Name	Value / Equation	Evaluates to	Comments
Global Variables			
"Root Chord W"	= 2 * "S_ref" / ("Span W" * (1 + "Taper Ratio W"))	22.666893	Scaling variable
"Tip Chord W"	= "Root Chord W" * "Taper Ratio W"	7.933413	Scaling variable
"Swept Angle W"	= 30	30.000000	Input
"Span W"	= sqr ("S_ref" * "AR W")	122.401224	
"AR W"	= 8	8.000000	Input
"S_ref"	= 1872.75746643	1872.757466	Input
"Taper Ratio W"	= 0.35	0.350000	Input
"MAC W"	= (2 / 3) * "Root Chord W" * (1 + "Taper Ratio W" - ("Taper Ratio W" / (1 + "Taper Ratio W")))	16.482469	
"Y W"	= ("Span W" / 6) * ((1 + 2 * "Taper Ratio W") / (1 + "Taper Ratio W"))	25.689146	
"V H"	= 0.34144516	0.341445	Input
"V V"	= 0.07109747887	0.071097	Input
"Swept Angle H"	= "Swept Angle W" + 5	35.000000	
"AR H"	= 4	4.000000	Figure 6-17
"Taper Ratio H"	= 0.35	0.350000	Figure 6-17
"l H"	= 0.5 * "Span W" * 0.4	24.480245ft	25 - 40%
"S H"	= "V H" * 1929.586775 * 17.885852 / "l H"	481.370143ft	Equation 6-3
"Swept Angle V"	= "Swept Angle H"	35.000000ft	
"AR V"	= 1.6	1.600000	
"Taper Ratio V"	= 0.55	0.550000	
"l V"	= "l H"	24.480245ft	
"S V"	= "V V" * 1929.586775 * 17.885852 / "l V"	100.233385ft	

TOGW [lb]	227652.239	
	Coefficients	**Weight**
Wing	0.0089409349	22559.15794
Fuselage	140.8946557	2557.722494
Landing Gear	0.04	9106.089561
Nacel + Pylon	0.0212713538	4842.471327
Tail	0.1967	4437.386367
PP	0.1070579991	24371.99319
Fixed Equipment	0.035	37827.82837
Fuel	0.3168728911	72136.82313
PAX	N/A	45150
Cargo	N/A	8000

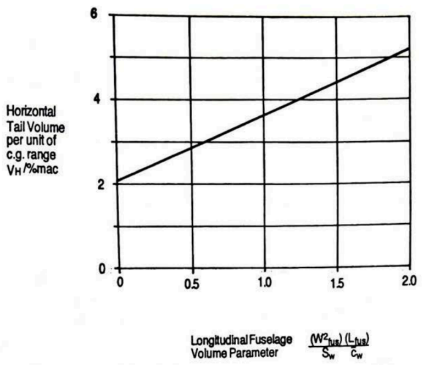
Configuration	Cargo	Fuel	PAX
Design	YES	YES	YES
Empty	NO	NO	NO
Ferry	NO	YES	NO
Landing	YES	NO	YES

Fuselage Length	165.78	<= input
Tail to bottom	10	<= input
Tail Arm	72	> output
Fuel to 0.25MAC	2.9605	<= input
Nacel to 0.25MAC	11.79023	<= input
MAC	17.885852	<= input

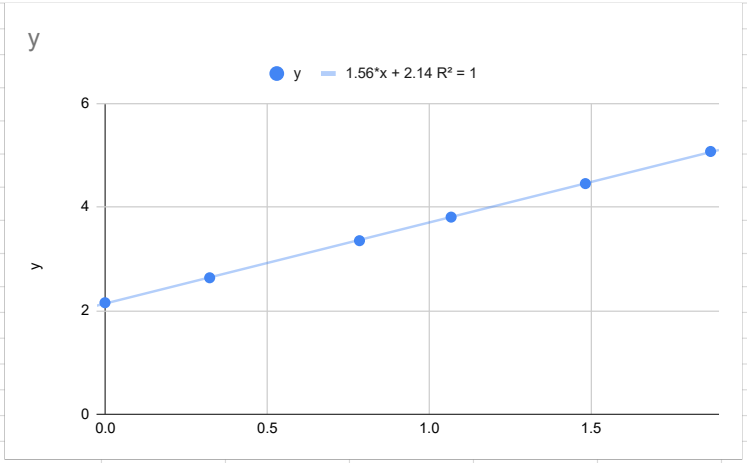
Component	Design			Empty			Ferry			Landing		
	Weight	Length	Moment	Weight	Length	Moment	Weight	Length	Moment	Weight	Length	Moment
Wing	22559.15794	183.78	4145922.046	22559.15794	183.78	4145922.046	22559.15794	183.78	4145922.046	22559.15794	183.78	4145922.046
Fuselage	2557.722494	265.78	679791.4844	2557.722494	265.78	679791.4844	2557.722494	265.78	679791.4844	2557.722494	265.78	679791.4844
Landing Gear	7669.289561	183.78	1409462.035	7669.289561	183.78	1409462.035	7669.289561	183.78	1409462.035	7669.289561	183.78	1409462.035
Nose Tires	224	143.78	32206.72	224	143.78	32206.72	224	143.78	32206.72	224	143.78	32206.72
Main Tires	1212.8	188.91	229110.048	1212.8	188.91	229110.048	1212.8	188.91	229110.048	1212.8	188.91	229110.048
Nacel + Pylon	4842.471327	171.98977	832855.5298	4842.471327	171.98977	832855.5298	4842.471327	171.98977	832855.5298	4842.471327	171.98977	832855.5298
Tail	4437.386367	255.78	1134994.685	4437.386367	255.78	1134994.685	4437.386367	255.78	1134994.685	4437.386367	255.78	1134994.685
PP	24371.99319	171.98977	4191733.504	24371.99319	171.98977	4191733.504	24371.99319	171.98977	4191733.504	24371.99319	171.98977	4191733.504
Fixed Equipment	37827.82837	183.78	6951998.297	37827.82837	183.78	6951998.297	37827.82837	183.78	6951998.297	37827.82837	183.78	6951998.297
Fuel	72136.82313	180.8195	13043744.29	0	180.8195	0	72136.82313	180.8195	13043744.29	0	180.8195	0
PAX	45150	183.78	8297667	0	183.78	0	0	183.78	0	45150	183.78	8297667
Cargo	8000	183.78	1470240	0	183.78	0	0	183.78	0	8000	183.78	1470240
Sum	230989.4724		42419725.64	105702.6492		19608074.35	177839.4724		32651818.64	158852.6492		29375981.35

	CG	Delta CG	Delta CG
Design	183.6435453	0.1364546776	0.76%
Empty	185.5022035	1.722203485	9.63%
Ferry	183.6027638	0.1772362095	0.99%
Landing	184.9259769	1.145976928	6.41%

Forward CG	181.9914148
Aft CG	185.5685852



x	y
-0.00194	2.153232
0.78427	3.350815
1.482214	4.452742
1.868962	5.07274
1.067343	3.805495
0.321457	2.634819



x	0.816956153 <= Actual value
y	3.4144516

Wing			
S_ref	MAC	l H	Span
1929.586775	17.885852	24.8488988	124.244494

V_H	0.34144516
S_H	474.22862

$$V_H = \frac{S_H}{S} \times \frac{l_H}{c}$$

Aircraft Type	AR	λ	c_e/c	t/c
Personal/Utility	3.5-5.0	.50-1.0	.35-.45	.06-.09
Commuters	3.5-5.0	.50-.80	.35-.45	.06-.09
Regional Turboprops	3.5-5.0	.50-.80	.30-.45	.06-.09
Business Jets	3.5-5.0	.35-.50	.30-.40	.06-.09
Jet Transports	3.5-5.0	.25-.45	.30-.35	.06-.09
Military Fighter/Attack	3.0-4.0	.25-.40	.30-1.0	.03-.04

Fig. 6-17 Summary of Horizontal Tail Geometric Characteristics

The wing span, b, is $b = \sqrt{AR \cdot S}$ (4-16)

where AR is the wing aspect ratio and S is the reference wing area. The root chord length is

$$C_{root} = \frac{2S}{b(1+\lambda)} \quad (4\text{-}17)$$

where λ is the wing taper ratio.

The tip chord length is $C_{tip} = \lambda C_{root}$ (4-18)

The wing m.a.c. length is $\overline{C} = \left(\frac{2}{3}\right) C_{root} \left[1 + \lambda - \frac{\lambda}{1+\lambda}\right]$ (4-19)

The distance from the centerline to the m.a.c. location is

$$\overline{Y} = \left(\frac{b}{6}\right) \frac{1+2\lambda}{1+\lambda} \quad (4\text{-}20)$$

Unit: inch

Table 2

Category	Long Range 3 Class	Medium Range 2 Class	Short/Medium 2 Class
PASS MIX %			
1st Class	5	8	9.5
Business	19 (18-20)	X	X
LAVS			
1st Class	15/LAV (2 MI	20/LAV (2 MI	ONE REQ'D
Business	35/LAV (2 MI	X	X
Economy	50/LAV	50/LAV	50/LAV
Standard Lav Size	38" × 40"		
Galley—Carts / Pass			
1st Class	0.40 CART/PA	0.30 CART/PA	0.30 CART/PASS
Business	0.20 CART/PA	X	X
Economy	0.095 CART/P	0.08 CART/PA	0.075 CART/PASS
Cart Size	12 IN × 34 IN	12 IN × 34 IN	12 IN × 34 IN
Galley Size			
Height	Up to ceiling or as required		
Width	As required, 15" per cart including wall thickness and clearances		
Depth	38	38	36
Seat Pitch			
1st Class	60 IN MIN	40 IN MIN	38 IN MIN
Business	38 IN MIN	X	X
Economy	32 IN MIN	32 IN MIN	32 IN MIN
Depth/Recline			
1st Class	28 IN / 43 IN	28 IN / 36 IN	28 IN / 36 IN
Business	25 IN / 36 IN	X	X
Economy	25 IN / 32 IN	25 IN / 32 IN	25 IN / 32 IN
Bulkhead to Seat Nose			
1st Class	24	24	22
Business	20	X	X
Economy	18	18	20
Aisle Width			
1st Class	25 IN MIN	20 IN ASSUM	20 IN ASSUMED
Business	20 IN MIN	X	X
Economy	18 IN MIN	18 IN ASSUM	18 IN ASSUMED
Coat Room			
1st Class	2 IN/PASS	1.5 IN/PASS	1.5 IN/PASS
Business	1 IN/PASS	X	X
Economy	0 IN/PASS	0 IN/PASS	0 IN/PASS

PAX	210	<= input
#s of Aisle	1	
Seat Abreast	6	

	1st Class	Economy
PAX	18	192
#s of rows	3	32
#s of LAV (restroom)	1	4
#s of Galley	6	16
Coat room	27	0
Seat Pitch	40	32
Aisle Width	20	18
Seat width	20	18
Seat length	28	25

Armrest	2	no shared for 1st class
LAV length	38	
LAV width	40	
Galley length	15	
Galley width	38	
#s of EM Exit Type A	4	2 on each side
EM Exit Type A Length	42	
EM Exit Distance	720	

TABLE 2 A

EMERGENCY EXIT DOOR DATA

	door type	minimum size	maximum evacuation capacity	crew assist	corner radii
entry door	x	60w x 76h	?	2	≤1/6w
entry door	A	42w x 72h	110	2	≤1/6w
entry door	B	32w x 72h	75	2	≤6inches
	C	30w x 48h	55	1	≤1/3w
	I	24w x 48h	45	1	≤1/3w
	II	20w x 44h	40	1	≤1/3w
	III	36w x 20h	35	1	≤1/3w
	IV	26w x 19h	9	1	≤1/3w
overhead hatch	comm.	36 x 20	-	-	≤1/3w
overhead hatch	military	24 x24	-	-	6 inches

ref. FAR PART 25 and Federal Register 14 CFR PART 25, 22 Feb 90, PART III , DOT. SD - 24 L Vol I.

NOTES: 1 Maximum distance between door jambs is 60 feet.
2 All side exits are located at floor level except the over wing exits.

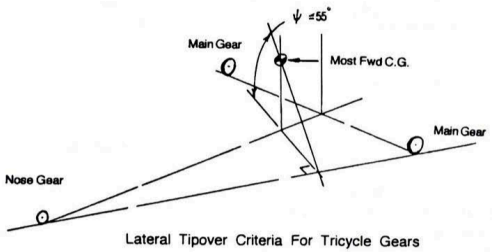
Unit change from inch to feet

	1st Class	Economy
PAX	18	192
#s of rows	3	32
#s of LAV (restroom)	1	4
#s of Galley	6	16
Coat room	2.25	0
Seat Pitch	3.333333333	2.666666667
Aisle Width	1.666666667	1.5
Seat width	1.666666667	1.5
Seat length	2.333333333	2.083333333

Armrest	0.1666666667	
LAV length	3.166666667	
LAV width	3.333333333	
Galley length	1.25	
Galley width	3.166666667	
#s of EM Exit Type A	4	2 on each side
EM Exit Type A Length	3.5	
EM Exist Distance	60	

Interior Layout		
Minimum Length	114.0833333	
Final (eyeball) length	165.78	<= input after done
Final Diameter	14	<= input after done

	Takeoff gross weight		
	TOGW [lb]	236,420	<= input
Main Gear 100% TOGW	Minimum load per tire [lb]	29,552	
Nose Gear 15% TOGW	Minimum load per tire [lb]	17,731	



Lateral Tipover Criteria For Tricycle Gears

Fig. 7-2 Tipover Criteria for Landing Gears

Adapted with permission from Ref. 7.3

Type VII - Extra High Pressure Tires Main Wheels

Tire Size	Ply Rating	Max Width inches	Max Diam. inches	Loaded Radius inches	Tire and tube wt. lbs.	Commercial Press lbs/sq.in.	Commercial Rated Load lbs	Military Press lbs/sq.in.	Military Rated Load lbs.
24 x 7.25	10	7.3	24.0	10.3	29.7	120	6,600		
29 x 7.7	12-16	7.6	28.0	12.2	36-44	160	9,800	220	13,800
34 x 11	18	11.0	33.0	13.9	84.1	125	15,500		
36 x 11	24	11.1	35.0	15.0	86.2			220	25,600
40 x 14	22	13.5	39.2	11.8	112	145	25,000		
44 x 13	26	13.4	43.2	18.4	141.5			200	35,000
44 x 16	26	15.6	43.1	18.0	151.6	165	35,500		
56 x 16	24	16.0	55.8	24.1	258.7			178	45,000
56 x 16	32	16.1	55.8	24.1	296.3			240	60,000
56 x 16	36	16.1	55.8	24.1	297.0			280	71,000

Fig. 4:11. Tire Ratings. Ref. U.S. Rubber Co.

AERODYNAMIC DESIGN

4-25

Business Jets	12,000	22 x 6.3	0.93	90	1	18 x 5.7	0.07	120	1
	23,000	27.6 x 9.3	0.95	155	1	17 x 5.5	0.05	50	2
	39,000	26 x 6.6	0.92	208	2	14.5 x 7.7	0.08	130	2
	68,000	24 x 9.25	0.93	174	2	21 x 7.25	0.07	113	2
Jet Transports	44,000	34 x 12	0.89	75	2	24 x 7.7	0.11	68	2
	73,000	40 x 14	0.92	77	2	29.5 x 6.75	0.08	68	2
	116,000	40 x 14	0.94	170	2	24 x 7.7	0.06	150	2
	220,000	40 x 14	0.94	180	4	29 x 7.7	0.06	180	2
	330,000	46 x 16	0.93	206	4	40 x 14	0.07	131	2
	572,000	52 x 20.5	0.93	200	4*	40 x 15.5	0.07	190	2
	775,000	49 x 17	0.94	205	4**	46 x 16	0.06	190	2
Military Trainers	2,500	17 x 6		36	1	13.5 x 5	0.18	28	1
	5,500	20.3 x 6.5	0.82	60	1	14 x 5	0.09	40	1
	7,500	20.25 x 6	0.91	65	1	17.2 x 5.0	0.08	45	1
	11,000	23.3 x 6.5	0.92	143	1	17 x 4.4	0.10	120	1
Military Fighters	9,000	20 x 5.25	0.86	135	1	17 x 3.25	0.14	82	1
	14,000	18.5 x 7	0.87	110	1	18 x 6	0.13	37	1
	25,000	24 x 8	0.91	210	1	18 x 6.5	0.09	120	1
	35,000	24 x 8	0.90	85	2	21.6 x 9.8	0.10	57	1
	60,000	35.3 x 9.3	0.88	210	1	21.6 x 7.5	0.12	120	2
	92,000	42 x 13	0.93	150	1	20 x 6.5	0 07	120	2

*Three main gear struts ** Four main gear struts

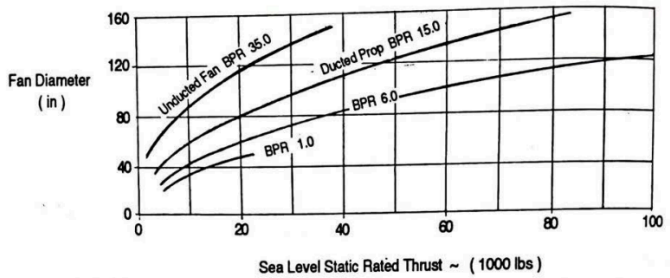
Fig. 7-7 Typical Landing Gear Wheel and Tire Data

Adapted with permission from Ref. 7.3

Main gear has double amount of tire in the pic ~ 8 tires for main gear

Front gear has 2 tires

	x	y
	14.60767	51.0565
	15.19421	51.68672
	15.67106	52.49702
	16.18134	53.13394
	16.69178	53.82766
	17.20256	54.64634
	17.71284	55.28326
	18.22386	56.19282
	18.73352	56.60254
	19.15782	56.79249
	20.77638	59.78638
	21.3213	60.69297
	21.79706	61.10566
	22.30722	61.69714
	22.81762	62.3795
	23.37089	63.2399
	23.88117	63.87682
	24.39145	64.51373
	24.90173	65.15065
	25.41201	65.78757
	25.8793	66.20101
	26.3469	66.72805
	26.94285	67.69833
	27.45313	68.33524
	27.96341	68.97216
	28.43132	69.61281
	28.94067	69.90892
	29.36528	70.21248
	54.23024	94.07048
	54.77404	94.56809
	55.28358	94.93236
	55.75922	95.29962
	56.30302	95.79723
	56.81255	96.16151
	57.32172	96.38946
	57.832	97.02637
	58.22805	97.21882
	62.24759	100.0471
	62.75787	100.684
	63.31052	101.3172
	63.77657	101.2762
	64.32922	101.9094



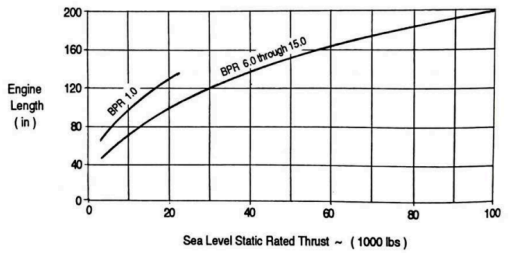
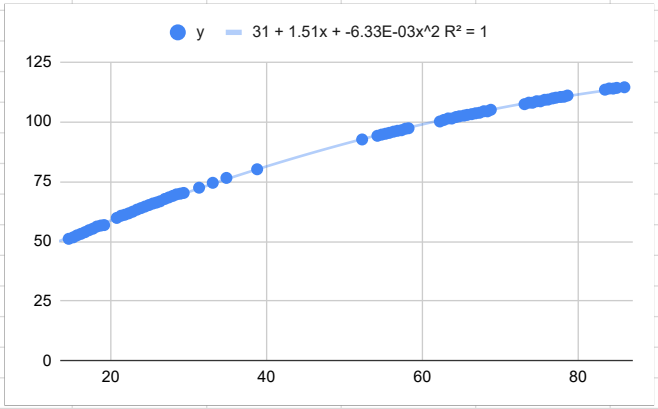
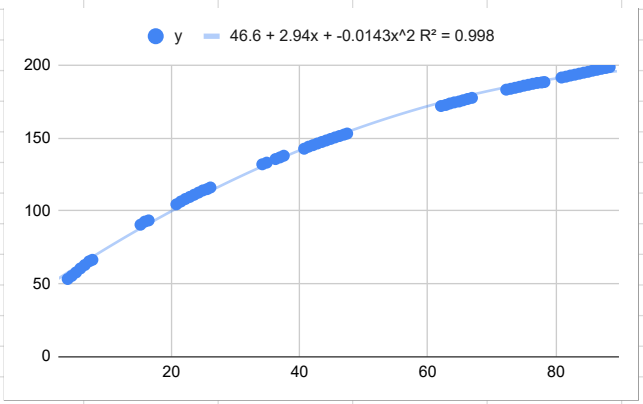


Fig. 8-15 Turbofan Engine Trend Data



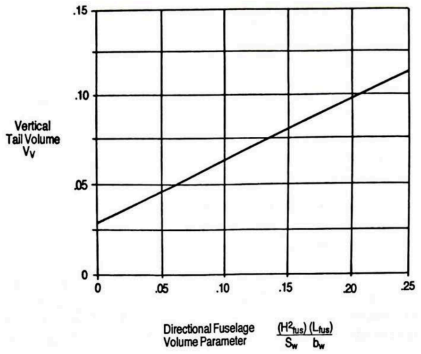


Fan			
TSLS [lb]	45500	<= Code (Thrust sea level static)	
x	45.5		
y	86.6003175		
Diameter [in]	86.6003175		
Diameter [ft]	7.216693125		
Nacelle			
Diameter [ft]	7.938362438		
Inlet length [ft]	5.051685188		
Length [ft]	19.37701766		
Inlet diameter			

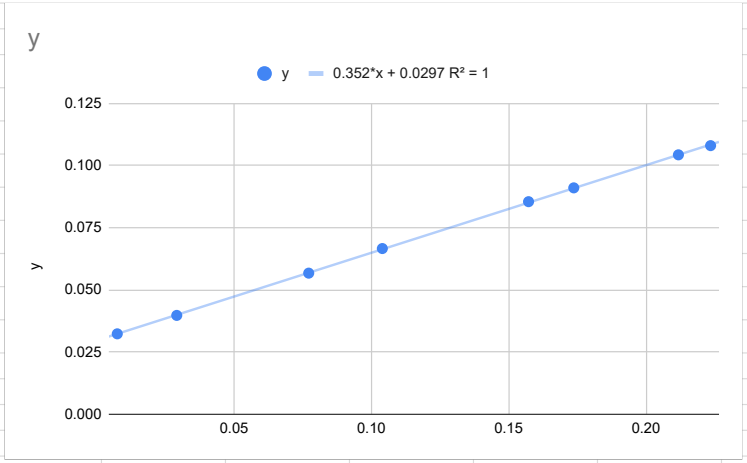
Engine		
x	45.5	
y	150.765425	
Length [in]	150.765425	
Length [ft]	12.56378542	

x	y
3.821058	53.27571
4.444633	55.36665
5.124189	57.76234
5.801521	60.51838
6.481355	62.86902
7.160078	65.39984
7.674472	66.43085
15.18073	90.55054
15.84472	92.65661
16.44716	93.48409
20.7766	104.5127
21.47046	106.4648
22.17149	108.1952
22.85716	109.5999
23.54228	111.0947
24.22739	112.5895
24.91251	114.0843
25.57242	114.9763
26.08626	116.0974
34.1755	132.0119
34.86284	133.1464
36.23641	135.5954
36.92375	136.7299
37.52416	137.8877
40.7058	142.6991
41.39147	144.1038
42.07937	145.1482
42.76671	146.2826
43.45461	147.327
44.14251	148.3713
44.83041	149.4157
45.5183	150.46
46.20676	151.4143
46.89521	152.3686
47.41127	153.1293
62.04954	172.0112
62.79149	172.7353
63.42756	173.7396
64.11712	174.5137
64.85974	175.1296
65.49681	175.9718
66.18582	176.8359

	64.75383	102.213											66.87539	177.61
	65.34791	102.5016											72.22175	183.2489
	65.77253	102.8052											72.91243	183.8428
	66.32424	103.0976											73.60255	184.5268
	66.83378	103.4619											74.29267	185.2108
	67.34294	103.6898											74.98224	185.9849
	67.89559	104.323											75.67292	186.5788
	68.36164	104.282											76.36304	187.2629
	68.78718	104.9264											77.05372	187.8568
	73.11618	107.2729											77.74607	188.1804
	73.66882	107.9061											78.17816	188.4841
	74.13487	107.8652											80.84967	191.5738
	74.67905	108.4991											81.54035	192.1677
	75.15357	108.4574											82.22991	192.9418
	75.69775	109.0913											82.92059	193.5357
	76.13875	109.1889											83.61071	194.2197
	76.71644	109.6835											84.30084	194.9037
	77.14953	109.9864											84.99151	195.4976
	77.73514	110.2758											85.68108	196.2717
	78.17614	110.3734											86.37176	196.8656
	78.63521	110.8784											87.06188	197.5496
	83.4391	113.3196											87.75256	198.1435
	83.9829	113.8172											88.3563	198.7608
	84.49132	113.7725												
	84.9583	114.0723												
	85.9337	114.3275												
	33.0984	74.44318												
	52.27352	92.53767												
	31.34418	72.39959												
	38.7969	80.09606												
	34.85261	76.48676												



x	y
0.007444432	0.032348561
0.077161287	0.056752858
0.211800514	0.104333743
0.157221043	0.08549462
0.223520049	0.10803362
0.173690383	0.091051417
0.103973528	0.06664712
0.029107562	0.039759485



x	0.117606474 <= Actual value
y	0.071097478

Wing		
S_ref	MAC	Span
1929.586775	17.885852	124.244494

V_V	0.071097478
S_V	19.74926766

$$V_H = \frac{S_H}{S} \times \frac{l_H}{c}$$

Aircraft Type	AR	λ	c_e/c	t/c
Personal/Utility	3.5-5.0	.50-1.0	.35-.45	.06-.09
Commuters	3.5-5.0	.50-.80	.35-.45	.06-.09
Regional Turboprops	3.5-5.0	.50-.80	.30-.45	.06-.09
Business Jets	3.5-5.0	.35-.50	.30-.40	.06-.09
Jet Transports	3.5-5.0	.25-.45	.30-.35	.06-.09
Military Fighter/Attack	3.0-4.0	.25-.40	.30-1.0	.03-.04

Fig. 6-17 Summary of Horizontal Tail Geometric Characteristics