DOCUMENT
GSM-G-CPL.022

DOCUMENT TITLE

GENERAL OPERATIONS, FLIGHT PLANNING AND PERFORMANCE

CHAPTER 4 – LOADING SYSTEM ALPHA

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LOADING ALPHA

INTRODUCTION

Now that we have an understanding of loading, it is time to look at Load graphs commonly used in the CASA VFR (DAY) Booklet.

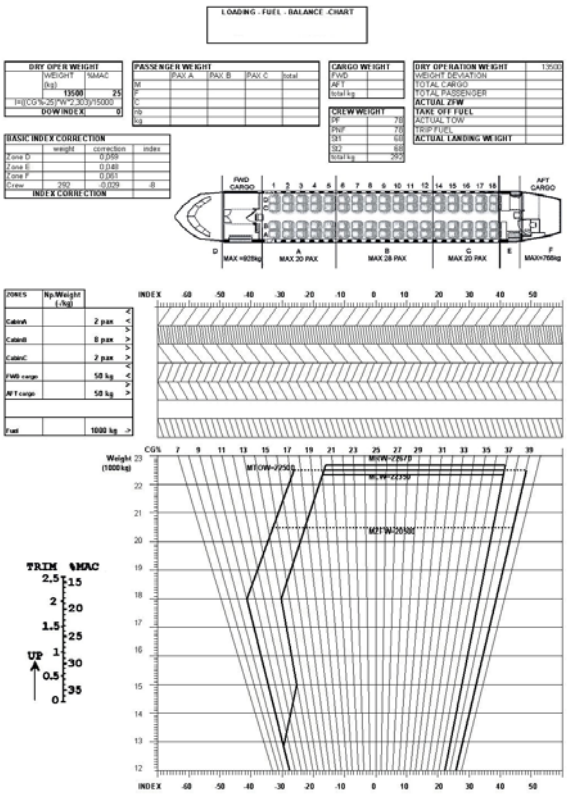
There are four types:

- ALPHA
- BRAVO
- CHARLIE
- ECHO (Mainly for CPL)

It is important to remember that these are generated for exam purpose and once you have attained your PPL or CPL you will come across many different types of load systems for many different types of aircraft.

The ATR 72-500 below may look a bit daunting now, but come back for another look later.

ATR 72-500 and Trim Sheet



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LOADING SYSTEM ALPHA

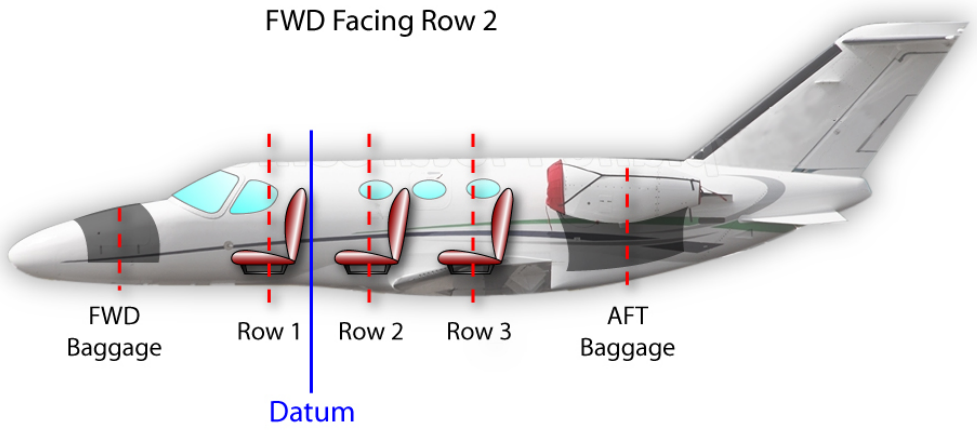
The aircraft used in the Alpha type LOAD SYSTEM for EXAM World is of 6/7 seats which can be configured in conventional or club class seating (AFT facing middle row). The ability to change seating layout causes a shift in the station at which the weight acts down.

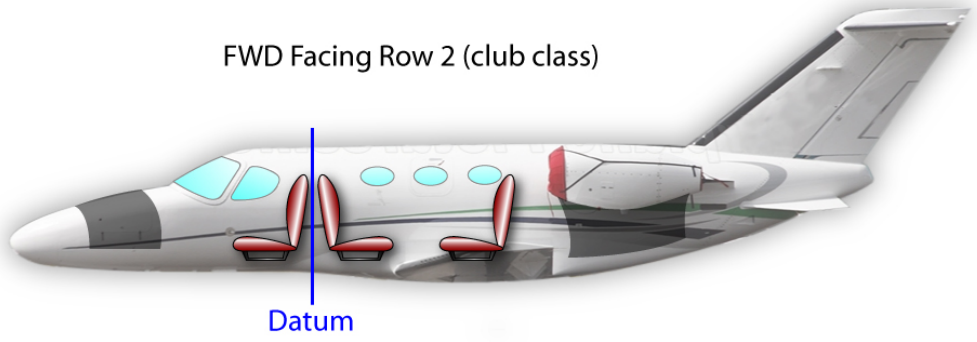
Below shows the seating layout for the aircraft used, as we can see when the seats are moved from FWD Facing to AFT Facing the seat location has moved forward, having an effecting on the turning moment created from passengers in row 2.

In addition to the in cabin seating the aircraft also has two baggage lockers, one Forward and one Aft, both lockers have a maximum capacity 45 kg each.

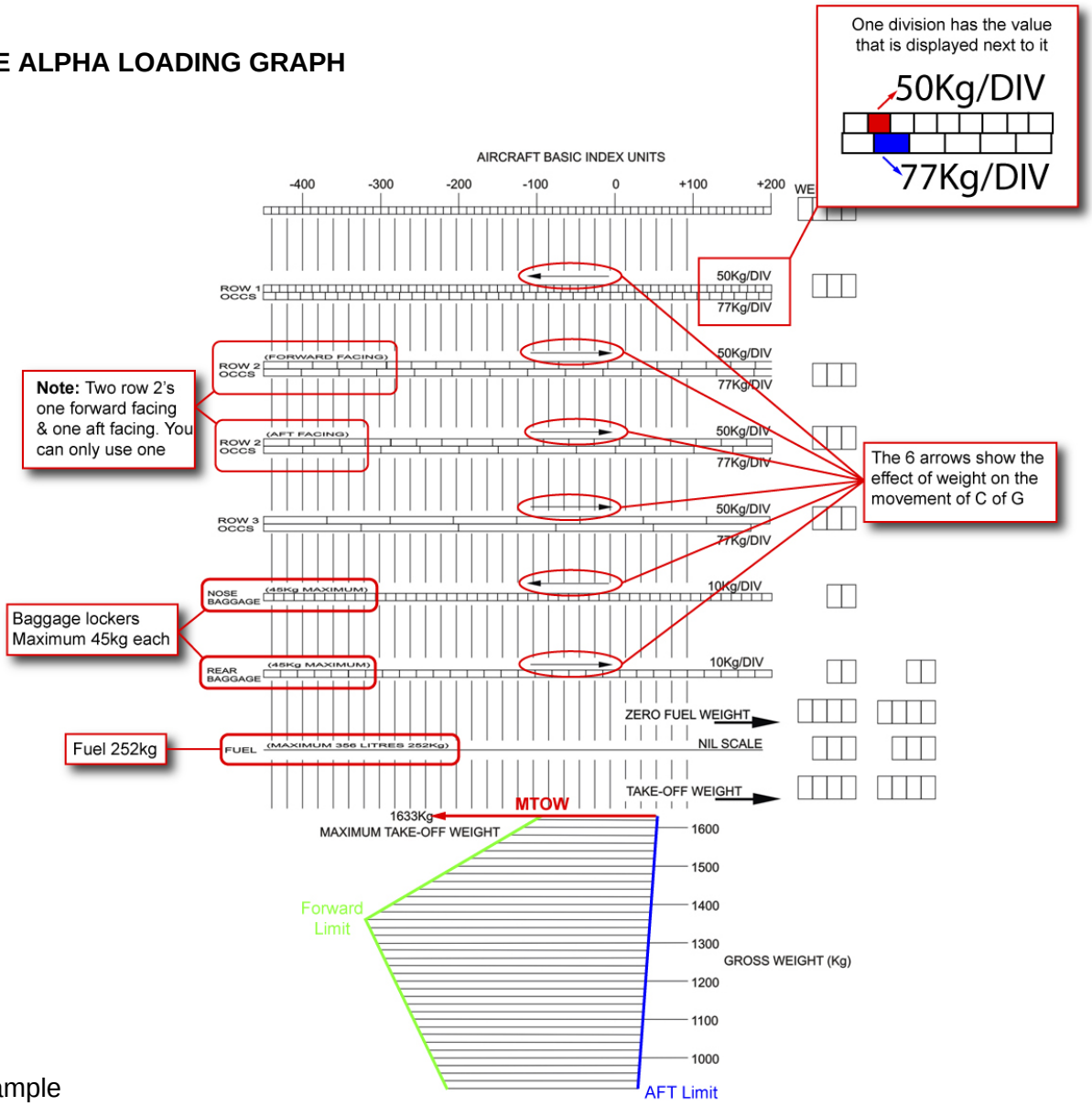
The Maximum fuel for the aircraft is 252kg (356 litres at a specific gravity of 0.71)

All of the above will be depicted on the load graph.





THE ALPHA LOADING GRAPH



Example	
Basic Empty Weight	1050 kg
Empty Index Unit	-260
Row 1	150 kg (2 persons)
Row 2 (forward facing)	160 kg (2 persons)
Row 3	120 kg (2 persons)
Nose baggage	40 kg
Rear baggage	Nil
Zero Fuel Weight	1520 kg
Fuel	113 kg
Take-Off Weight	1633 kg

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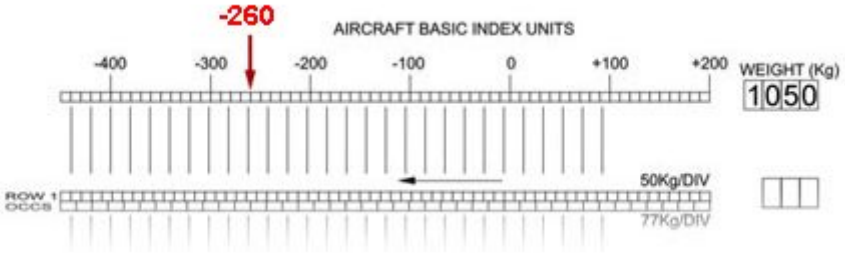
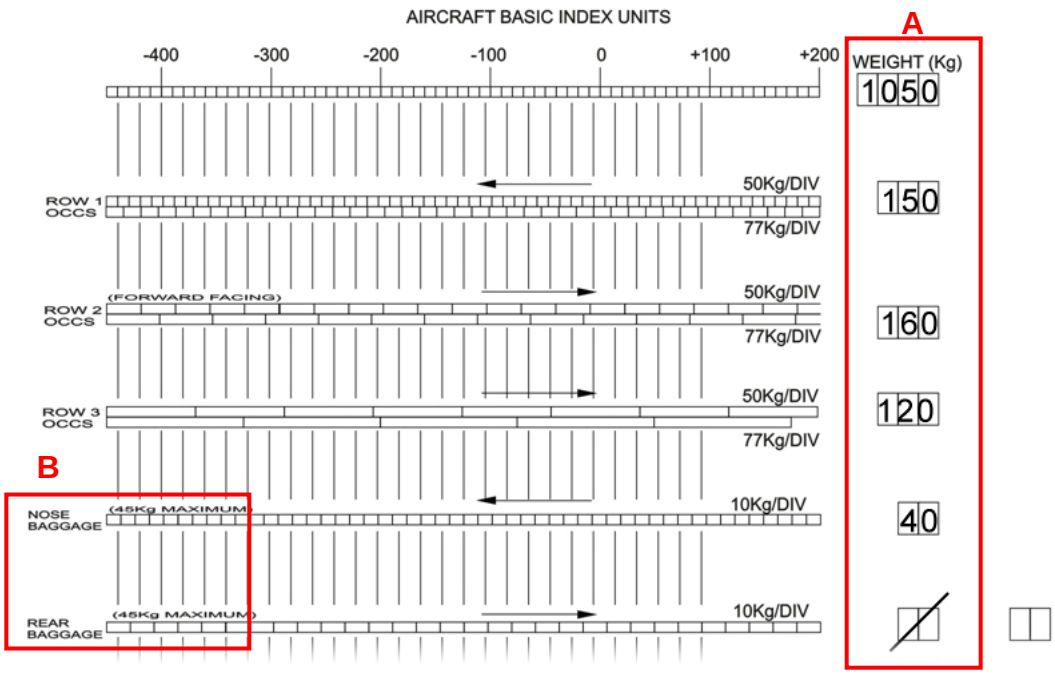
1. Obtain Basic Empty Weight (Exam world) and Index Unit from current section of 6.2 of Flight Manual:

   - Basic empty weight 1050 kg
   - Empty INDEX Unit -260

2. Mark Basic Empty Weight Index Unit on top scale. Enter Basic Empty Weight at top right hand column



3. Enter weights of loaded items required for flight in appropriate squares on right-hand column (A). Maximum weights for loaded items are indicated on Index Unit scales (B).



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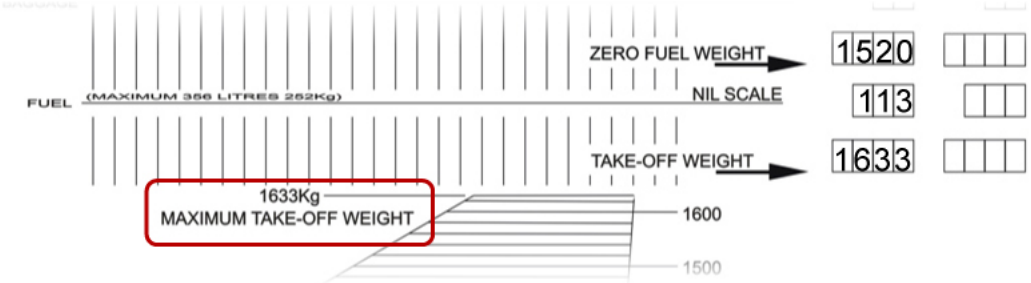
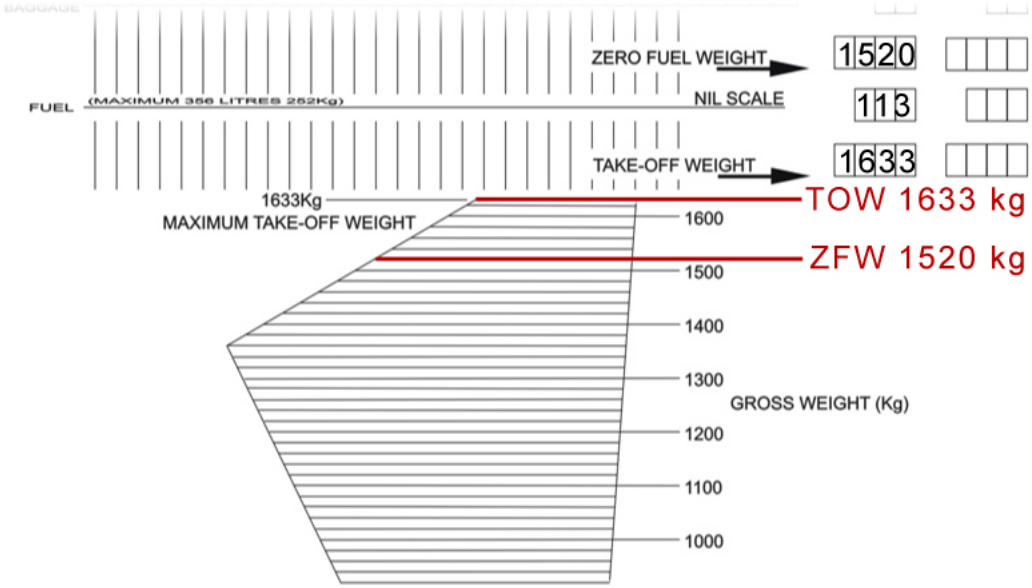
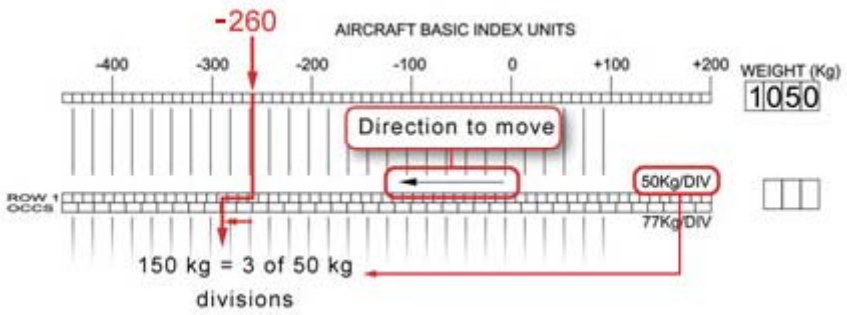
4. Total weight in right-hand column to obtain Zero Fuel Weight And Take-Off Weight (DO NOT EXCEED MAXIMUM TAKE OFF WEIGHT)



5. Draw horizontal lines on the C of G Envelope graph corresponding to Zero Fuel Weight and Take off Weight



6. Draw a line vertically down from a point marked on Basic Empty Weight Index Unit scale to FIRST load item scale



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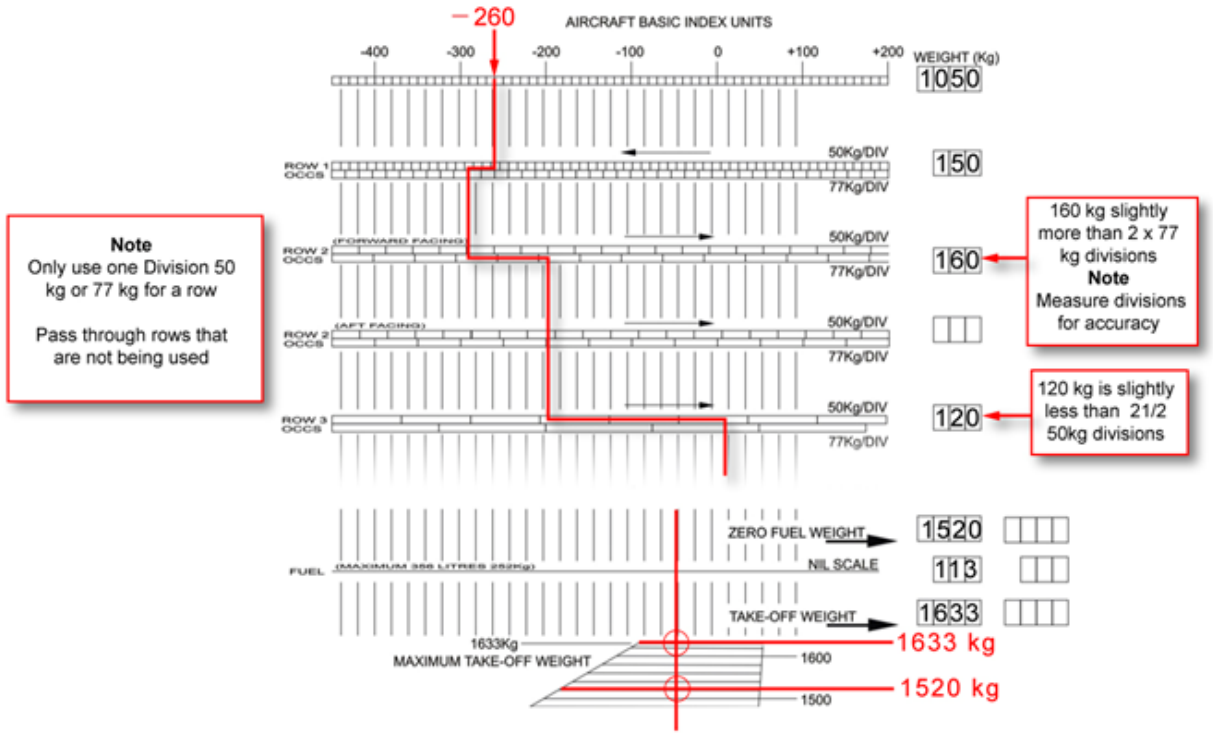
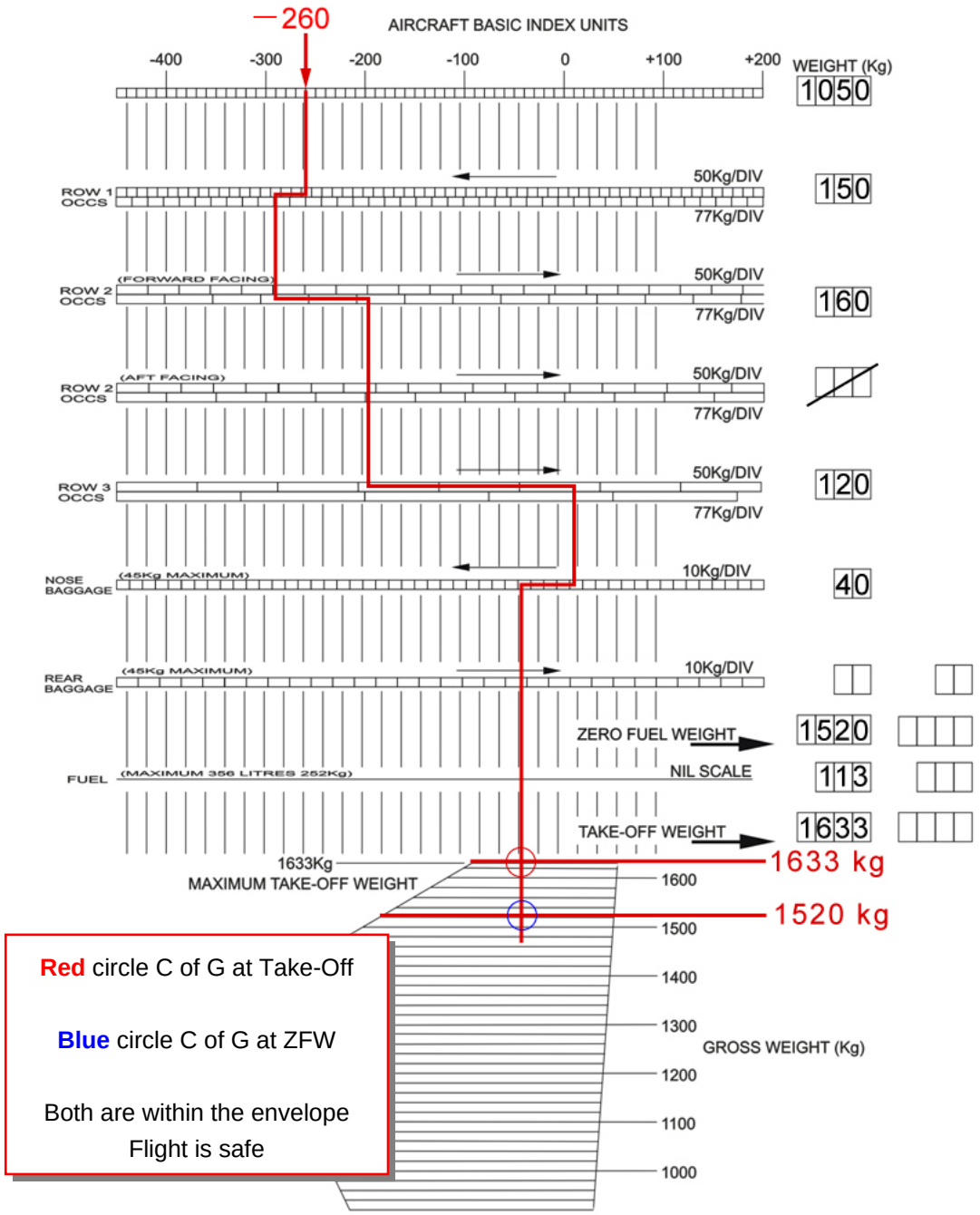
Move to the left or right on this load item index scale as per arrow direction and mark a point as appropriate to the load indicated in the right-hand column.
(e.g. 150 kg load @ 50kg = 3 Divisions)

7. Draw a line vertically down from the point marked on the first load item index scale to the second load item scale and continue as per above. Continue down the scales to Rear Baggage. Draw a line vertically down from the Rear Baggage to intersect the Zero Fuel Weight line previously marked on the C of G envelope graph



8. The two intersection points above must not exceed the boundaries of the C of G envelope graph. If they do, re-organise the load in the aircraft and start again.

Completed Example



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ALPHA LOADING SYSTEM ADVANCED

What if the C of G is out side the envelope?

An aircraft is loaded as follows:

Basic Empty Weight	829 kg
Empty Index Unit	-270
Row 1	154 kg (2 persons)
Row 2 (forward facing)	154 kg (2 persons)
Row 3	154 kg (2 persons)
Nose baggage	? kg
Rear baggage	? kg
Zero Fuel Weight	???? kg
Fuel Full	252 kg
Take-Off Weight	???? kg

The question is, what is the maximum baggage one could carry on this flight and remain in balance at all phases of flight ?

Step 1

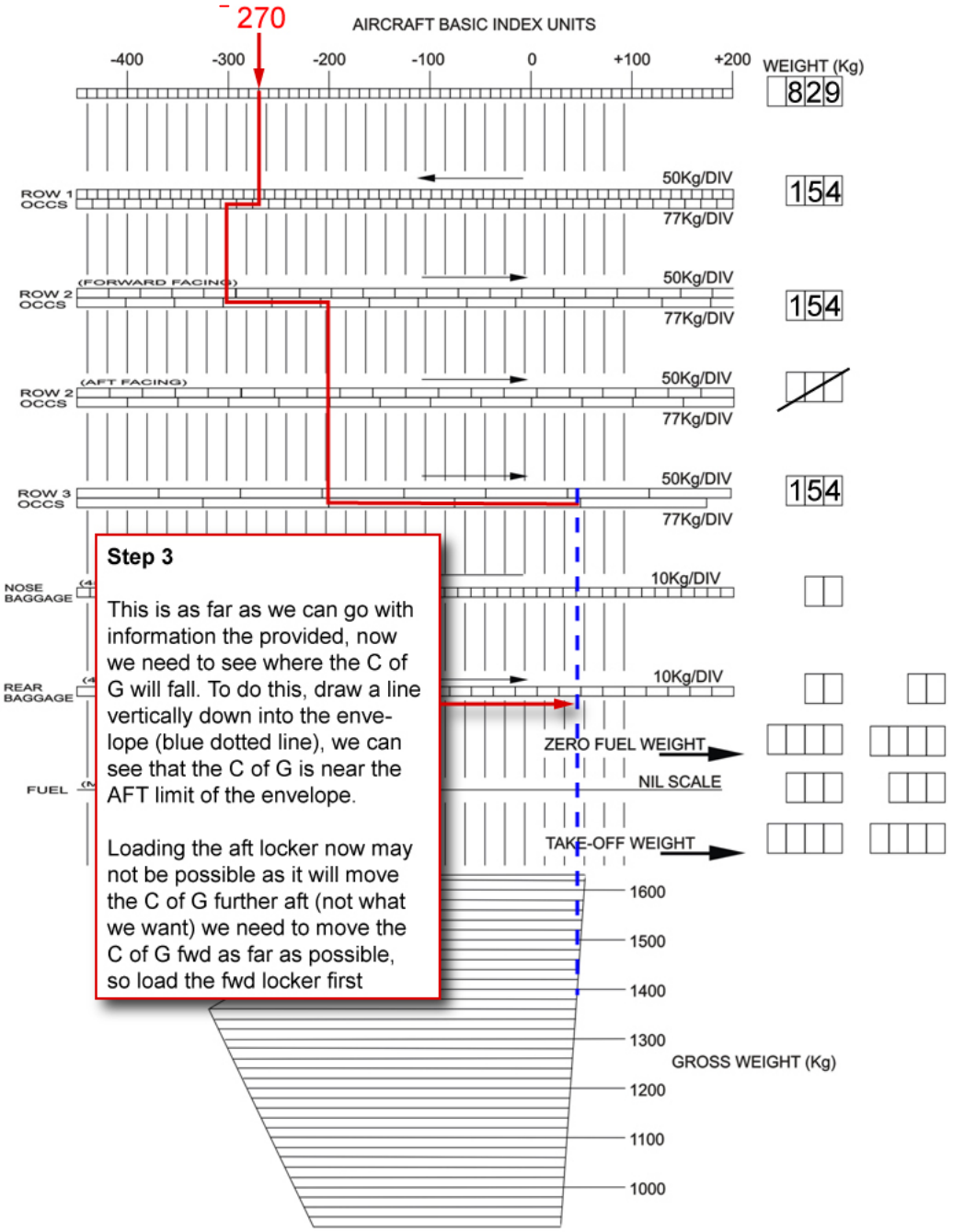
Add all the weights to see if you can carry any extra weight, there is no Zero Fuel Limitation, so only Take off weight will be the limiting factor for remaining within weight limitations. (no performance limitation).

Take-off weight with information given:	1543 kg
Maximum Take-off weight allowable:	1633 kg
Useful load left for baggage:	90 kg

You can see from the graph that the maximum baggage is 45 kg in each locker. 45 x fwd and aft = 90 kg so weight is safe but what about balance?

Step 2

Enter relevant information on to the graph and work through the graph as far as possible, as shown previously.



Step 3

This is as far as we can go with information the provided, now we need to see where the C of G will fall. To do this, draw a line vertically down into the envelope (blue dotted line), we can see that the C of G is near the AFT limit of the envelope.

Loading the aft locker now may not be possible as it will move the C of G further aft (not what we want) we need to move the C of G fwd as far as possible, so load the fwd locker first

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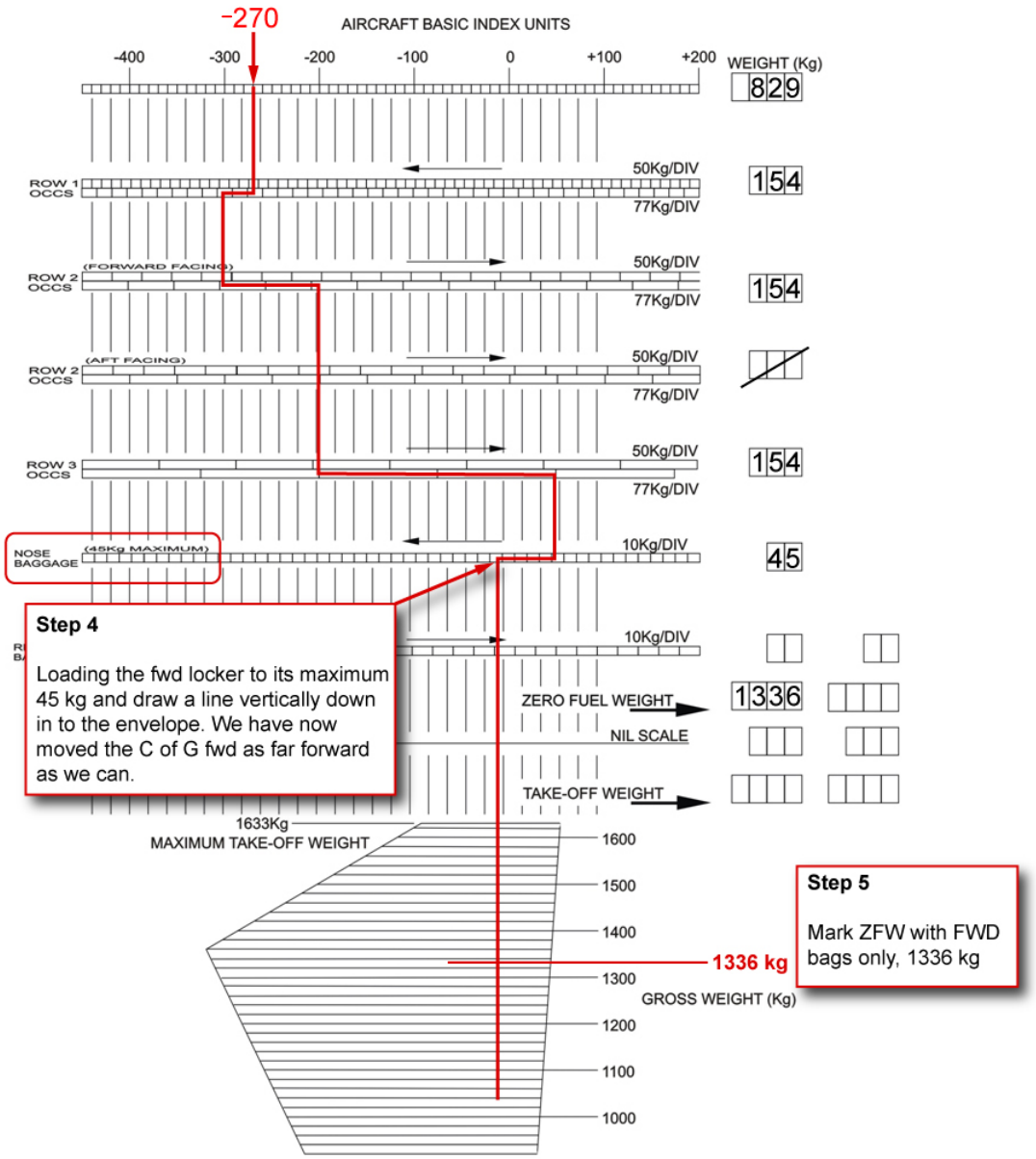
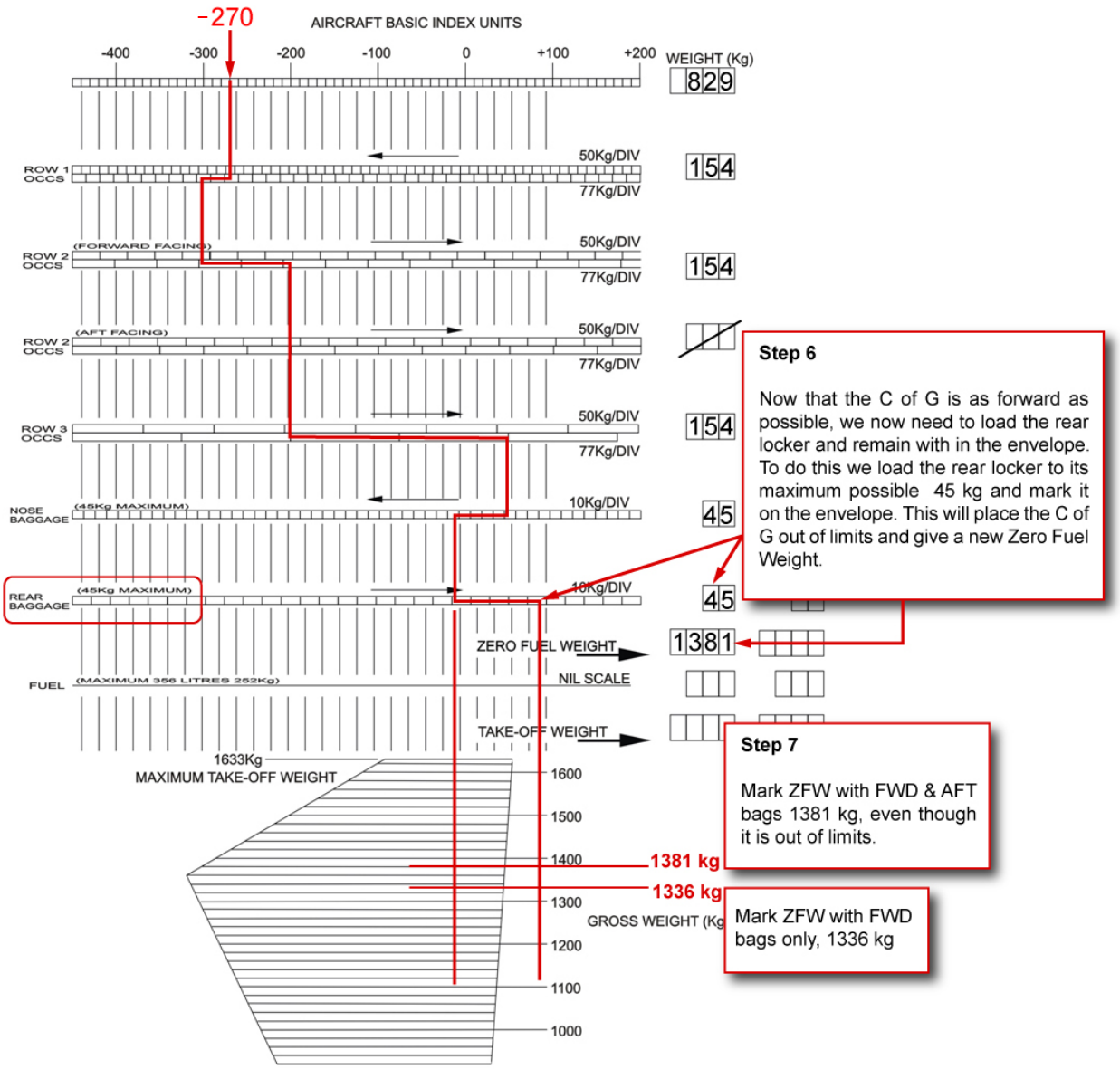

-270
AIRCRAFT BASIC INDEX UNITS
-400
-300
-200
-100
0
+100
+200
WEIGHT (Kg)
829
ROW 1 OCCS
50Kg/DIV
77Kg/DIV
154
ROW 2 OCCS
(FORWARD FACING)
50Kg/DIV
77Kg/DIV
154
ROW 2 OCCS
(AFT FACING)
50Kg/DIV
77Kg/DIV
ROW 3 OCCS
50Kg/DIV
77Kg/DIV
154
NOSE BAGGAGE
(45Kg MAXIMUM)
10Kg/DIV
45
10Kg/DIV
ZERO FUEL WEIGHT
1336
NIL SCALE
TAKE-OFF WEIGHT
1633Kg
MAXIMUM TAKE-OFF WEIGHT
1600
1500
1400
1336 kg
1300
GROSS WEIGHT (Kg)
1200
1100
1000
Step 4
Loading the fwd locker to its maximum 45 kg and draw a line vertically down in to the envelope. We have now moved the C of G fwd as far forward as we can.
Step 5
Mark ZFW with FWD bags only, 1336 kg


-270
AIRCRAFT BASIC INDEX UNITS
-400
-300
-200
-100
0
+100
+200
WEIGHT (Kg)
829
ROW 1 OCCS
50Kg/DIV
77Kg/DIV
154
ROW 2 OCCS
(FORWARD FACING)
154
ROW 2 OCCS
(AFT FACING)
ROW 3 OCCS
154
NOSE BAGGAGE
(45Kg MAXIMUM)
10Kg/DIV
45
REAR BAGGAGE
(45Kg MAXIMUM)
45
ZERO FUEL WEIGHT
1381
NIL SCALE
FUEL
(MAXIMUM 356 LITRES 252Kg)
TAKE-OFF WEIGHT
1633Kg
MAXIMUM TAKE-OFF WEIGHT
1600
1500
1400
1381 kg
1336 kg
1300
GROSS WEIGHT (Kg)
1200
1100
1000
Step 6
Now that the C of G is as forward as possible, we now need to load the rear locker and remain with in the envelope. To do this we load the rear locker to its maximum possible 45 kg and mark it on the envelope. This will place the C of G out of limits and give a new Zero Fuel Weight.
Step 7
Mark ZFW with FWD & AFT bags 1381 kg, even though it is out of limits.
Mark ZFW with FWD bags only, 1336 kg

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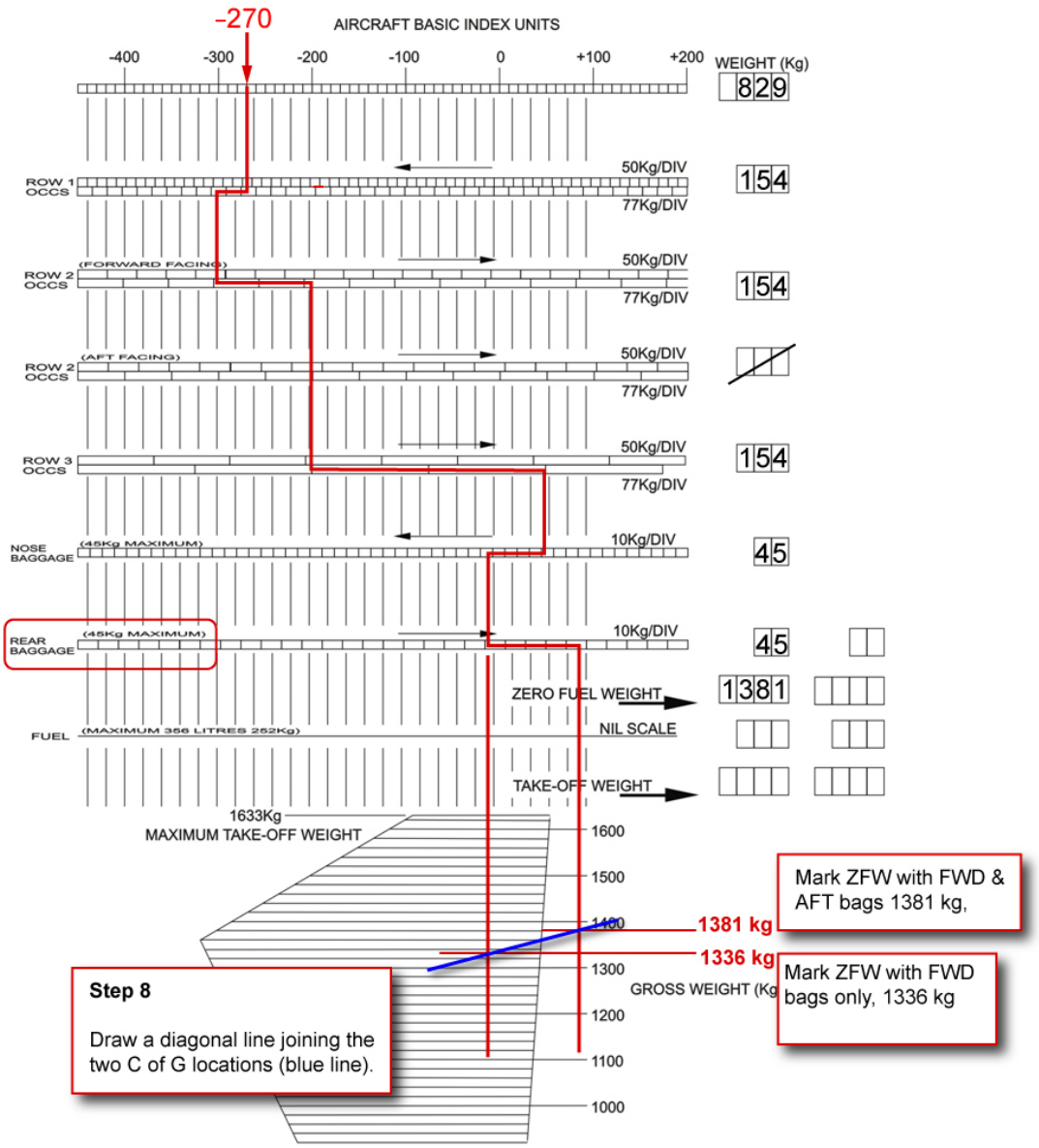
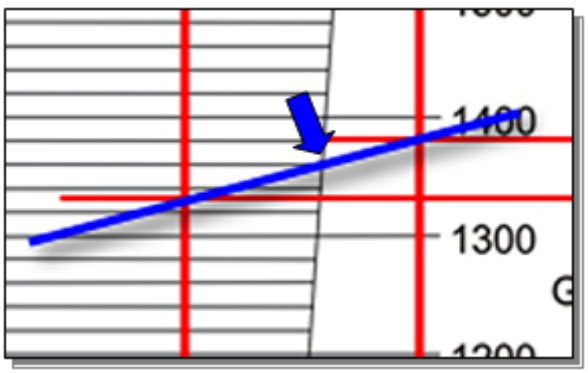


Step 9 where the diagonal line between the two C of G location intersects the aft limit of the C of G envelope is the maximum weight you can place in the rear locker.

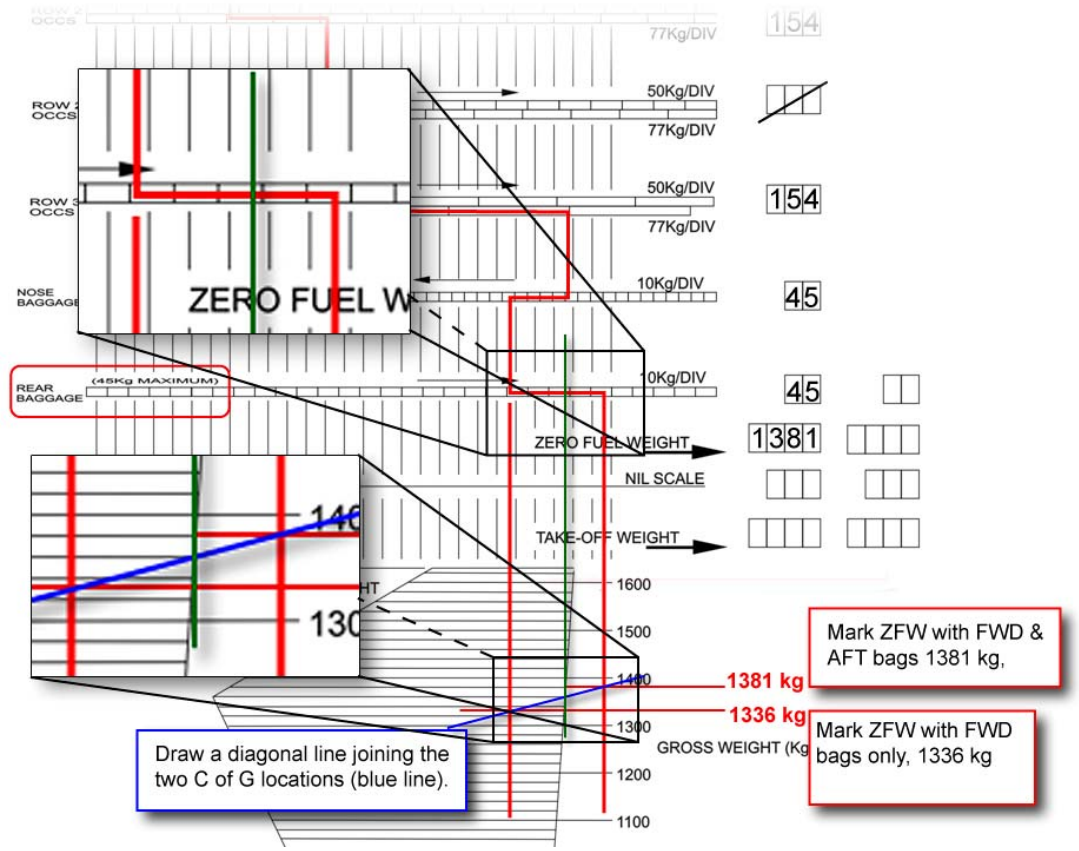
The vertical component of the blue line represents an increase of weight added to the rear locker and the Horizontal represents the movement of C of G as weight in increase.



There are two ways of determining the maximum weight that can be carried in the rear locker. The first is to measure from the line representing Zero Fuel with FWD baggage only to where the BLUE line intersects the aft limit of the envelope.

Approximately 28 kg as each division equals 20 kg.

The second method is to draw a line vertically up from the point of intersection of the aft limit and the diagonal line between the two C of G locations, then count the divisions between the line from Fwd locker and the line brought up from the envelope.



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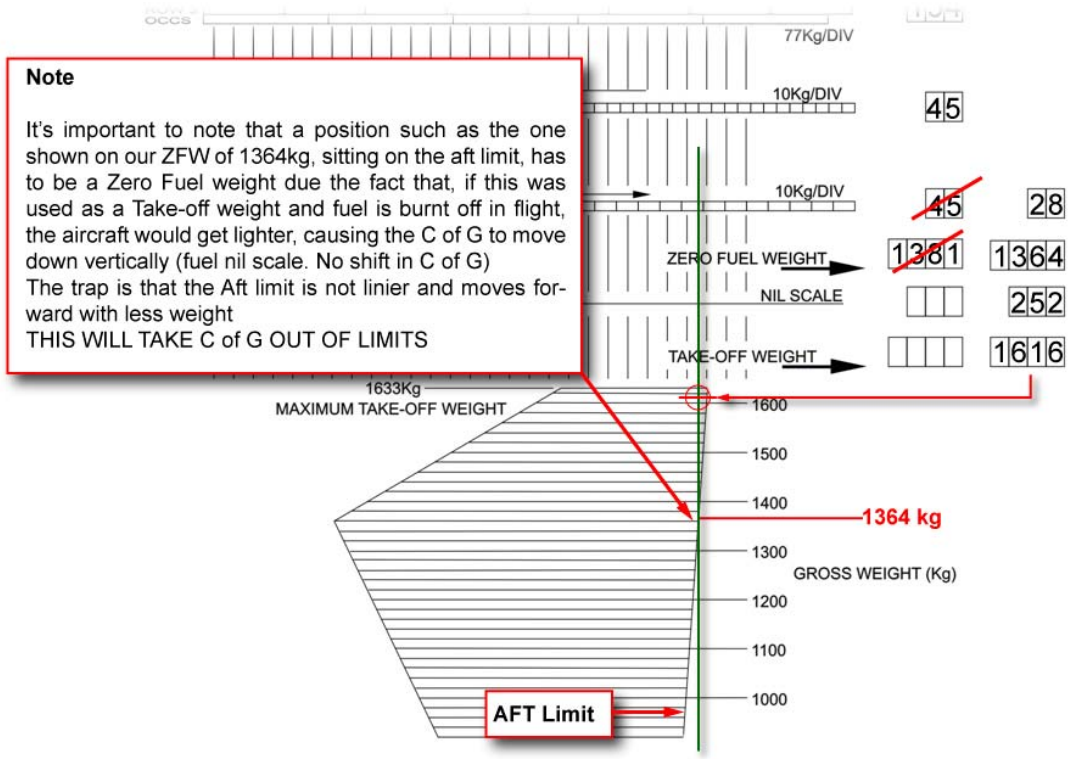
Step 1 Work out the new Zero Fuel based Weight to be carried in the rear locker. Then check the Take-off weight for weight and balance, by calculation and plotting on the graph.

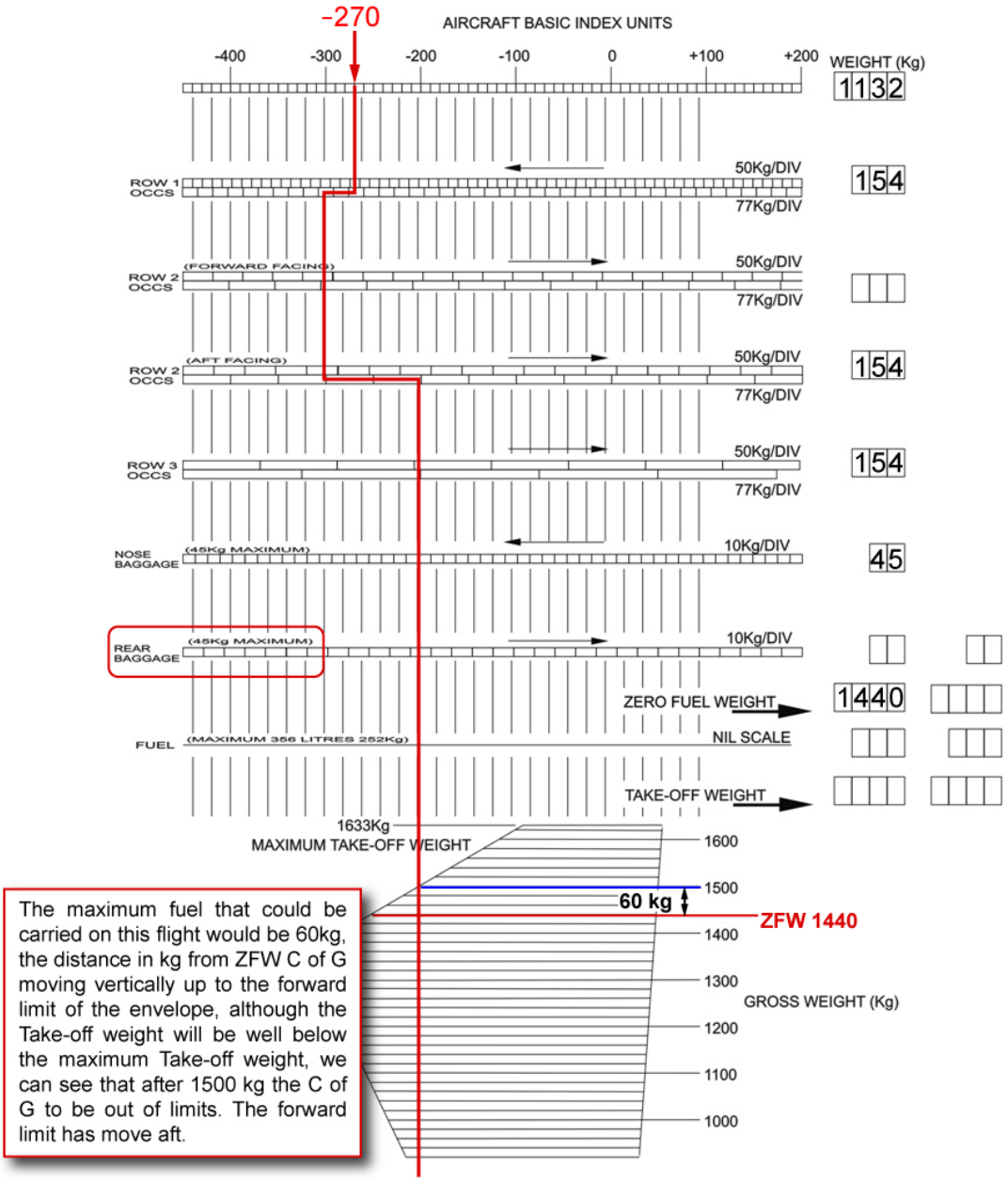


Example information

Basic Empty Weight	1132 kg
Empty Index Unit	-270
Row 1	154 kg (2 persons)
Row 2 (AFT facing)	154 kg (2 persons)
Row 3	000 kg (2 persons)
Nose baggage	0 kg
Rear baggage	0 kg
Zero Fuel Weight	1440 kg
Fuel Full	??? kg
Take-Off Weight	???? kg

What is the maximum fuel you could carry for this flight?

The question as per previous examples:



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