Note-A-Rific: EMF

The term ***"electromotive force"*** is still commonly used to describe the ***voltage*** measured in a conductor (like a wire, or a piece of metal) as it moves perpendicularly through a magnetic field.

- It is not really a force.
- Electromotive force (EMF) is measured in volts
  - It's exactly the same as when we calculated voltage, A.K.A. potential difference.

As a piece of wire moves through a magnetic field, a force acts on the charges in the wire.
Because the charges are moved to where they would not normally accumulate, a potential difference (voltage) builds up.

- If the wire is moving perpendicular to the magnetic field and perpendicular to its own length, a voltage will occur given by…

$$\mathbf{V = \mathit{l}\ v\ B_{\perp}}$$

V is the voltage (in volts)
l is the length of wire in the magnetic field (in metres)
v is the velocity of the wire moving through the field (in m/s)
$B_{\perp}$ is the strength of the magnetic field (in teslas)

Example: An airplane is flying at 1000km/h through an area where earth's magnetic field is 5.0×10^{-5}T and nearly vertical. What is the potential difference induced between the wing tips which are 70m apart?

Remember to change the velocity into metres per second before doing any calculations…

$$v = 1000 \text{ km/h} = 280\text{m/s}$$

$$V = l\ v\ B_{\perp}$$
$$V = (70\text{m})(280\text{m/s})(5.0 \times 10^{-5}\text{T}) = 1.0\text{V}$$

Which isn't much, but it must be taken into account when designing the plane.