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**91 Scaled Up 1/2A Fubar 375 - Final Balance**

1 message

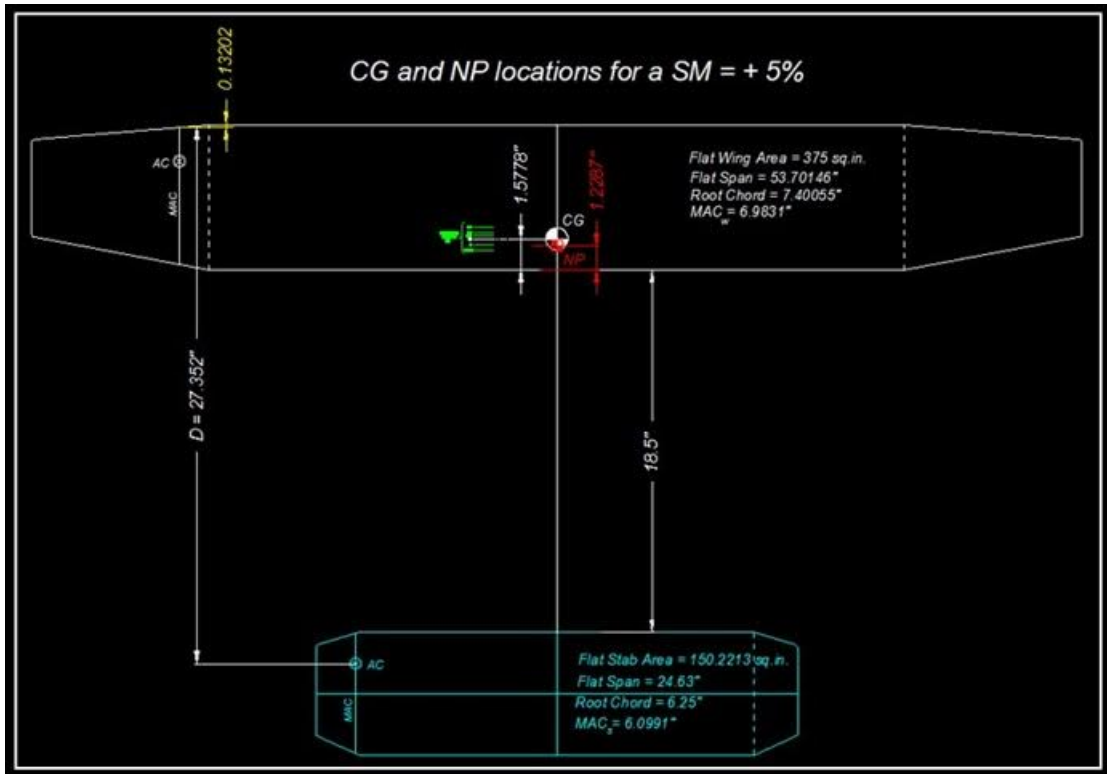
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**Tandy Walker** <rdb435021@icloud.com>  
To: Tandy Walker <rdb435021@icloud.com>*Scaled Up 1/2A Fubar 375**September 25, 2019*

Based on Bob Galler's final balance point of 1.5" forward of wing's root chord trailing edge determined through flight tests (~ 80% CG), I installed the LiPo battery and placed on ballast weight until the Fubar balanced 1.5" forward of the wing's leading edge. Then I weighed in Fubar on the AccuLab scale at 586 grams or 20.67 ounces as shown below. The wing loading is  $20.67 \times (144 \times 375) = 7.94$  oz/sq. ft.



Alfredo Herbon developed the 1/2A Fubar's area-moment geometry shown below using his ACAD program



Dr. Sergio Montes provided the analytical method for calculating the model's neutral point ( $X_{np}$ ). Alfredo programmed the method in an Excel spread sheet which is attached above. In addition, Alfredo added the necessary calculations to determine the center of gravity ( $CG$ ) location forward of the wing's trailing edge ( $D_{te}$ ) for a given static margin ( $SM$ ). The Excel spread sheet results illustrated above for a 5% static margin using the 1/2A Fubar's area-moment geometry is shown below.

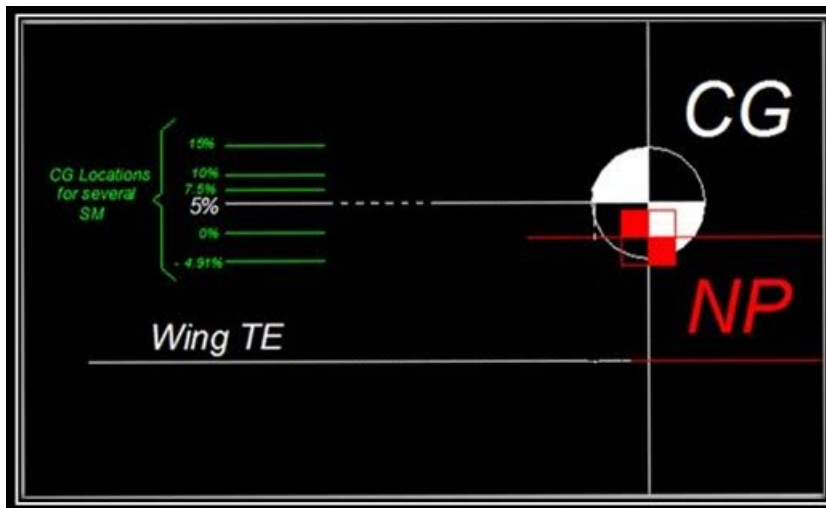
**1/2 A Fubar Balance Calculations**

Wing Span <i>b</i> (inch)	Wing Area <i>S</i> (sq. in.)	Average Wing Chord <i>c</i> (inch)	Wing Aspect ratio <i>AR</i>	Stab Span <i>b<sub>h</sub></i> (inch)	Stab Area <i>S<sub>h</sub></i> (sq. in.)	Average Stab Chord <i>c</i> (inch)	Stab Aspect Ratio <i>A<sub>rh</sub></i>	Tail moment <i>A<sub>m</sub> L<sub>h</sub></i> (inch)	Distance <i>D</i> (inch)	Tail Volume <i>V<sub>h</sub></i>	Neutral Point Location <i>X<sub>np</sub></i>		CG Location <i>X<sub>cg</sub></i>		Stability Margin (%)	<i>D<sub>te</sub></i> (inch)
											MAC fract.	(inch)	MAC fraction	(inch)		
53.701	375.000	6.9831	7.690	24.630	150.221	6.099	4.038	21.6615	27.3520	1.243	0.86492	6.0298	0.8149	5.6905	5.00	1.5781

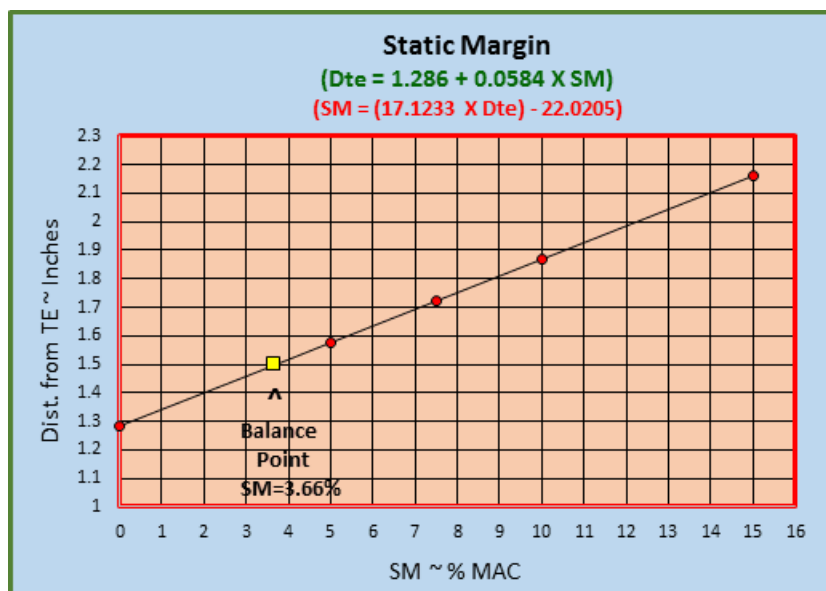
In addition, Alfredo also calculated the variation of  $CG$  both in (% MAC) and distance from the trailing edge (TE) with static margin ( $SM$ ), which are presented in the table below.

Distance from CG to stab Aerodynamic Center <b>Lh</b> ( inches )	Neutral Point Location <b>NP</b> ( % of MAC w )	CG Location <b>CG</b> ( % of MAC w )	Static Margin <b>SM</b> ( % )	Distance from TE <b>Dte</b> ( inches )
22,2445	88,147	73,14	15	2,161
21,9530	87,32	77,32	10	1,869
21,8075	86,91	79,40	7,5	1,724
21,6615	86,492	81,49	5	1,578
<b>21,3702</b>	<b>85,665</b>	<b>85,665</b>	<b>0</b>	<b>1,286</b>

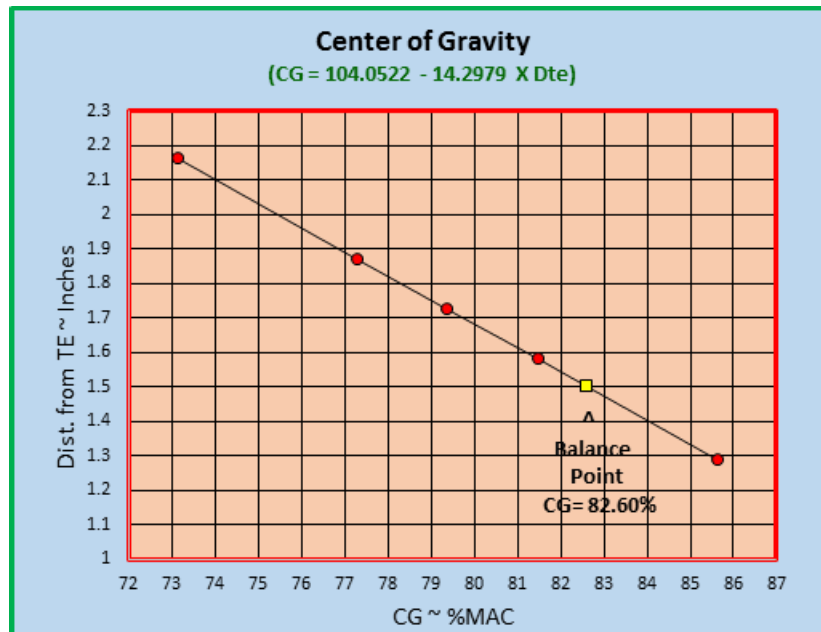
The location of the CG for the range of SM is illustrated graphically below.



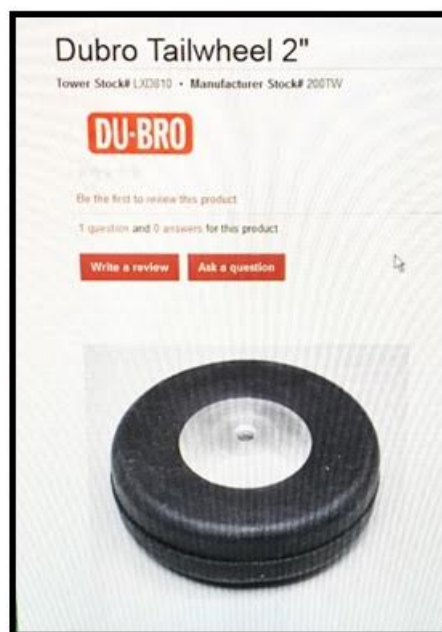
From the data in the table above, the linear equation for static margin (SM ~ % MAC) as a function of distance forward of the wing's trailing edge (Dte) is  $SM = (17.1233 \times Dte) - 22.0205$ . For the balance point 1.5" forward of the wing's leading edge, the SM is 3.66% as shown below.



From the data in the table above, the linear equation for center of gravity (CG ~ % MAC) as a function of distance forward of the wing's trailing edge (Dte) is  $CG = 104.0522 - 14.2979 \times Dte$ . For the balance point 1.5" forward of the wing's leading edge, the CG is 82.60% MAC as shown below.



I ordered this large scale 2" tailwheel from Tower Hobbies this morning. It has an aluminum hub and hard rubber tire and I hope it will be close to the weight I need to balance the Fubar.....Tandy





**12A Fubar Balance Calculations.xlsx**

12K