

# Flight Lab: Calculation of C.G

Group D

April 3, 2018

## 1 Aim of the Experiment

To find the center of Gravity of the Airplane and find the C.G of the airplane as passengers are loaded.

## 2 Introduction

The Location of center of gravity has great influence on the stability and control of the airplane. An airplane must be designed in such a manner that there is minimum variation of C.G. In this Experiment We need to find out how C.G travels longitudinally when passengers move in and out of airplane. The C.G is further used in determination of neutral point and maneuvering point.

The center of gravity is calculated as follows.

$$x_{c.g} = \frac{x_1N + x_2L + x_3R}{L + N + R}$$

Where:

$x_1$  is distance of Reference point from Nose wheel

$x_2$  is distance of Reference point from Rear wheel

$L$  is weight measured in Nose wheel

$N$  is weight measured in left wheel

$R$  is weight measured in Right wheel

For **Piper Saragota Aircraft**:  $x_1 = 14.2$  inches,  $x_2 = 109.7$  inches.

## 3 Procedure

1. Find Out Reactions at Nose Wheel, and main Wheels when 5 passengers are sitting.
2. One by one ask each passenger to move out of aircraft and Note down the reactions.
3. Note Down reading in Tabulated Form

4. Plot a Graph Showing Variation of C.G and number of passengers

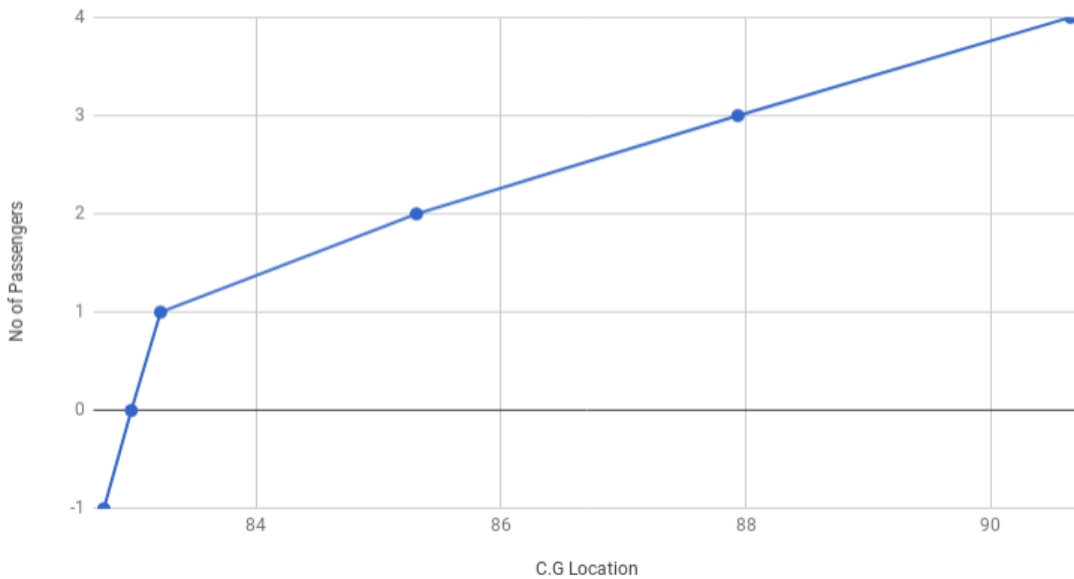
#### 4 Record Chart : CG Location

No of Pas- sengers	Left Wheel Reaction (L)	Nose Wheel Reaction (N)	Right Wheel Reaction (R)	Total Weight	$X_{C.G}$ (inches)
P4	603	308	633	1544	90.649481865285
P3	564	338	581	1483	87.9339851652057
P2	500	355	535	1390	85.3097122302158
P1	467	366	487	1320	83.2204545454546
P0	441	343	442	1226	82.9818107667211
Empty	406	325	421	1152	82.7577256944445

Table 1: Observation table

#### 5 Plot

C.G vs No of Passenges



## 6 Discussions

1) Why this graph look like this?

A) The position of cg is closer to the pilot seat so addition of pilot, co-pilot weights doesn't effect the position much but as the number passengers gets increased and as they sit farther from the C.G the position of cg will shift away from the reference point. From the Graph we can confirm that addition of pilot and co pilots weight change the C.G position little compared to the addition of passengers which changed the C.G

2) What is Range of C.G position drastically.?

A) the position of cg moves away as the number of passengers gets increased with a range of 9 inches (82.98-90.64 inches).

3) Why pilot prefers for having a co-pilot with heavier mass?

A) Heavier mass co-pilot will shift the cg towards the pilot (or will not shift too much away from him) so that he can apply less amount of stick forces to control the aircraft. static Stability is more when the cg is nearer.

### Physical Significance

- The position of the C.G is important since it affects the static margin.
- The C.G position is important in case of disturbance to flight angle the stability is affected by position of C.G as the control to be applied depends on the position of Center of gravity.

## 7 Conclusions

- The Center of Gravity of the Piper Saratoga aircraft is 82.7 inches from the Reference point.
- variation of the C.G with addition of passengers is observed.