

Contents

Preface	xi
Acknowledgements	xiii
1 Introduction	1
1.1 Why another aircraft design book?	1
1.2 Topics	2
1.3 The design process	2
2 Why should we design a new aircraft?	7
2.1 Market surveys	7
2.2 Operator-derived specifications	11
2.3 Specification for a close air support aircraft	12
2.4 Airline specification for a 150-seat airliner	13
3 Why is it that shape? – Civil aircraft	19
3.1 Background	19
3.2 Civil aircraft types	24
4 Why is it that shape? – Other types	37
4.1 Military aircraft types	37
4.2 Rotorcraft and V/STOL aircraft	50
5 What’s under the skin? – Structure and propulsion	55
5.1 General	55
5.2 The structure	55
5.3 Propulsion – the primary power system	63
6 What’s under the skin? – Airframe systems	73
6.1 Secondary power systems	73
6.2 The fuel system	80
6.3 Furnishings	82
6.4 Safety installations	83
6.5 Landing gear installations	84

7	What’s under the skin? – Avionics, flight control and weapon systems	89
7.1	Avionic systems	89
7.2	Flight control systems	96
7.3	Weapon systems	100
8	Why do aircraft cost so much?	109
8.1	General	109
8.2	Acquisition costs (the costs of buying or acquiring the aircraft)	109
8.3	Civil aircraft operating costs	115
8.4	Military aircraft life-cycle costs	116
8.5	The costs of reliability and maintainability	118
9	What help can I get? – Bibliography and computer-aided design	129
9.1	Aircraft design bibliography	129
9.2	Relevant data sheets	131
9.3	Computer design tools	135
9.4	The integration of computer tools as part of concurrent engineering	140
9.5	Classic computer-aided design systems	141
10	The shape of things to come – Should the project continue?	149
10.1	Introduction	149
10.2	Conceptual design definition	149
10.3	Comparison and choice	150
10.4	Simple decision-making techniques	151
10.5	Example of a conceptual aircraft design definition description – The Cranfield A–90	153
10.6	Progress of the A–90 project beyond the conceptual design stage	161
11	What can go wrong? – Some lessons from past aircraft projects, and a glimpse into the future	163
11.1	Introduction	163
11.2	Aircraft that suffered from requirements that were too restrictive, too ambitious or were changed during development	163
11.3	Projects that were overtaken by events	167
11.4	A step too far or too soon?	171
11.5	Some challenging future projects	174
11.6	Conclusions	177
	Appendix A – Useful aircraft design data	179
A1	Introduction	179

A2	US/UK nomenclature	179
A3	UK and US/SI conversion tables and airspeed charts	180
A4	Aircraft leading data tables	183
A5	Power plant data	196
A6	Aerodynamic data	213
A7	Structures and materials data	220
A8	Landing gear data	222
A9	Aircraft interior data	223
A10	Aircraft weapons	238
 Appendix B – A–90 parametric study. Example – the A-90 500-seat airliner		243
B1	Introduction	243
B2	Landing field distance	243
B3	Take-off field length	245
B4	Second segment climb	246
B5	Missed approach	247
B6	Cruise performance	248
B7	Ceiling with one engine inoperative	252
B8	Arrival at the match point	253
 Appendix C – The prediction of aircraft reliability and maintainability targets		255
C1	Introduction	255
C2	Commercial aircraft dispatch reliability prediction	255
 References		259
 Index		261