

Mission Planning Project

By Captain Dave Nicholls, Pilot

- Centre of Gravity
- Graphs
- Moment
- Bearings
- Speed, Distance, Time



HAMPSHIRE AND ISLE OF WIGHT AIR AMBULANCE

**“Helimed 56,
we have a job
for you”.**



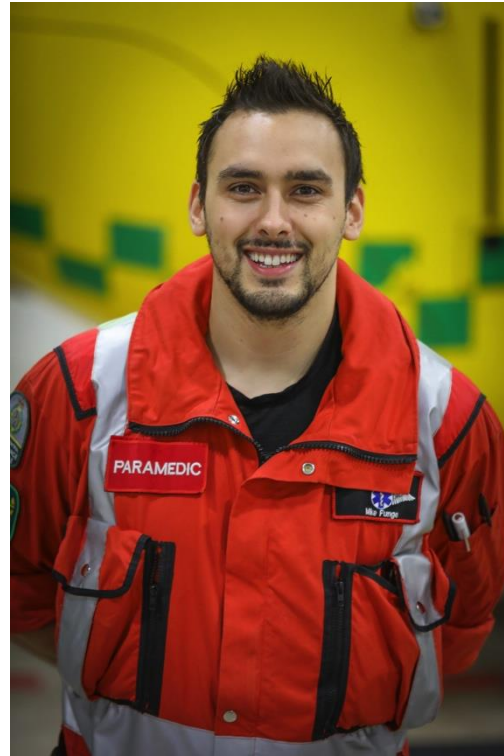
Watch the video of Captain Dave explaining his daily responsibilities –
<https://youtu.be/VaCxomPSLRE>



Today the Critical Care Team on shift are:



**Nicola Hawkes,
Paramedic**



**Mike Funge,
Paramedic**



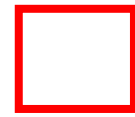
**David Sutton,
Doctor**



**Dave Nicholls,
Pilot**



Pilots' Check List before Take Off



Is the helicopter within the limitations of mass?



Is the mass distributed correctly within the helicopter (CofG)?

To answer these questions we need to create a graph.

TASK 1: Aircraft Calculations

TASK 1:A The Centre of Gravity (CofG) Graph

Tools: Ruler, graph paper, pencil.

- Choosing a suitable scale, draw a graph and plot the limits for **MASS** and **CofG**.
- **THE Y AXIS** will be used to show mass and needs to cover the range from **1400 kg to 3000 kg**.
- **THE X AXIS** will be used to show distance (in millimetres) from the datum point and needs to cover the range from **4100 mm to 4600 mm**

The distance from the datum is called the arm.

REMEMBER

MASS =the amount of matter (stuff) in an object.

WEIGHT = the force exerted on an object due to gravity.



TASK 1:A: The Centre of Gravity (CofG) Graph continued..

The graph will be used once we have calculated our **MASS** and **CofG**.

Plotting CofG Limits

- Now you have the graph prepared, you will need to plot the corners of our **CofG** limits.
- Plot the points shown in the table below and then use straight lines to join points A to B to C to D to A.
- The area inside the box is called the **CofG** envelope. We cannot fly if, when plotted, the mass and **CofG** fall outside this envelope.

Point	Arm(mm)	Mass (kg)
A	4201	2980
B	4369	2980
C	4555	1600
D	4152	2039

TASK 1:B Zero Fuel Figures

Before we can start to add fuel or patients to our helicopter, we must work out the **MASS** and **CofG** point of the helicopter. Complete the following task to obtain these figures.

1. Use the above formula to calculate the **Mass** and **CofG**. Use it to help you fill in the spaces of the table.
2. Add the **MASS** and **MOMENT** columns and enter the results in the **Zero Fuel Totals** row.
3. Divide the **Zero Fuel Moment** by the **Zero Fuel Mass** to obtain the **CofG** for the helicopter.

MOMENT = MASS (kg) X ARM (mm)

(This formula can be rearranged in the same way all formulae can)

APS is the **Aircraft Prepared State**. This is the mass and CofG data for the helicopter with all the equipment. It dose not include any crew members or fuel.

	Mass (kg)	Arm (mm)	Moment
APS	2143	4502	9647786
Pilot –Dave Nicholls	85	2428	
Paramedic- Nicola Hawkes	75		200400
Paramedic- Mike Funge		4323	449592
Doctor – David Sutton	99	3465	
Zero Fuel Totals <i>(add each column)</i>			
Centre of Gravity = $\frac{\text{Total Moment}}{\text{Total Mass}}$ =			

TASK 1:C Payload

Well done! We now know the mass and CofG for our helicopter.

We now need to know how much mass can be carried, while staying within the limits of our graph. This spare mass is called the **Payload**.

Subtract the **Zero Fuel Mass** from the **Maximum Mass** of the helicopter to calculate the **Payload**.

	Mass(kg)
Maximum Mass	2980
Zero Fuel Mass	
Payload	

The **Payload** figure will be used throughout the day to ensure we do not exceed the maximum mass of the helicopter. This involves juggling figures because.....





We could use the entire payload for fuel but, although we could fly further, we would have no spare mass to carry a patient.



We could use the entire payload to carry patients but we would have no fuel to fly them anywhere.



A good trade-off between carrying the most fuel but leaving enough mass for a patient is what we need!

TASK 1:D Centre of Gravity at Take-Off

Our payload will usually allow us to carry 420 kg fuel. Before we can add this fuel, we need to make sure that it will keep us inside our **CofG** limits.

- Complete the table below using the **Zero Fuel Totals** you calculated earlier.
- As before, divide the total **MOMENT** by the total **MASS** to get the **CofG**.
- Now plot the **CofG** figure and mass on the graph you made.



	Mass (kg)	Arm (mm)	Moment
Zero Fuel Totals			
420kg of Fuel	420	4181	
Zero Fuel Totals <i>(add each column)</i>			
Centre of Gravity = $\frac{\text{Total Moment}}{\text{Total Mass}}$	=		

Does this point fall inside our **CofG** envelope?

If it does, we are ready to fly!

TASK 2: The Mission

A call has come in. The Ambulance Service Emergency Operations Centre has given us the following details:

- RTC (Road Traffic Collision)
- A pedestrian has been hit by a car at Bishops Waltham

Receiving the call:

Control room: "Helimed 56, Incident when ready."

Helimed56: "Ready to receive."

Control room: "Grid reference Sierra Uniform Five Three Nine One Eight Two.

Location Bishops Waltham.

Incident pedestrian versus car, that's pedestrian versus car.

We'll update you with further details, over."

We need to plan our route and get airborne as quickly as possible!



TASK 2:A Mission Planning.

It's time to plan our mission!

1. On your map, draw a straight line from Thruxton (our base) to the incident at Bishops Waltham. Use a protractor to work out the bearing to our destination by placing the centre of your protractor on the line you have drawn. Make sure it is lined up with the closest north/south line to Thruxton. Read off the bearing and write the number in the box below.
2. Cut out the printed aviation ruler and stick together matching the numbers. Measure the line with the aviation ruler and write the distance in the box below. Make sure you use the correct scale (1:250,000).

NOTE: Line up the protractor with the closest North/South line to Thruxton. N/S lines on an aviation map do not run parallel to the edges of the map.



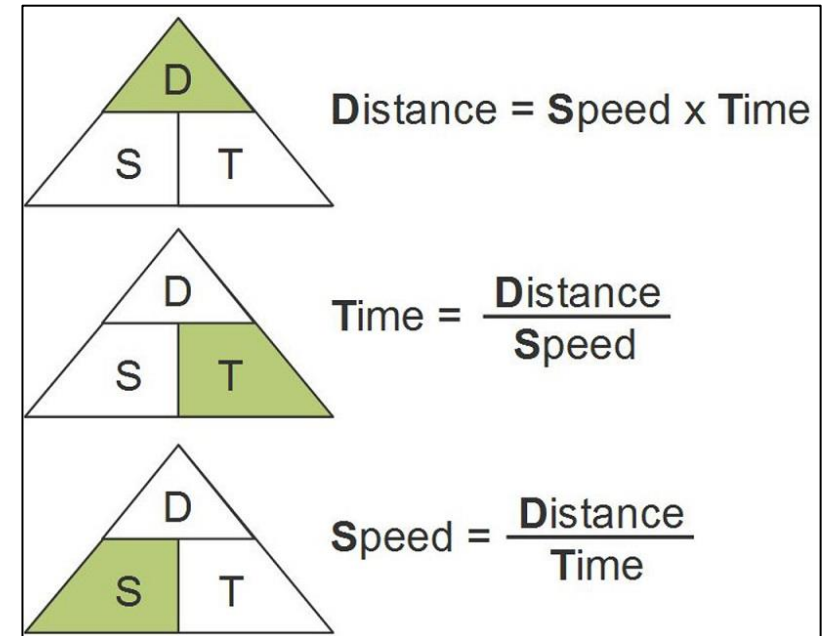
TASK 2:A Mission Planning continued.....

3. Work out how long it will take us to get to our destination Bishops Waltham. Use the **speed/distance/time** triangle to help you.

NOTE: Remember, if you want to work out the time in minutes, you will need to use the speed in miles per minute. The units must match.

Thruxton – Bishops Waltham

Bearing	
Distance	
Speed	120 mph (2 miles per minute)
Time	



TASK 2:B Arriving at our Destination

By the time we arrive at the destination, we will have burned approximately **30kg** of fuel. We also need to fly the patient who weighs **80kg**. We cannot take off until we are satisfied that this new loading will stay within our **CofG** envelope.

	Mass (kg)	Arm (mm)	Moment
Zero Fuel Totals			
390kg of Fuel	390	4193	
Patient	80	4383	
Totals			
Centre of Gravity = $\frac{\text{Total Moment}}{\text{Total Mass}}$			

Complete the table and then plot the results on your CofG graph to see whether it is safe to fly.



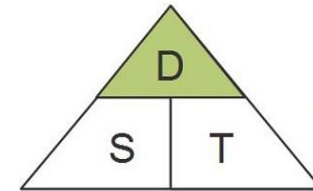
TASK 2:C Flying to the Hospital

We now need to fly the patient to University Hospital Southampton.

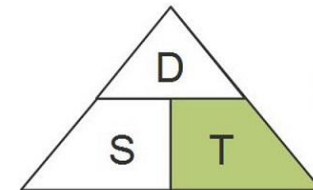
Plan our journey to the hospital by completing the table below. If it took us 4 minutes to reach the helipad at the hospital, what would our speed be? Use the speed/distance/time triangle again.

Bishops Waltham – Southampton General Hospital

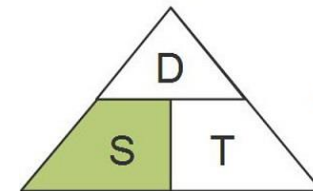
Bearing	
Distance	
Speed	
Time	4 mins



$$\text{Distance} = \text{Speed} \times \text{Time}$$



$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$



$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$



We made it!

We have used calculations to make a real difference to somebody's life by delivering them safely to hospital.

With a little practice you can increase the speed of your calculations. Remember, we need to get airborne in 4 minutes!

Pilot Test

Test your mission planning knowledge and see if you can explain what the following terminology.

Wording	What Does it Mean?
Helimed 56	
Critical Care Team	
HIOWAA	
HEMS	
Centre of Gravity	
The Arm of the Helicopter	
Datum Point	
APS	
Payload	
Zero Fuel Mass	

Well done team!