

How to Use This Sheet

This sheet was used to size the 2023-24 MCR aircraft's twin boom. Key inputs and outputs are displayed on the "Parameters" tab. Tail sizing calculations and their respective formulas are shown on the "Tail Sizing" tab. Further documentation, including full formula derivations can be found in the ***fill this in*** folder. Key references used are Snorri Gudmundsson Chapter 11. Volume coefficients used were copied from <https://www.mdpi.com/2226-4310/9/4/208>.

	Intermediate calculations
	Values given by other subteams
	Input variables determined by fuselage
	Coefficients
	Outputs

Only alter values using **THIS TAB**. All other tabs are intermediary and are used for calculations and variable reference.

Input

Output

Assumptions:			
parameter	variable	value	units
Wing Reference Area	S REF =	272.24	in^2
Wing Reference Span	b REF =	33	in
Wing Mean Geometric Chord	c REF =	8.25	in
Tail Boom Thickness at Wing Quarter Chord	T1 =	5.15	in
Tail Boom Thickness at Tail Quarter Chord	T2 =	5.15	in

Fixed Coefficients			
parameter	variable	value	units
Volume of vertical stabilizer	V VT =	0.04	n/a
Volume of horizontal stabilizer	V HT =	0.6	n/a
Horizontal Tail Aspect Ratio	AR_HT	3	n/a
Vertical Tail Aspect Ratio	AR_VT	2	n/a

Results			
parameter	variable	value	units
Length of tail arm	L T =	12.873337	in
Span of vertical stabilizers	b VT =	7.471923	in
Span of horizontal stabilizer	b HT =	17.721221	in
Surface area of vertical stabilizer	S VT =	27.914814	in^2
Surface area of horizontal stabilizer	S HT =	104.680553	in^2
Average Horizontal Tail Chord	C_avg,HT =	5.907074	in
Average Vertical Tail Chord	C_avg,VT =	3.735961	in

REFERENCE:	Snorri Gudmundsson - General Aviation Aircraft Design, Applied Methods and Procedures-Butterworth-Heinemann (2021)		
ASSUMPTIONS	Calculations for surface area and volume remain the same as for a single boom aircraft with the exception of tail arm length (figure 11-44 in textbook)		
DO NOT CHANGE VALUES HERE. CHANGE VALUES IN "Parameters (input/output)" sheet below acts as reference for input/output sheet and formulas			
Outputs:		Value	Units
Length of tail arm	L T =	12.873337	in
Combined length of vertical stabilizers	b VT =	7.471923	in
Length of horizontal stabilizer	b HT =	17.721221	in
Combined surface area of vertical stabilizer	S VT =	27.914814	in^2
Surface area of horizontal stabilizer	S HT =	104.680553	in^2
Average Horizontal Tail Chord	C_avg,HT =	5.907074	
Average Vertical Tail Chord	C_avg,VT =	3.735961	
Parameters:		Value	Units
Wing Surface Area	S REF =	272.24	in^2
Wingspan	b REF =	33	in
Mean geometric chord	c REF =	8.25	in
Tail Boom Thickness at wing quarter chord	T1 =	5.15	in
Tail Boom Thickness at H tail quarter chord	T2 =	5.15	in
Coefficients:		Value	Units
Volume of vertical stabilizer	V VT =	0.04	n/a
Volume of horizontal stabilizer	V HT =	0.6	n/a
Horizontal Tail Aspect Ratio	AR_HT =	3	n/a
Vertical Tail Aspect Ratio	AR_VT =	2	n/a

L	Tail		Vertical stabilizer		Horizontal stabilizer	
	Length of tail arm	refer to figure 11-44 on textbook	Combined span of vertical stabilizers	refer to eq. 11-60 on textbook	Span of horizontal stabilizer	refer to eq. 11-59 on textbook
	$L_T = \sqrt{\frac{S_{REF} \cdot (V_{HT} \cdot c_{REF} + V_{VT} \cdot b_{REF})}{T_1 + T_2}}$		$b_{VT} = \sqrt{AR_{VT} \cdot S_{VT}}$		$b_{HT} = \sqrt{AR_{HT} \cdot S_{HT}}$	
S	IT =	12.87333663	b VT =	7.471922668	b HT =	17.7212206
C			Combined surface area of vertical stabilizers		Surface area of horizontal stabilizer	
			refer to eq 11-23 on textbook		refer to eq 11-20	
			$S_{VT} = \frac{V_{VT} \cdot S_{REF} \cdot b_{REF}}{L_T}$		$S_{HT} = \frac{V_{HT} \cdot S_{REF} \cdot c_{REF}}{L_T}$	
	S VT =	27.91481418	S HT =	104.6805532		
			Average chord vertical tail		Average chord horizontal tail	
			refer to eq 11-62 on textbook		refer to eq 11-61 on textbook	
			$(C_{avg})_{VT} = \frac{b_{VT}}{AR_{VT}}$		$(C_{avg})_{HT} = \frac{b_{HT}}{AR_{HT}}$	
	(Cavg)VT	3.735961334	(Cavg)HT	5.907073533		