

---

**FIGURES**

---

2.1.	History of Aircraft Composite Use . . . . .	9
2.2.	A Comparison of the Percentage of Composites Used in the Initial Configuration with the Current Configuration of Some Military Airframes . . . . .	10
2.3.	History of Titanium Use . . . . .	11
2.4a.	F/A-18E/F Substructure Material Use . . . . .	12
2.4b.	F/A-18E/F Composite Use As Compared to the F/A-18C/D . . . . .	12
2.4c.	F/A-18E/F Overall Material Use . . . . .	13
2.5.	B-2 Overall Material Use . . . . .	13
2.6.	F-117 Overall Material Use . . . . .	14
2.7.	F-22 Overall Material Use . . . . .	14
2.8.	V-22 Overall Material Use . . . . .	15
2.9.	Carbon Fiber Fabrication Process . . . . .	22
2.10.	Composition of a Quasi-Isotropic and a Unidirectional Laminate . . . . .	27
2.11.	Typical Composite Fabric Weave Patterns . . . . .	28
3.1.	Hand Layup Process Steps . . . . .	43
3.2.	Fiber Placement Machine Fiber Placement Head . . . . .	46
3.3.	Automated Fiber Placement Steps Compared to Hand Layup . . . . .	46
3.4.	RTM Process . . . . .	48
3.5.	RTM Fabrication Process Steps . . . . .	49
A.1.	Notional Stress-Strain Plot . . . . .	111
A.2.	Stress-Strain Plot of Sheet Aluminum with Carbon-Epoxy Laminate. . . . .	112