

Table of Contents

1.Introduction	10
2. Comparison	11
2.1 Comparison Table	11
2.2 Special Features	12
2.2.1 Lisa Akoya	12
2.2.2 Dornier Seastar	12
2.2.3 Grumman Albatross	13
2.2.4 Shinmaywa	13
2.2.5 DHC Twin Otter	13
2.2.6 Canadair CL 415	13
2.2.7 Beriev 200	14
3. Initial Design Requirements	15
3.1 General	15
3.2 PAX Mission	15
3.3 ASR Mission	16
4. Layout	17
4.1 Wing Positioning	17
4.2 Stabilizers	17
4.3 Hydrofoil	18
4.4 Engine	20
4.5 Hull	20
5. Initial Weight Estimation	21
5.1 Takeoff Weight	21
5.2 Payload Weight	21
5.3 Empty Weight	23
5.4 Mission Profile	24
5.5 Fuel Weight	24
6. Wing Sizing	29
6.1 Taper Ratio	29
6.2 Wing Sweep	29

6.3 Wing Loading	29
6.4 Wing size and planform	30
7. Thrust to Weight Ratio	31
8. Airfoil	32
8.1 Wing Airfoil	32
8.2 Horizontal and Vertical Tail Airfoil	34
9. Initial Sizing	35
9.1 Fuselage	35
9.2 Hull	35
9.3 Vertical and Horizontal Stabilizers	36
9.4 Hydrofoil	37
9.5 Floats	38
9.6 CAD	39
10. Component Estimation	40
11. Revised Sizing, Weight Estimation and C.G Calculation	41
12. Drag	43
12.1 Fuselage	43
12.2 Wing	43
12.3 Vertical Tail	44
12.4 Horizontal Tail	44
12.5 Hydrofoil	45
12.6 Floats	45
12.7 Nacelle	45
12.8 Induced Drag	46
12.9 Drag Polar	46
12.10 Minimum Drag and Minimum Power	48
12.11 Hydrodynamic Drag	49
13. Engine Selection	50
14. Stability	54
15. Performance	56
15.1 Vmin and Vmax	56

15.2 Rate of Climb	56
15.3 Takeoff Distance	58
15.4 Landing Distance	59
15.5 V-n Diagram.....	59
15.6 Range and Endurance.....	60
15.7 Turning Performance	52
16. Timeline	66
17. References	67

LIST OF FIGURES

Figure 1: PAX Mission.....	15
Figure 2: ASR Mission.....	16
Figure 3: Aircraft with Hydrofoil	18
Figure 4: Hydrofoil used on a boat [14]	19
Figure 5: Hydrofoil forces at normal state	19
Figure 6: Hydrofoil forces under gust or other unstable condition	19
Figure 7: PAX mission profile	23
Figure 8: ASR mission profile	24
Figure 9: Wetted area ratio[1]	26
Figure 10: Maximum L/D ratios[1]	26
Figure 11: NACA 4415 airfoil	33
Figure 12: C_l vs α curve for airfoil	33
Figure 13: C_l vs α with flaps	34
Figure 14: Hydrofoil[23]	38
Figure 15: Aircraft CATIA Model	39
Figure 16: Hydrodynamic Drag	48
Figure 17: Honeywell TPE 331-10 Engine Power vs Altitude	51
Figure 19: V-n Diagram	60

List of Tables

Table 1: Performance comparison of similar aircrafts.....	11
Table 2: Geometric comparison of similar aircrafts.....	11
Table 3: Design characteristics of similar aircrafts	12
Table 4: Empty Weight fraction	22
Table 5: Jet engine Specific Fuel Consumption[1]	25
Table 6: Propeller Specific Fuel Consumption[1]	25
Table 7: Thrust-to-Weight ratio[1]	31
Table 8: hp/W_o vs V_{max} (mph)[1].....	31
Table 9: Airfoils in similar aircrafts[24]	32
Table 10: Horizontal Tail and Vertical Tail Coefficient[1].....	36
Table 11: Initial Component Weight	40
Table 12: Final Component Weight and Position from Nose	42
Table 13: Component Drag Coefficient wrt Reference Area	46
Table 14: Hydrodynamic Drag.....	49
Table 15: Turning at Sea Level	63
Table 16: Turning at 3280ft.....	63
Table 17: Turning at 6561 ft.....	63
Table 18: Turning at 9842 ft.....	64

List of Graphs

Graph 1: C_l vs C_d	47
Graph 2: C_d vs C_l^2 for aircraft	47
Graph 3: Drag vs Equivalent Velocity curve	48
Graph 4: Power Available vs Power Required at Sea Level	51
Graph 5: Power Available vs Power Required at 3280 ft	52
Graph 6: Power Available vs Power Required at 6561 ft	52
Graph 7: Power Available vs Power Required at 9842ft	53
Graph 8: Derivative of Moment Coefficient with angle of attack	54
Graph 9: Rate of Climb Vs Velocity at various altitudes	57
Graph 10: Rate of Angle Vs Velocity at various altitudes	58
Graph 11: Range(km)vs Velocity (m/s)	61
Graph 12: Endurance(hr) vs Velocity(m/s)	61
Graph 13: Range vs Payload(lb)	62
Graph 14: Radius of Turn	64
Graph 15: Rate of Turning.....	65