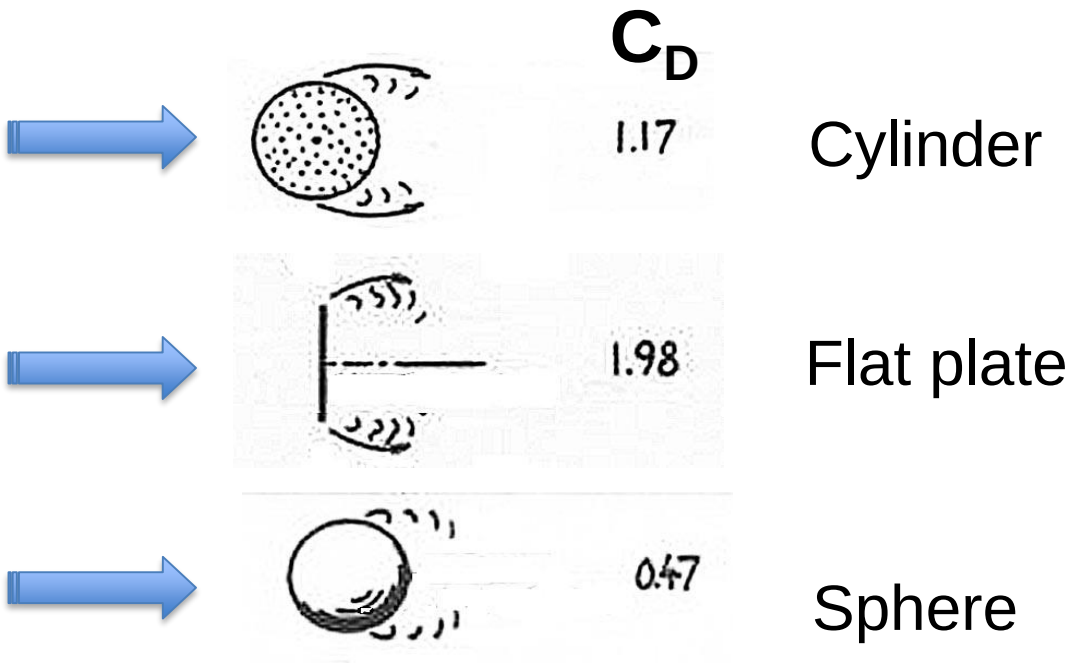
Experimental Activity

- *Measure yourself to find your frontal area.*
- *Go flying!*
- *During your flight, we'll record your terminal velocity*
- *After your flight, use your measurements to predict what your terminal velocity should be.*
- *Compare your predicted velocity with your actual velocity. How close did you get?*

Now let’s go flying!

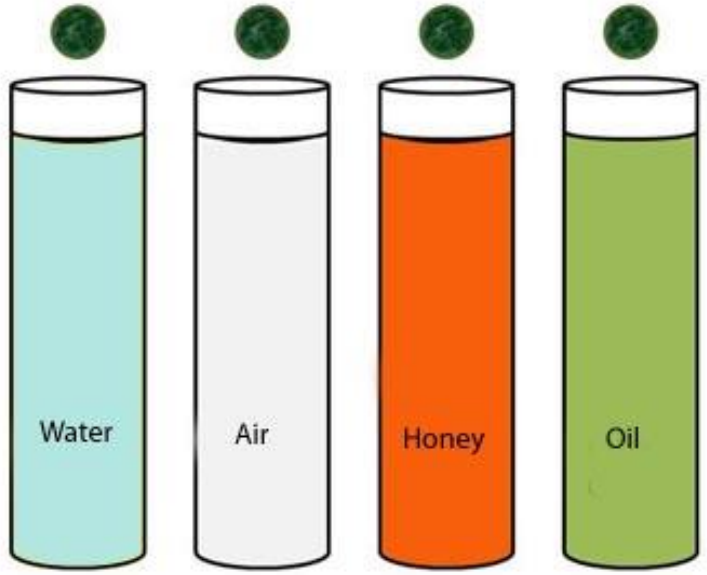
Additional Slides

Drag coefficients for simple objects



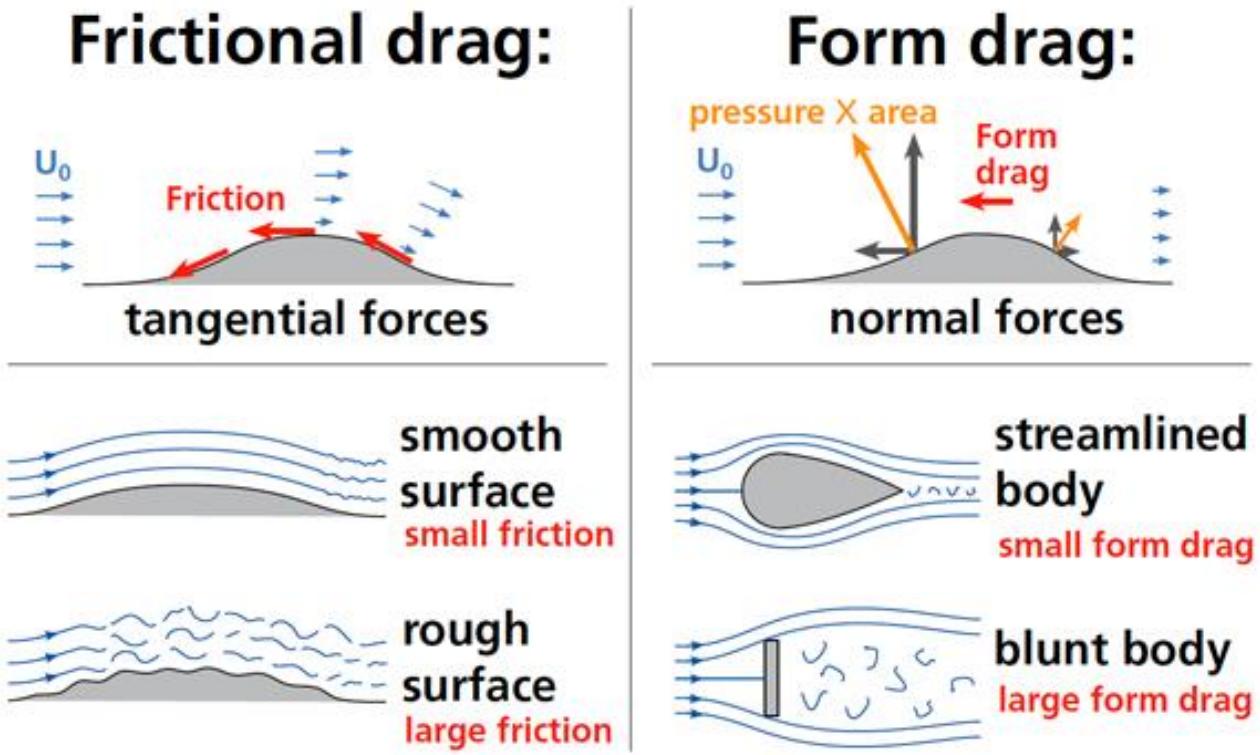
What would you guess the drag coefficient of your body is in free flight?

Fluids also have *viscosity*, which produces *friction* forces



Which type of fluid has the higher viscosity, liquids or gases?

Drag is the combination of friction and pressure forces



Which kind of drag do you think is more important for air flows?

How do we know the air speed?

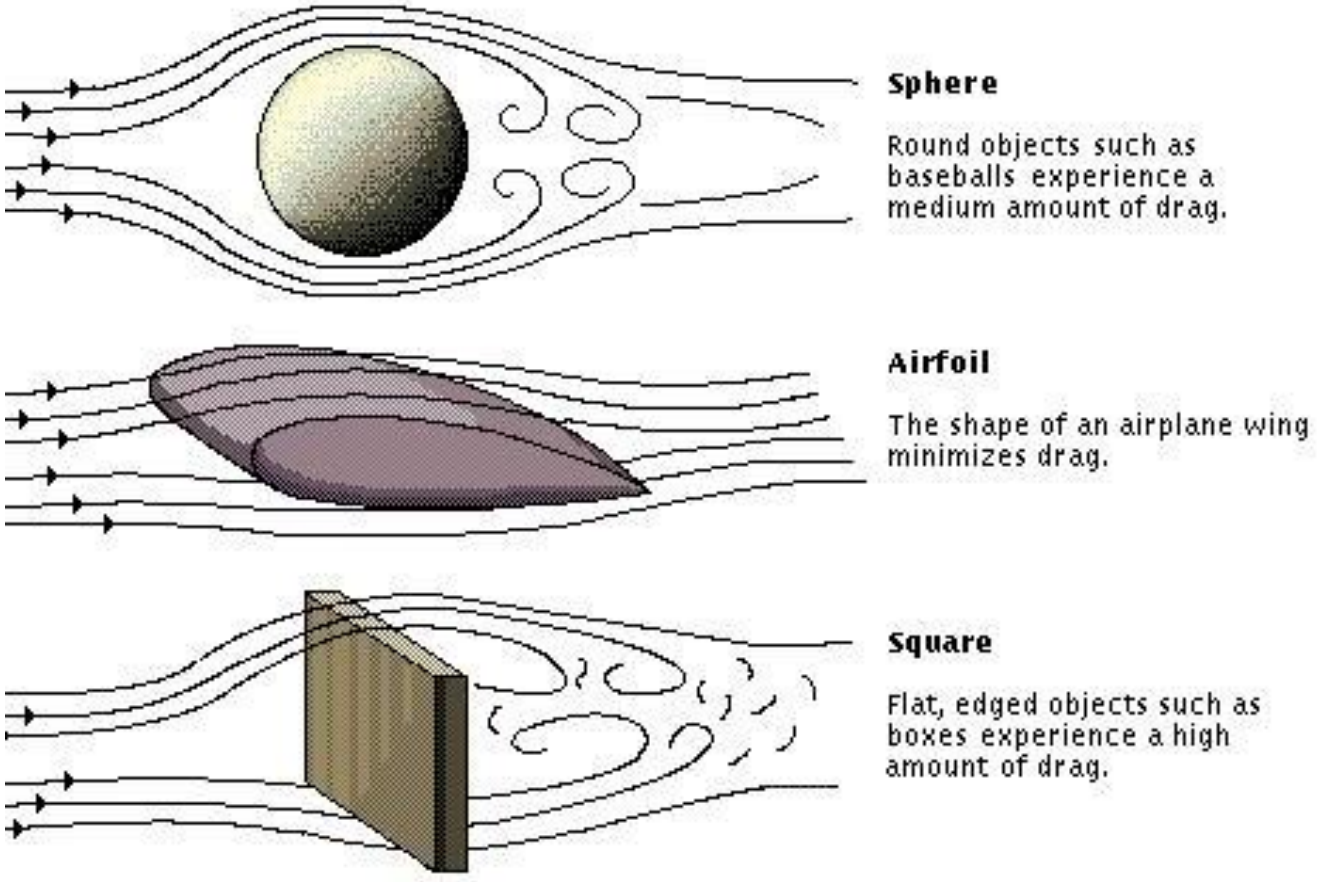
…we measure it…

…with a Pitot Static Tube.

Can you find them in our wind tunnel?

Drag of an object depends on its shape, its size, and the velocity of the air stream

Shape:



WHERE MATH AND SCIENCE TAKE FLIGHT

iFLY MAKES LEARNING FUN WITH STEM

The Science & Engineering of iFLY

iFLY INDOOR SKYDIVING